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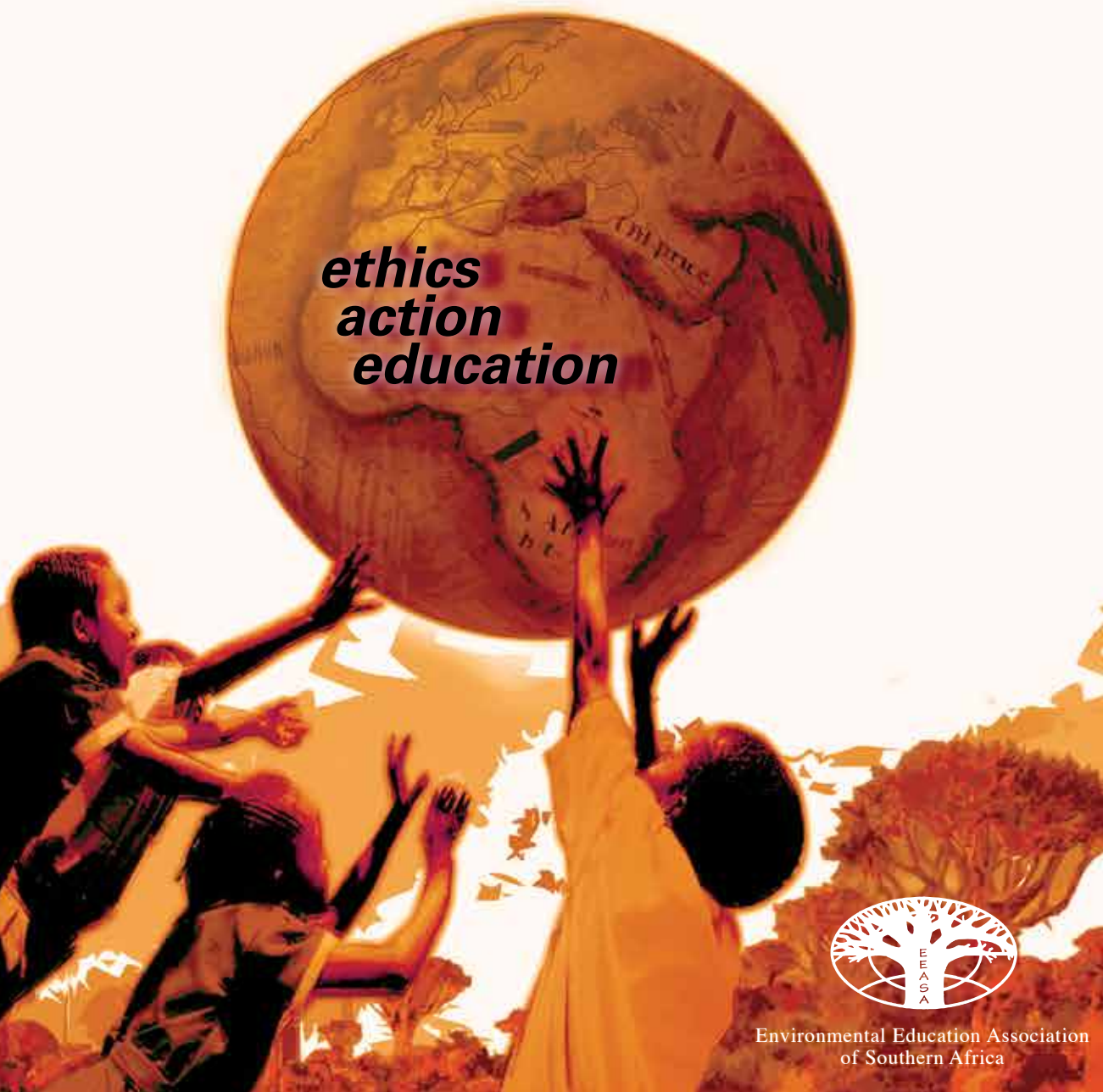

Environmental Education Association
of Southern Africa

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The Southern African Journal of Environmental Education (SAJEE) is an internationally refereed journal published once a year. The journal is published by the Environmental Education Association of Southern Africa (EEASA).

The SAJEE aims to publish and report on a wide range of aspects relating to Environmental Education, Ethics and Action in southern Africa and elsewhere. The journal seeks to further the study and practice of environmental education by providing a forum for researchers, scholars, practitioners and policy makers. The journal aims to carry papers reflecting the diversity of environmental education practice in southern Africa, and includes conference reviews and keynote papers, retrospective analyses of activities or trends in a particular field, commentaries on policy issues, comparative aspects of an environmental education, environmental ethics or environmental action issues, and critical reviews of environmental education, ethics and action in a particular country or context. The journal actively seeks out international dialogue in order to provide perspective on and for environmental education in southern Africa.

The Southern African Journal of Environmental Education aims to provide southern African and other authors with a forum for debate, and professional development. The journal incorporates an author support programme to encourage new authors in the field to establish themselves as professional writers.

Papers published in the Feature Article section of the journal are reviewed by two and at times three advisory editors. Keynote, Viewpoint and Think Piece papers are reviewed by one of the editors of the journal or an advisory editor.

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Editorial
Methodology, Context and Quality

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Note: This edition of the Southern African Journal of Environmental Education (SAJEE) is a 'double volume' and contains papers submitted in 2012 and 2013. The production of a double volume has been necessitated by administrative problems experienced by the journal production team in 2012, which affected the successful publication of a 2012 edition. However, the Council of the Environmental Education Association of Southern Africa (EEASA) agreed to respond by producing a double-volume edition for 2012/2013. Journal readers are reminded that the production of this journal is voluntary and depends heavily on voluntary administration and other systems. The patience of authors and readers in the 2012/2013 years of production is much appreciated.

The 2012/2013 double-volume *SAJEE* is richly textured with two think pieces that open the journal, thirteen research papers and three viewpoint papers. The papers in the 2012/2013 double volume include papers by authors from Sweden, the United Kingdom, India, South Africa, Zimbabwe, Botswana, Zambia, Lesotho, Ethiopia, Mozambique and Kenya, showing that the journal is attracting not only southern African authorship, but also authorship from across the continent and internationally.

The present edition of the journal is also interesting in that three different perspectives stand out, namely *methodology*, *context* and *quality*, perspectives which permeate the journal papers in various ways. The journal opens with a methodology think piece by Price. In this think piece, she challenges us to avoid 'methodolatry' in an environmental education context, noting that this requires us to resist hegemonic methodological assumptions – she suggests that positivism, post-structuralism and participatory methodology may all have such 'hegemonic status' and calls on us to critically and reflexively challenge the assumptions that inform and shape our methodologies and methodological commitments. She explains how she herself navigated this problem via the use of critical realist research approaches. The paper can therefore serve as a useful reflexive tool for authors who have contributed to the journal to review their methodological assumptions and practices and to 'think deeply' about the role of methodology in the research that we undertake.

Other papers that bring methodological questions to the fore are the two papers on the Supporting Urban Sustainability (SUS) Project by Westin, Hellquist, Colvin and Kronlid, and, from India, the paper by Bharti and Bansal. These papers deliberate ways of working with multistakeholder groups in urban sustainability settings and they report on the methodology and approaches adopted in the SUS Project, showing also how methodological choices can enhance and contribute to learning and practice outcomes. The paper by Mukute also raises questions

of methodology and process, not only in research, but also in ways of facilitating co-learning, this time not in urban settings but among rural farmers in Zimbabwe. Similarly, the paper by Muchanga shows how survey research can be used to develop insights into people's perceptions of climate change in a Zambian context, showing a different perspective on methodology, but also raising questions about the use of survey research for fully understanding such questions. The paper by Kasembe, Mukundu and Nyamukunda shows how the use of an action-research approach helped teachers to improve their responses to children affected by HIV/AIDS in their schools, broadening their views of what counts as quality education in their schools.

Following the think piece on methodology is a think piece on educational quality, provided by Lotz-Sisitka. This think piece synthesises and discusses some of the theoretical work that emerged from a five-year Southern African Development Community (SADC) Regional Environmental Education Programme (REEP) research programme focusing on the potential contribution of environment and sustainability education to educational quality and relevance. The think piece shares deliberation on the meaning, or meanings, of educational quality and how this has come to be constituted and influences southern African education. It proposes a reframing of educational quality discourses to be more inclusive of social–cultural and social–ecological perspectives via a 'learning as connection' perspective that allows for meaning-making and epistemological access in education. The paper also points to implications for research and teacher education, contouring some of the research that is emerging in southern Africa that is beginning to articulate ways of thinking more deeply about the meanings of educational quality and relevance and the role of environment and sustainability education (also called 'education for sustainable development' or 'ESD' by various authors) in enabling and strengthening learning and change.

This think piece on the conceptualisation of educational quality provides a backdrop for a number of the papers in the journal, including papers by: Ketlhoilwe and Jeremiah; Chikunda; Shumba and Kampamba; Namafe and Chileshe; Kasembe, Mukundu and Nyamukunda; Kilian and Ferreira; Mokuku, Ramakhula and Jobo; Dessie and Tadesse; and Kariaga, Kariaga, Ogemah and Nyando; as well as the viewpoint papers – all of which address this question in some or other way. Ketlhoilwe and Jeremiah deliberate the emergence of women's capabilities and agency via social-learning processes in the *Kgetsi-ya-Tsie* Project, while Chikunda deliberates the use of a capabilities approach to enhancing the quality of teacher education so that it takes greater account of the full participation of girl children especially, but of gender issues more broadly, in science, mathematics and teacher education subjects. The paper by Shumba and Kampamba also deliberates how to achieve improved quality and relevance in teacher education programmes for science and technology subjects, and their research with students shows that ESD approaches that foreground 'learning as connection' are offering positive experiences for student teachers that broaden their experiences of teacher education and enhance their teaching capacities. Namafe and Chileshe, who are working on documenting local cultural artefacts as a basis for curriculum contextualisation and enabling stronger relevance to curriculum activities, argue that such approaches provide a strong foundation for the learning of related concepts and are an underutilised approach for enhancing quality and relevance in schools. Mokuku and his colleagues from Lesotho, Ramakhula and Jobo, through their research, are seeking ways of

supporting quality and learning outcomes by means of peer-teaching approaches, while Killian and Ferreira in South Africa report on how the use of different methods can help to engage learners more effectively in learning via influences on their attitudes. These papers therefore also bring pedagogy and method into focus in educational quality discussions.

The discussions on educational quality and relevance are not, however, limited to schools and teacher education, and/or community education (which are covered by the bulk of the papers in the journal), but are also relevant to discussions on epistemology and curriculum change in higher education. Kariaga *et al.* at the Masinde Muliro University of Science and Technology in Kenya, and Dessie and Tadesse from the Wondo Genet College of Forestry and Natural Resources in Ethiopia, also deliberate on how ESD can improve the quality and relevance of university education and forestry education respectively. In the case of the Kariaga *et al.* paper, they assess current ESD practices in their university and identify where new forms of practice can emerge. In the case of the paper by Dessie and Tadesse, they analyse the current status and relevance of forestry education with regard to the current context of forestry in Ethiopia using ESD lenses and conclude that there is a need to reorient the epistemology and approach to forestry education at a broad meta-level, but also at local praxis levels.

An important question that threads its way through all of the papers is how context affects and shapes our thinking about environment and sustainability education. In the Supporting Urban Sustainability case study in India reported on by Bharti and Bansal, for example, we see that urbanisation poses particular threats to ecosystem services, which, in turn, affects livelihood options in India, and this has implications for urban education and change practices. In the case of the Zimbabwean farmers reported on in the Mukute paper, we see that there is a need to accelerate practice-oriented changes in agriculture towards more sustainable, climate-resilient agricultural practice, and this influences the kinds of methodological approaches that may work best in such a context. In the case of the women's groups seeking to learn about sustainable livelihood practice in Botswana, we see that it is the women's dependence on natural resources and their need to escape poverty that has shaped their learning and agency.

In the case of the Lealui Basic School in Zambia, reported on by Namafe and Chileshe, we see that local cultural artefacts are rich in knowledge, yet remain neglected in school curriculum development. In the case of engagement with high-school teachers in the 'growth-point' community reported on by Kasembe, Mukundu and Nyamukunda in Zimbabwe, we see that HIV/AIDS issues are severe and have impacts on teachers and learners alike. In Ethiopia, the seriousness of deforestation concerns, urbanisation patterns, the perceived lack of opportunity for students in rural areas, and the predominance of international influences on the curriculum for forestry education all influence how forestry education for sustainable development is being, and can be, practised in Ethiopia. The three viewpoint papers also highlight how context influences educational practice, as is shown in the paper by Ferreira on the Kids in Parks Programme in which the rich biodiversity resources of the South African national parks play a key role in defining the kind of environmental education that is possible in the various park contexts. In Mozambique, Monjane suggests that contemporary issues such as water quality and climate change can shape pedagogy in teacher-education classrooms, and Jobo suggests that local cultural references and metaphors are helpful in framing ESD practices

and approaches. The papers all highlight various perspectives on context and how context influences education and training. However, they all also show how educators and learners are engaging and responding to these contexts, mobilising their and others' agency for change in the process, with various social innovations emerging.

So where does this richly textured journal leave us? Ought we to be reviewing our methodologies more critically, as outlined by Price's challenging paper? And how would this change the way in which we have approached our research? Would stronger emancipatory change outcomes emerge via methodological changes?

And how do we take further our reframings of educational quality into the mainstream of education and training systems? So many of the papers appear to point out that, based on the research concerned, this would be an important 'way forward'. Perhaps seeing the papers presented as a whole may help us to make stronger cases and to expand our own research beyond the single case-study context and into wider forms of meta-research in which the methodological reorientations proposed by Price may also be helpful.

And what of the context–agency relationship that shows through in all of these papers? Are we clearly thinking through how structures and contexts influence agents, and how agents in these contexts can mobilise themselves and others to engage more critically, collectively and substantively with the concerns of the day? What does, and can, our educational research point to?

As editor of this journal, I have placed these open-ended questions on our research landscape following a collective reading of these papers in the 2012/2013 double volume. The year 2014 is the penultimate year of the United Nations Decade on Education for Sustainable Development (UNDESD), which ends in 2015. We invite readers and authors to take up the challenge of 'synthesis readings' of our collective research and to submit, for the 2015 edition of the *SAJEE*, synthesis papers that reflect critically and constructively on the last ten years of environment and sustainability education research during the UNDESD.

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Think Piece
Naked[1] Science[2]: Avoiding Methodolatry in an Environmental Education Context

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Abstract

Research methodology is significantly political and in this think piece I try to better understand the effect of this politicisation in the production of science. The main focus of the think piece is to identify the dominant methodological discourses and analyse them using techniques borrowed from post-structuralism. From this analysis, I suggest that methodological discourses are reproduced and normalised in much the same way as discourses of, for example, sexuality, and I give examples of this from my experience as a PhD student of environmental education. I also suggest that some transgressive methodologies, such as those associated with postmodernism or participatory research, despite purporting to empower, at times also disempower. Furthermore, all of the methodologies that I analyse are, in one way or another, 'loaded'; they cloak their agendas. From this analysis, I move towards suggesting an alternative critical realist methodology for environmental education which is naked; its agendas are clearly stated, not least because this epistemology does not lend itself to deception. An important part of this critical realist conception of methodology is the idea of 'meta-reflexivity' in which truth is not vulgarly pragmatic or fideistic.

Introduction

For some time, it has been generally understood that research has a sociopolitical component and that it is not naively objective, although there may be disagreement as to how 'objectivity' is defined (Sayer, 2000:61). As a result, a range of methodological discourses have emerged in the social and political domains of the academic context.[3] In the words of Lather (2003:204):

> As the concept of 'disinterested' knowledge implodes and collapses inward, social inquiry becomes, in my present favorite definition of science, a much-contested cultural space, a site of the surfacing of what has historically been repressed.

Many of the surfacing discourses declare our subjection to an era of methodological repression, related to the hegemony of positivism, and demand a transgressive move towards greater methodological freedom (e.g. Lather, 1991; Usher, Bryant & Johnston, 1997). Choosing to base our research on transgressive alternative methodologies could be considered to be a liberatory practice undertaken in an attempt to resist hegemonic methodological assumptions: Mary Daly's (1973:11–12) 'methodolatry'. Part of this liberatory practice involves the writing of academic papers, and peer debate. Researchers are encouraged to share experiences and dilemmas, both

as a move towards improving their professional practice, but also in the interests of social and political change. A key assumption is that academics are significantly influential in reproducing or dismantling methodological hegemony with all of its dire social and political consequences (Popkewitz, 1984).

My interest in methodological discourse was prompted by ambivalence around the operation of these discourses in my professional capacity as an environmental educator. I should have felt emancipated in this context of liberatory practice, but, instead, I felt constrained and unconvinced that my work was contributing to anything useful. In this paper I explore my ambivalence through a post-structural-style framework, despite nevertheless critiquing some of the methodological assumptions of post-structuralism. I therefore consider the methodological discourses as socially and historically constructed, both constituting knowledge and conferring power. I argue that power play is produced and reinforced in the transgressive methodological discourses as well as in positivist methodological discourses (Foucault, 1975:194). Foucault (1976) made similar claims concerning discourses of sexuality.

One of the places where power circulates is in university faculties. The common practice in these faculties of sharing experiences and research dilemmas, or publishing these in our research texts, can be considered the equivalent of Foucault's confessional.[4] Whilst the discussions ostensibly promise liberation from methodological hegemony and the release of what was repressed, they ultimately constitute a subtle and complex form of regulation and determination (Foucault, 1976). One might argue that the university methodology course, the thesis methodological chapter, or personal interviews with supervisors are confessional forums that serve to construct the researcher identity as well as to reproduce and normalise certain assumptions, generally those adhered to by the methodological discourses dominant in a particular context.

If, following Foucault, we assume that the confessional constructs meaning, practice and understanding, then we must admit that, through the confessional act of disclosing our methodological assumptions and challenges, we are implicated in the governing of ourselves and our research practice. In these confessional forums, we are presented with a variety of methodological options. Once we have chosen an option, and have invested time or money in it, in theory it must give us an advantage. Educators and researchers are involved in the struggle for symbolic capital, money and power (Bhaskar, 1993:214) and I explain how our agendas are furthered by our particular methodological choices,[5] whether we are aware of this or not. In the following discussion, I will look at three common methodological options and consider them as discourses. I will explain how they 'seize' political advantage (power). I use the term 'seize' to draw attention to the lack of mutuality involved; power is seized, it is not willingly given. I have labelled these discourses as being associated with: positivism, participation and post-structuralism. Referring to Bhaskar's (1993:164–167) critical realist description of agency, I assume that the production of discourse (an action) is influenced by, amongst other things, the authors' stratified personality, including their conscious being (providing them with routine or tacit reasons for their actions) and their unconscious being (actually causing their action, but without their knowledge).

I will also refer to how environmental educators tend to take up multiple (often contradictory) methodological positions, hoping to either maximise each methodology's advantages or minimise its problems. I will go on to explain how I avoided being fully constructed by the confessional forum in the university context, perhaps putting a question mark over the determinism suggested by Foucault (1975). Specifically, I avoided being fully determined because of a relationship to reality that Bhaskar (1993) has called 'meta-reflexivity'. As an antidote to the problems with the discourses of positivism, participation and post-structuralism, I will introduce a fourth methodological discourse, associated with critical realism. This discourse is also potentially empowering, but it does not necessarily achieve its power by seizing it.

The Construction of Methodological Identity: Loaded Truths

How the discourse of positivism seizes power

Positivism is often linked with activism; historically, it has been associated with certain dominant versions of Marxism and it was a key component of the activism against the hegemony of superstition during the Enlightenment (Popkewitz, 1984). Positivism is empowering for activists because, for the positivist, morality is the nature of things; what is good is what is (supposedly) simply and obviously natural (Comte, 2000). Positivism assumes positive, stand-alone, natural categories disconnected from, and unconstructed by, humans (Latour, 1999). This is useful in politics and polemical debates, because it supposedly justifies a polemical position objectively – for one cannot argue with the facts – although one could argue with a person. For environmental educators, it is tempting to turn to positivism when we want to prove, for example, that global warming is anthropogenic or that nuclear power is both unnecessary and unjustifiably dangerous as a way to cope with global energy demands.

An example of how positivism seizes power is to be found in the way that a pathological virus can be portrayed, without qualification, as an objective thing in itself. The researcher merely 'finds' it and then 'objectively' describes it and its mode of transmission. The scientist's particular world views are, supposedly, irrelevant and thus his or her research is portrayed as entirely objective and 'true'. An example of such a virus is the HIV virus. Here, the objective naturalness of the mode of transmission of the virus is linked to moral standings. For example, 'Moral Majority' leader Jerry Falwell (in Weinstein, 1997) commented: 'When you violate moral, health, and hygiene laws, you reap the whirlwind. You cannot shake your fist in God's face and get by with it.' Thus, the scientists state, 'objectively', that owing to its mode of transmission, the virus, devoid of its human constructedness, is most easily contracted through homosexual sex. Moralists can take this fact and seize power by reifying it to show the immorality of homosexual sex. Likewise, another researcher with the aim of protecting homosexual rights might emphasise the transmission of the virus in terms of certain sexual practices, which can be found in heterosexual and homosexual sex. The moralists from this side of the moral combat zone can also seize power by reifying the objective fact of the transmission of the virus to argue that HIV infection is an issue for all sexual beings and that homosexuality versus heterosexuality is of no consequence in the fight against HIV transmission.

Thus, the objective 'rightness' of the scientific information is translated into the objective 'rightness' of a moral stand. Proponents can feel morally justified in their position because of the scientific 'facts'. This is an example of what Latour (1993) describes as the modernist settlement. Here, the methodological position of positivism is held in place because it can be used to bolster the power of those who have an activist agenda, whilst at the same time secretly denying this agenda. Relatedly, Latour (1999:7) describes the science of positivism as based on 'the fear of mob rule'. It confers power by insisting on the innate moral rightness of certain positions against possibly a large majority who disagree, claiming the epistemological privilege of the objectivity of science, this privilege being unavailable to the non-experts (the mob).

Nevertheless, activists who use positivism to gain the political edge over opponents also risk losing power. Because these objective facts are reified, and combined with the existence of the secret agendas, they can congeal in such a way as to backfire. For example, if science can be used to support the idea that homosexuality is immoral, then what about the evidence that lesbians are least likely to transmit the virus: is their sexuality therefore more moral than that of heterosexuals? If it is true that one's sexuality is of no consequence in the fight against HIV transmission, might this not prevent us from addressing the different needs of different groups: perhaps gay men do in fact need special attention given their higher rates of infection? Many activists appear to demonstrate partial vision: they can see how positivism works against their cause, but fail to see it as problematic that they also revert to positivism when it suits them.

Instead of trying to gain the upper hand by reifying the facts and removing the human component (its constructedness – critical realism's transitive dimension) (Bhaskar, 1975), it would be better to acknowledge the objective of the preferred way of constructing the facts. Thus, the activists might state their original objective, which already existed before the scientific information became available, in this case either to condemn gays or to protect them from condemnation. They then present the facts in terms of using them to make a case for their particular position. They thus construct the facts, although, because this is a weak constructionism, the facts' constructedness does not detract from their truthfulness. These facts, differently constructed by each camp, are nevertheless not fictional. The facts ought not to be made to 'speak for themselves', but, instead, should be used by way of debate to allow judgemental rationality, ultimately leaving it up to the involved humans to make informed decisions, even if the decision is to disagree with one another.

In terms of the environmental education issue of global warming, the unstated, not-so-hidden agenda on the two sides of the activist divide, that pre-exists the issue, is to do with challenging (or maintaining) the current world order of consumerism and capitalism. If human industrial activity were shown to be uninvolved in global warming, the left would be in trouble because they would have to concede a green light to excessive production and consumption, which is actually what they are against. Therefore, it would be wise for them to be honest about their actual agenda in case the 'facts' which supposedly clinch the argument backfire. Similarly, for the right agenda, if global warming were shown to be driven by human industrial activity, then they must concede reduced production and consumption. However, since indeed this does seem to be the current situation (Intergovernmental Panel on Climate Change, 2013), the way that the right are trying to get around this is by advocating for nuclear energy to allow them to continue their industrial

activity without causing excessive release of carbon dioxide. Again, discussions of nuclear energy, supposedly informed by impartial scientific evidence, get as heated as they do because the hidden agenda is to do with maintaining the current economic order and its inequalities.

I think that both sides feel that they need reified facts to bolster their arguments because they lack social acceptance of a conception of a layered ontology (Bhaskar, 1975). Such an ontology accepts that some things can be real even if they are not empirical or actual. In the absence of such an ontology, activists cannot justify their rational arguments that posit real but unempirical structures and mechanisms, such as capitalism or liberalism, to explain the problems that they are concerned about. Thus activists looking to improve global environmental and social conditions are forced to rely on shallow, empiricist theory of cause and effect to prove their point. In the current context of what is considered appropriate knowledge for environmental activists, one reified fact on your side ('proving' your point) is worth a great deal more in terms of power than a general (unprovable) theory that capitalism is the cause of global heteronomy. If contemporary activists were allowed the possibility of the existence of real mechanisms and structures, the left and right would be able to discuss their politics without resorting to shallow, reified theories of cause and effect. In the context of ecology, such theories of cause and effect are particularly nonsensical given that ecosystems are open systems and any self-respecting empiricist would question claims for causation based on constant conjunctions of events in open systems. However, activists break their own empirical rules of not assuming causation based on correlation because they think that there is no alternative. The reason they think that there is no alternative is that they cannot conceive that some things (such as generative mechanisms) are real even if they do not satisfy the criteria of being empirical. We can avoid empiricism and its degeneration into positivism by having discussions about mechanisms and structures, where no one tries to dominate. We instead try to persuade through reasoned argument based on empirical evidence, not reified facts.

How the discourse of participation seizes power

Although most contemporary overviews of research methodology would prefer to talk about the phenomenological or interpretative approaches at this point, I prefer to talk about participatory research methodologies, which are often justified from a phenomenological or interpretative perspective. This is because my focus is on methodological discourses, rather than the methodologies themselves. In an environmental education context, phenomenology and interpretative methodologies are often fairly invisible, whilst nevertheless assumed within the more clearly defined discourse of 'participation' or perhaps 'participatory action research'. This approach is typified by the phenomenologically justified, participatory action research of environmental educators Stapp, Wals and Stankorb (1996). The idea of people's participation originated in the 1970s as a response to oppression. For example, advocacy for participatory methods of research and activism can be found in the work of Freire (1970) and, more recently, Chambers, Pacey and Thripps (1989) and Chambers (1997, 2004). In southern Africa, researchers are acutely aware of their postcolonial heritage and therefore seek ways to avoid oppression. Participatory action research has therefore become popular among environmental educators in southern Africa because of its promise to effect change whilst at the same time being empowering and democratic.

Participatory action research methodologies are a reaction against positivist methodologies, and, therefore, I consider them to be transgressive. They are based on the epistemological assumption that we can decide on truth by putting it to the vote; participatory action research supposedly 'democratizes research' (Smith, Bratini, Chambers, Jensen & Romero, 2010). Thus, positivist facts that support a Western agenda and can be overruled by grassroots communities on the basis of a participatory epistemology in which truth is what the community says it is; the community's knowledge trumps so-called scientific knowledge. However, whilst participation is a useful strategy to insist on marginal agendas against dominant, oppressive agendas, it is not a method that allows a search for knowledge, since it is conceivable that minority groups could be mistaken, just as it is possible for anyone to be mistaken. Furthermore, participatory research methods can also be used by majority groups to insist on questionable agendas against minorities, and vice versa. The key is in the strategic division of the community into groups: thus, gerrymandering becomes equivalent to truth-making. An example might be the questionable claim, common in southern African countries such as Botswana (Ntseane, 2004), that it is wrong for women to insist that their partners use a condom, despite the risk of HIV, since the majority belief in this culture is that women must always play the submissive role. However, if we were to draw the voting boundaries differently, and allow all of the people in the world to vote, or only allow women to vote, the result might be significantly different.

The question remains as to why marginalised groups would opt for participatory research when it can so easily also be used against them. Remembering that participation is a transgressive reaction against positivism, to answer this question, one must consider the reason that positivism has been so effective against marginalised groups. Briefly, where the discourse of positivism is hegemonic, for one to be allowed to participate in discussions, one must have access to reified facts that reflect sympathetically upon your cause. Most marginalised groups do not have trained scientists within their group and cannot afford to pay for the services of such scientists to gather the kinds of facts that they would need to play the positivist version of activism. Indeed, their indigenous knowledge may not lend itself to 'scientific' engagement at all. Marginalised groups opt for participatory action research because it gives them a socially sanctioned right to make knowledge claims and to participate in discussions relevant to themselves, even if they are not trained scientists or even if their knowledge is not 'scientific'.

Unfortunately, the epistemology underlying such 'democratic knowledge' is questionable for the reasons already given. Once again, an alternative is to avoid positivism by insisting that we have access to knowledge of a layered reality. Therefore, we not only have access to knowledge of facts (through the objective, hypothetico-deductive methods of so-called science), but we also have access to knowledge of events, structures and mechanisms (through reason, based on experience, using retroductive logic). Retroductive logic is the logic that we use every day. With retroduction, we draw on experience and facts to suggest structures and events that have led to the current state of affairs. In social research, retroduction allows us to fallibly posit the existence (or absence) of structures and mechanisms that explain our oppression, without the need to prove the absolute existence of those structures and mechanisms. Retroduction also has implications for democracy. Positivism's logic of deduction makes so-called 'scientific' knowledge the only valid knowledge and insists that this knowledge is fully available only to the scientific elite. However, retroduction

is available to everyone, and if it were to be a socially acceptable way of determining knowledge – it currently has a taboo status – it would satisfy the activist's criteria that communities have equal standing with scientists. In this version of epistemology, measuring and reporting facts and correlations is demoted to a technical activity, rather than being the epistemological high point of knowledge. It is only one way amongst several of identifying facts, and these facts only become useful once they have been used as the basis for transfactual theory (theory that suggests structures and mechanisms that are implied by the facts). 'Scientists' who currently enjoy elite status must, in the epistemology that I advocate, share their currently cloistered world with other people, who just as rightly can claim the title of scientist. These non-statistically trained scientists (admittedly, these would be – the 'mob' – just about everyone in the world) routinely use retroduction to arrive at theory that explains the facts. Elsewhere, I have argued that retroduction is the logic of indigenous knowledge claims (Price, 2005a). The decision as to which competing theory should be used to decide action then turns on discussions as to which theory best explains the facts. If we take an everyday example of retroduction, imagine a family who can't agree as to what condiment is missing from their soup – some think it needs salt, others paprika. They might resort to a vote, but the person who loses the vote is not necessarily wrong, just outvoted. Unlike the situation in participatory research, the voting in this context is not linked to epistemology. Instead, democracy is evident in the collective process of deciding the best theory that explains the evidence, and in deciding on the best course of action implied by the theory.

How the discourse of post-structuralism seizes power

Post-structuralism surfaced in France during the 1960s. It was a response to general discontent with the social status quo, most especially with the hegemony of institutional monopolies regarding truth. These monopolies were enabled by the dominance of the discourse of positivism, as described above. Post-structuralism and its associated cultural movement, postmodernism, is therefore, like the participatory methodologies, a transgressive methodology.

For some post-structuralists, there are no special political advantages to their position, because they flatten all truth claims into the same thing, namely fiction. Therefore, they would maintain that they do not seize power, as there is nothing inherent in a post-structuralist epistemology that gives one power. The most powerful get to decide what is true, no matter what one's epistemological position. For many, this leads to an inability to act and they become nihilistic and ineffectual (Eco, 2000:47).

However, for other post-structuralists, the idea that there is no way to determine better or worse versions of truth provides the promise of empowerment; it does allow one to seize power. This is because no one is allowed to challenge whatever position one might hold. Bauman (1991:260) calls this 'the protective wall of playful unconcern…'. If positivism and participation are offensive positions, then post-structuralism is a defensive one, but they are all fighting in a dirty war. Positivists and participation practitioners win their war by insisting that they have the epistemological trump card – special access to what is true. Post-structuralists win their war by insisting that we all have epistemological trump cards, so there can be no epistemological winners, only winners of the struggle for power. This leaves them free to believe as they please, even if this leads to actions that are underhanded.

There is another questionable advantage offered by post-structuralism which might explain its popularity. Specifically, I would like to identify a subset of this group, whom I will call the 'non-labellers'. I take this term from Blumberg and Soal (1997). The non-labellers problematise the whole process of categorisation. As Lather states (2003:205), 'I am suspicious of the desire for definitions (…)'. Oppression cannot be carried out if there are no markers of difference. I would like to suggest that this methodological position is particularly (although not uniquely[6]) attractive to many individuals who find themselves labelled as belonging to the previous oppressor groups, such as men or people whose ancestors were colonisers.

We know that the previous oppressors can themselves suffer oppression. Freire (1970:29, 30) puts it thus: 'But almost always, during the initial stage of the struggle, the oppressed, instead of striving for liberation, tend themselves to become oppressors, or "sub-oppressors" (…). Their ideal is to be men; but for them, to be men is to be oppressors.' Examples might include, from Rwanda, the treatment of the Tutsis by their previous subordinates, the Hutus (Mamdani, 2001), or, from Zimbabwe, the mass murders by the Shona of their previous oppressors, the Ndebele (Catholic Commission for Justice and Peace in Zimbabwe, 1999). Another previous (?) oppressor group which suffers oppression is men. The oppression of men has been documented by New (2001).

However, those belonging to groups identified as the previous oppressors find it hard to be taken seriously should they try to draw attention to their plight, since they still have many of the trappings of their privilege and there is still ill feeling towards them. Furthermore, many might distrust their motive as attempting either to maintain privilege or regain lost privilege, rather than innocently trying to insist on their human rights. For these previous oppressor groups, the activist process of identifying themselves as an oppressed group is counterproductive. There is no sympathy for their situation and to label themselves is to attract negative attention. Their hope for survival becomes attached to the removal of categories which enables them to vanish into a sea of sameness. I argue that the advantages to the previous oppressors of non-labelling explains, at least in part, why, for some authors such as Habermas (in Lather, 2003:206, note 3) and Van Staden (1998), post-structuralism and its close relative postmodernism are associated with neoconservative, elitist positions.

Nevertheless, the attempt to reject categorisation has internal contradictions. Very often, those same researchers who intuitively identify as non-labellers for their personal safety are nevertheless activists for other groups, for whom they intuitively suspect a better strategy is to label. Alternatively, they may have dual, even multiple, identities, one of which is linked to a previous oppressor group and one of which belongs to a currently oppressed group, such as a white female or a gay black male. Furthermore, to avoid labels is to find it hard to speak, because what then does one speak about? Kottler and Long (1997:56) have demonstrated how 'the resistance to naming denies individuals much of what is subjectively and politically important to them'.

Contradictory Subject Positions

Each of the three approaches to research methodology outlined above, namely positivism, participatory research methodologies and post-structuralism, are associated with their own particular discourses. Environmental educators, at the time that I was writing my PhD, were encouraged to choose amongst them. As demonstrated by Blumberg and Soal (1997), the

power bestowed on a person through the identification with one discourse can result in the loss of power in other ways. In the context described by Blumberg and Soal (1997), to identify as a 'normal' bisexual, for example, bestows certain social advantages, but it also constrains behaviour, because one has then to remain within the social confines of 'normal'. To problematise the idea of normality, and claim the acceptability of transgression, allows greater freedom of identity, but at the expense of potentially easier acceptance by society.

In the context of our methodological identities, we can see that the same applies. For example, to be a post-structural non-labeller confers some advantages whilst removing others. One can (arguably) avoid discrimination, but at the expense of being able to speak. Furthermore, the structural oppression remains, and is even enabled, if it is hidden by the act of 'not labelling'. Participatory research can ensure that marginalised agendas are advanced, but a problem arises when there is a majority consensus within a marginalised group that another sector of that group should remain marginalised. This would be the case where a majority (of a minority) condone the subjugation of women or discrimination against homosexuals. Many researchers try to maintain the relative advantages of all the methodologies by attempting a contradictory combination of them. Thus we find:

- Critical phenomenological methodologies – mix critical (positivist) and phenomenological methodologies;
- Critical post-structuralist methodologies – mix critical (positivist) and post-structural methodologies; and
- 'Mixed methods' methodologies – suggest a pragmatic commitment to any methodology, depending on the required outcome.

Practitioners who can justify their research identity as a mix of methodologies have access to the idea that truth is 'what the majority say it is', 'what is best for society', 'what the marginalised say it is', 'what is beautiful', or 'what is an empirically validated reality'. Some researcher/activists are aware of this contradiction, merely seeing it as a pragmatic necessity. For example, Beck (in Irwin, 2001:186) writes: 'The decision whether to take a realist or a constructivist approach is for me a rather pragmatic one, a matter of choosing the appropriate means for the desired goal.' Before I came across critical realism, I identified with Lather who grappled with the question: 'How do the very efforts of educators to liberate perpetuate relations of dominance?' (Lather, 1991:16). This aporia was the result of engaging with both: post-structuralism and its sceptical view of 'emancipation' as yet another form of domination; and the intuition that, nevertheless, we need to act to change unfair power relations, that is, we need emancipation (Lather, 1991:2).

I will briefly try to outline an optimistic alternative to the idea that 'power over' and relations of dominance in educational contexts are unavoidable.

Imagining an Alternative Science

Foucault (1975) and Lather (1991) were right; our discourse choices are about gaining power and achieving agendas, but this is only problematic if one does not distinguish between:

$power_1$ – which is the transformative capacity of the agent; and $power_2$ – which are relations of domination, exploitation, subjugation and control, which can also be described as generalised master–slave(-type) relations (Bhaskar, 1993:60).

As I have explained, positivism, participatory research and post-structuralism are all, in one way or another, complicit in seizing power – reproducing master–slave relations – despite the emancipatory objectives frequently held by their proponents. Among other things, all of these methodologies have agendas cloaked by their epistemologies. Specifically, they have the objective to advance the interests of certain sections of society, whilst pretending that their primary objective is simply truthfulness, even if, in the postmodern and participatory versions, this is a relativist 'truthfulness' based on individual or collective truths. Hiding information is a way of taking power by removing another's power, and therefore it is likely to be evidence of $power_2$. It is important that we develop our personal 'power to do', but not in a way that dominates others, that is, not by assuming 'power over' others. Making our agendas naked would allow readers of our work to make informed decisions as to its integrity and its relevance to their lives. However, in our unjust world, where there may be real threats to our security if we were to we reveal ourselves completely, perhaps some cloaking is a pragmatic necessity. We may need to leave it to others, outside the realm of our dangerous social milieu, to make a case for us. Nevertheless, it is the use of dishonest, manipulative methods that perhaps turns victims into oppressors. Perhaps, wherever possible, we need to bravely insist on naked science, even where there is personal risk.

One of the places where we might encounter methodological choices that evoke issues of personal risk is within the confessional forum of the academy. I do not have any simple answers to the regulatory nature of our student/lecturer/peer interactions, but the fact that I have passed through an academic system dominated by a non-labelling, irrealist version of the discourse of post-structuralism and emerged an ontological realist, albeit an epistemological relativist, perhaps demonstrates that the confessional may not be entirely determinist and disempowering. Possibly, a precondition for this might be the open-mindedness of the community into which one confesses. Nevertheless, my PhD research process was not without a sense of danger, as the following excerpt from my confessional methodological chapter suggests:

> [Self-reflexive note – wanting to fit in:] The greatest self-reflexive step that I made to help me solve my methodological riddle was my movement away from doxa, my strongly held, socially generated, beliefs. In this difficult process, I was worried that I would lose my peer approval, and with it, symbolic capital, not to mention my self-esteem. When I first began exploring what seemed to be the heretical possibility of realism, my language was extremely tentative in my discussions with my peers. Fortunately, my research friends' commitment to honest inquiry has meant that they have allowed me much leeway on my journey, even when I was moving in a direction with which they were unfamiliar and of which they were at times unsure (Price, 2007:87).

One might ask what prompted me to make the uncomfortable move beyond my set of fundamental beliefs (termed 'doxa' by Bourdieu, 2000) to solve my methodological riddle, of being both a social activist for the environment and a non-labeller. There were many socially comfortable solutions

to this riddle, in the form of a variety of mixed methodologies. To answer this question, it seems it is necessary to explain that, in analysing the appropriateness of our methodological practice (reflexivity), we can use different measures of our success or failure. In one type of reflexivity, we examine our claims for truth through the lens of our faith in socially acceptable ideas of right and wrong (fideism). In another type, we might examine our truth through a vulgar, pragmatic lens of: 'Does it achieve my goals, or the goals of those that I represent?' The kind of reflexivity that I unwittingly adopted was one in which we examine our truth by considering the contradictions we have noticed; instances where what we think does not add up to how we act or where the expected outcomes of our actions are not achieved. It was the existence of these contradictions that insisted I keep searching for resolution. Bhaskar (1993) would call this 'meta-reflexivity'.

Meta-reflexivity assumes our deep and meaningful unity with the world; knowledge is possible because we have immediate access to the world through being a part of it and not only because of our socially constructed learning, although the social construction of our knowledge is not insignificant.[7] Meta-reflexivity is reflexivity based not on a subjectivity that is informed solely by socially constructed meaning, but by a subjectivity informed in some sense, or overreached, by objectivity (Bhaskar 1993:249). Haraway (2004:50) is perhaps suggesting meta-reflexivity and linking this to ethics when she writes: 'I believe that all ethical relating, within or between species, is knit from the silk-strong thread of ongoing alertness to otherness-in-relation.' Reflexivity based on alertness to otherness-in-relation would require some sort of objectivity, or links to the other – Haraway's silken threads. This is different from fideistic or vulgar, pragmatic reflexivity based only on what others are telling us or what we would find convenient to be true. Meta-reflexivity is also what gives people the confidence to speak truths against the beliefs of an entire population and at significant personal risk. My response to the postmodern question, 'How do we escape discourse?' (Parker, 1992:20) or, equally, 'How do we escape the power$_2$/knowledge dynamic?', lies in this engagement with meta-reflexivity.

Furthermore, meta-reflexivity, which also includes retroductive logic, acknowledges that there are different layers of reality: the real, the actual and the empirical. Often, our meta-reflexive process will reveal deeper realities to us. Having access to these deeper realities of structures and mechanisms is the reward available to us when we give up trying to dominate by hiding our agendas to gain unfair advantage. However, the downside is that we can no longer claim that our knowledge is absolute or certain. Fortunately, this is not troublesome because, if we could achieve a research culture where meta-reflexivity, transfactuality and retroduction were accepted, then the playing field would be levelled and we would realise that no one's knowledge is certain. If we do not have something, but also do not need it, we do not experience its absence as a lack. This is the case with absolutism and certainty. Since we do not need them to function, their absence is unlikely to be experienced as a lack. As Latour (1999:15) puts it: 'We do not lack certainty, because we never dreamed of dominating the people.'

Conclusion

A way to summarise some key points of this think piece is to return to the metaphor of methodolatry. The discourses of positivism, post-structuralism and participatory research are all

kinds of 'methodolatry'. This word joins together 'idolatry' and 'methodology'. Idolatry is the assumption that something replaces a real God. There are arguably several kinds of idolatry. In one kind, the existence of a real God is not denied, but the generally accepted words for God are confused for the God itself. Religious fundamentalism is one example of this kind of idolatry; it does not deny the existence of God but takes 'God's Word' as an absolute, thereby denying any possibility of different interpretations and different relationships with God depending on changing times and contexts. This would be similar to extreme versions of participatory research whereby people's words – what they say or agree is the truth – is considered to be unquestionably true. Certain kinds of Gnosticism might also be an example of idolatry whereby what is experienced is deemed to be the only true knowledge of God – thus experience becomes the worshiped idol. This kind of idolatry is similar to empiricist, positivist and phenomenological accounts of reality which assume that what is experienced or measureable exhausts reality. Another kind of idolatry denies the existence of a real God and worships only the human-constructed images of God which are considered to be God. This kind of idolatry is similar to extreme versions of post-structuralism which deny the existence of reality. For these post-structuralists, there is nothing under the human-constructed words; the words are themselves reality.

Hollway (in Wilbrahim, 1997:80) suggests that it is awareness of the contradictory empowering effects produced by particular discourses that serves as a first step towards resistance and/or discursive and social transformation. All of the methodological discourses (positivism, participatory research and post-structuralism) outlined above exhibit such contradictions. In my own early research, I eventually had to adjust my methodological commitments because of the performance contradiction of being a non-labelling post-structuralist, but also an activist who needed labels to identify oppressed groups and to describe the status of the environment. My personal PhD story is evidence against social determinism; it is possible to resist our construction by dominant discourses if we consider the contradictions of those discourses.

My aim for this think piece is therefore that it might allow us to move beyond 'methodolatry' in our scientific research. I suggest some reasons for why we should avoid methodolatry and indicate how many mainstream research discourses are guilty of such methodolatry. However, it is not possible to fully outline an alternative. Instead, I merely suggest one such alternative, namely the critical realism of Roy Bhaskar (1944–). Critical realism allows us to achieve meta-reflexivity and, through its conception of reality as having a layered ontology, it gives us a purchase from which to tackle many of the political deceptions that are made possible through the questionable epistemological manoeuvres of mainstream research methodolatry.

Notes on the Contributor

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Endnotes

1. Latour referred to naked rather than loaded science in an interview with Hugh Crawford (1993).
2. In the think piece I use the term 'science' to refer to the epistemological process that we use for all research, not just empirical or statistical research. Thus I reclaim the meaning of 'science' to include all research traditions, even those, such as anthropology, which traditionally have been denied the label of 'science'. Hence anthropological methods must be applied in certain contexts, whilst experimental techniques must be applied in other contexts. I assume the existence of a meta-theory of science, which allows methodological unity but also method plurality, in which the methods used are determined, inter alia, by the unique nature of that which is being researched.
3. There are many definitions of 'discourse'. Three definitions most appropriate for this think piece are: '…a form of social practice, rather than a purely individual activity or a reflex of situational variables' (Fairclough, 1992:3);'…products and reflections of social, economic and political factors, and power relations' (Widdicombe, 1995:107); and '…a particular network of meanings, their heterogeneity and their effects' (Hollway, 1989:38).
4. The chapter, Being vulnerable and being ethical, by Tisdale (2003) is a good example of a confessional methodological text. Indeed, so is this think piece.
5. For example, legal clerks' methodological choices with regard to the interpretation of the Unites States Constitution were found to reflect their political agendas (Furgeson, Babcock & Shane, 2007).
6. For a discussion of non-labelling bisexuals, see Blumberg and Soal (1997).
7. Refer to Price (2005b) for a discussion of the way that truth is both social and not-social.

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Think Piece
Conceptions of Quality and 'Learning as Connection': Teaching for Relevance

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Abstract

This think piece captures some of the thinking that emerged in and through the Southern African Development Community (SADC) Regional Environmental Education Programme research programme. This research programme emerged over a five-year period (2008–2012) and involved ten southern African teacher education institutions from eight countries (see 'Acknowledgements'). The research programme sought to understand what contributions environment and sustainability education could make to debates on educational quality and relevance. Issues of educational quality are high on the national agendas of governments in southern Africa, as it is now well known that providing access to schooling is not a sufficient condition for achieving educational quality. Educational quality is intimately linked to the processes of teaching and learning, but the concept of educational quality is not unproblematic in and of itself. It is, as Noel Gough (2005) noted many years ago, an 'order word' that shapes the way people think and practise. Our enquiries during this research programme involved a number of case studies (that were reported on in the Southern African Journal of Environmental Education (SAJEE) in 2008, and are again reported on in this edition of the SAJEE), but the programme also involved theoretical engagement with the concept of educational quality and relevance.

This think piece helps to make some of this thinking and theoretical deliberation visible. The author of this think piece was also the leader of the regional research programme and was tasked with synthesising the theoretical deliberations that emerged from the research design which were found to be useful for guiding interpretations and deliberation on more detailed case studies undertaken at country level.

Introduction

In this think piece, I briefly review different conceptions of educational quality and their implications for teaching and the training and provisioning of teachers. As noted in the orientation papers for the *Second International Policy Dialogue Forum on Providing Teachers for Education for All (EFA): Quality Matters,* hosted by the 2010 UNESCO International Task Force on Teachers for EFA, there is little value in simply supplying teachers for EFA without giving equal attention to issues of quality in the training and preparation of teachers, and without examining the relationship between teacher supply and educational quality. Too few teachers will necessarily lead to problems in providing quality education, and much has been written about a 'good' or 'ideal' teacher:pupil ratio. Too few teachers for subjects that are most needed in society (e.g. science or mathematics) also creates a problem, as these skills remain lacking in the

economy and thus hamper the development of society. There are, however, broader and more complex discussions to be held about the relationships that exist among teachers, teaching and educational quality. One such discussion is related to the relevance of teacher education itself (i.e.: Are teachers being trained to provide relevant education, and, if so, relevant as defined by what – the economy; the need for developing learners' subject knowledge, citizenship and life skills; the need for developing a sustainable society; or all of the preceding?). This is the subject matter of this think piece. Such discussions are important, as they also define how teachers themselves think of quality in education and of how they may be inducted into developing insights and reflexivity in relation to conceptions of quality in and through teacher education.

As indicated in the 2010 United Nations Educational, Scientific and Cultural Organization (UNESCO) Education for All Global Monitoring Report, 'success or failure in achieving education for all hinges critically not just on countries delivering more years in school; the ultimate measure lies in what children learn and the quality of their education experience… Many countries are failing the quality test' (UNESCO, 2010). But what is the 'quality test', how are concepts of quality constituted, and what are the associated implications for teaching, teacher education and teacher supply? I begin this discussion with what often seems most obvious (at least if one is framing the discussion within dominant discourses of the day) when discussing the issue of quality and relevance, namely the quality and education 'fit' with the economy.

Quality and Educational 'Fit' with the Economy

One way of considering the quality and relevance of education is through technical analysis of the supply–demand relationships that exist between education and production of the necessary skills for the labour market. Is education relevant to the economy, are we producing enough graduates for the job market, and do we have enough science and technology graduates? These are some of the more dominant questions asked when discussions about the relevance and quality of education arise. Such questions are critically important, as all people need to participate in an economy of some sort, and all people need to have the skills necessary for contributing to at least their own and others' sustainable livelihoods. Poverty reduction is reliant on such discussions and on links between the economy and education in developing countries; hence it is essential that such discussions be held. Many examples of studies that analyse the 'fit' between education and the economy abound, but, most often, these studies are oriented towards quantifying supply and demand in relation to economic-sector needs in education systems around the world.

A typical result of such studies is provided here by way of example only. In a study quantifying skills demand and supply in the South African automotive components industry, Barnes (2009) noted that this industry is South Africa's leading manufacturing industry and is therefore important within the economy and within the job-creation sphere. The same study goes on to explain that this industry is now operating in a 'fierce and competitive environment', which creates new demands for skills. The study then goes on to analyse demand for skills, with emphasis on 'high-skills' categories such as management, professional staff and

artisans. It then produces projections of skills demands and proceeds to analyse skills supply issues, such as number of people graduating from educational institutions (schools, technical colleges and universities) with the requisite skills profiles and competences necessary for this very important industry in South Africa. In this particular study, the conclusion is that there will be a demand for over 45 000 new employees over a five-year period, mostly within the production worker category. However, in the high-skill category, there will be a demand for up to 1 500 managers and professionals with engineering-linked qualifications. The study typically concludes that there is a 'mismatch' between the skills sets being generated in local technical and educational institutions and the skills required by business. Numerous other similar studies have been conducted at national and international levels (e.g. Pogue, 2009; ILO, 2010), but the examples are too numerous to list or even analyse coherently. Studies such as these typically lead to requests for alignment between industrial development policies and skills development and educational policies (e.g. Kraak, 2009; ILO, 2010), and this 'mismatch' typically comes to be seen as an educational quality problem, as education is seen to be lacking in relevance in relation to economic skills-demand projections. An example here is the recent synthesis paper by Borel-Saladin and Turok (2013), who comment on the need for the following number of skilled people in South Africa to 'drive' the green economy.

Table 1. Employment estimates by green-economy categories and segments

Broad, green-economy category	Long-term net employment	Long-term net direct manufacturing employment
Energy generation (includes renewable (non-fuel) electricity), fuel-based renewable electricity, and liquid fuels	130 023	22 566
Energy and resource efficiency	67 977	2 686
Emissions and pollution mitigation	31 641	20 797
Natural resources management (biodiversity and soil and land management)	232 926	0
TOTAL	462 567	46 049

Source: Borel-Saladin & Turok, 2013, drawing on Maia et al., 2011.

Quality and Teaching Capacity

What is most interesting in studies such as these is the almost total lack of attention to the *teaching capacity* needed to address these skills across the education and training system, starting from foundational knowledge, values and skills in schools, all the way through to implications for higher education, including teacher education. In South Africa, where these examples are drawn from, there is noticeable neglect of teacher education in respect of vocational education and training, and few teachers are oriented in teacher education programmes to consider these types of issues, that is, issues of 'relevance' to the economy in their teaching practices. As is the case elsewhere, the closest we seem to get is to constantly emphasise the

need for more mathematics and science teachers, who remain scarce in developing economies owing to a number of factors, including competitive employment opportunities for science and mathematics graduates, and the brain drain as a result of which qualified science and mathematics teachers are attracted to teach in other countries where salaries are higher and teaching conditions are better. Of course, an overemphasis of such notions of relevance also has the potential to narrow education and teacher education to become an instrument of the market, leaving learners and teachers alike with a substantively narrowed experience of education and learning and with society thinking that only science and mathematics teachers count. The rise of corporate universities, where universities seek to provide only those skills that are needed, is perhaps the most explicit sign of this type of narrowing form of education. Teachers who are trained to teach in such institutions are likely to have an equally narrow view of teaching and of the meaning of education. So, while educational relevance and the 'match' to the economy may be an important facet of educational thinking and educational quality, and, consequently, also an important issue to consider in thinking through the scope, content and supply of teachers and teacher education, care should be taken not to narrow discussions of educational quality and teacher supply to a focus on supply and demand for the economy only.

One way of avoiding the problems of too narrow a view of educational quality (i.e. as a match to the economy only) is to develop a broader view of educational quality and relevance. In research conducted under the auspices of the Southern African Development Community Regional Environmental Education Programme (SADC-REEP) in southern Africa, involving ten universities from as many countries in the southern African region (Lotz-Sisitka, 2011)[1], a new concept of educational quality has been emerging to *complement and extend* other notions of educational quality and relevance, which has implications for teacher education and for thinking about the relationship among teachers, teaching and educational quality.

Reframing Educational-quality Discourse to Include 'Learning as Connection'

In the SADC region, as in other developing countries, education systems are still suffering from colonial 'hangovers' such as structured and outdated syllabi, forms of pedagogy offered in foreign languages or content that is decontextualised and disembedded from local history, experience, culture and aspirations. These issues are exacerbated by poverty, the inadequate supply of teachers, textbooks and learning materials, poor-quality school buildings and poor-quality teacher education, inadequately qualified teachers, and many other issues which, by now, are well known and well documented. In such contexts, much attention is being given to discourses on educational quality, and organisations such as UNESCO and the World Bank regularly undertake monitoring and other types of studies to quantify and qualify what is meant by quality, what counts as quality-indicators, and how national governments should take up and respond to issues of educational quality, including supplying more teachers, classrooms, books, access mechanisms, and the like.

These issues are, however, also shaped by the views of educational quality that circulate in education systems, and by how these are translated into teaching and teacher education practice. In an extensive literature review on educational quality, undertaken through an international

research project called 'EdQual', Barrett, Chawla-Duggan, Lowe, Nikel and Ukpo (2006) identified two prominent conceptions of quality in education systems around the world. This analysis was based on literature and research on educational quality from major international studies such as the UNESCO Education for All Global Monitoring reports (see www.unesco.org) and major international educational journals. The two conceptions of educational quality identified in this extensive review are the following:

- **An efficiency/mastery discourse on educational quality** (Barrett *et al.*, 2006). This discourse seeks out mastery, efficiency, and learner achievement and performance against set standards and expectations as its measure of quality. For example, learner achievements measured against certain set tests such as PIRLS (Progress in International Reading Literacy Study) and TIMMS (Trends in International Mathematics and Science Study) are counted as a measure of quality (Reddy, 2006; Van Staden, 2006); and
- **An inclusivity/participatory discourse on educational quality** (Barrett *et al.*, 2006). This discourse seeks out inclusion in the education system as its measure of quality – for example, if girls are included in the school system, the quality of the system is seen to be higher or better, or if learners' views are included in pedagogical processes (e.g. through learner-centred approaches), then the quality of the education is seen to be higher or better.

Both of these quality-discourses are important and are not mutually exclusive. Both have substantive implications for teacher education and how teachers are oriented or trained to undertake their teaching practices. A teacher oriented towards the first discourse on educational quality is likely to value technical efficiency and mastery of content more than a teacher oriented towards the second discourse on educational quality. The latter teacher is likely to value learner involvement, group work, and self expression on the part of learners more than a teacher oriented to the first educational-quality discourse. Of course, both these discourses on educational quality are important and valuable in education, and thus both ought to be considered in teacher education. What is most important, however, is to expose teachers in training to a full understanding of *both discourses* so that they are able to reflexively assess what kind of educational-quality practices they are favouring, or can favour and can develop, in and as part of their teaching practice.

In our research programme in the southern African region, we have however found it necessary to give attention to *a third framing of educational quality*, namely **a concept of quality that favours or emphasises the 'sociocultural' or the processes of meaning-making that occur at the interface of existing experience and context and more abstract forms of representation** most often used in the symbolic practices in schools – to put it more simply, the meaning that occurs at the interface between context and concept (Vygotsky, 1978).

Of interest in our analyses of quality and its implications for teaching and teacher education is an observation that the first discourse on educational quality was brought in to African education by colonial educational discourses that followed 'mastery-of-the-subject' strategies in respect of pedagogy and teaching. Today, this discourse is also valued by those with economic

interests in education, as it is seen to be 'efficient' to master the most important content of education as quickly as possible. Further analysis of the second conception of quality – the one focusing on inclusion – shows that it has roots in democracy and human rights movements and associated institutions tasked with ensuring greater equity of access and participation in society, such as global development organisations (Unterhalter, 2007). Again, the roots of this quality-discourse were not found in African society, but rather in global influences on the local sphere.

This led us to inquire how educational quality is viewed by parents, learners and teachers in southern African school contexts (see the articles in the 2008 *SAJEE* that reported on the early phases of this research programme, as well as a number of the articles in this 2012/2013 edition of the *SAJEE*). Through a series of case studies, we explored the meanings of educational quality, finding these most often to be situated in community interests and issues and in local cultures. Of what significance is this to discourses on educational quality? For our research team, this was an interesting question that we have begun to investigate in more depth in various contexts (as can be seen in this edition of the *SAJEE*).

Researchers working as part of the SADC-REEP education quality and relevance research programme have found early signs that giving attention to the third discourse on educational quality (i.e. sociocultural discourses) further deepens notions of inclusivity or inclusivity concepts of quality so as 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. We have called this 'learning as connection' in order to express the relationship between meaning-making, context and concept (Lotz-Sisitka, 2011). It is encouraging that the United Nations Decade on Education for Sustainable Development (UNDESD) (see www.unesco.org/desd) has been seeking ways of valuing sociocultural notions of inclusivity and meaning-making in education. The UNDESD argues, in fact, for a reorientation of education towards sustainability, with the underlying assumption that educational practices that are oriented more towards understanding the role of education in creating more sustainable, equitable and just societies will also strengthen life skills, citizenship and, indeed, educational quality.

We are also beginning to find that giving attention to sociocultural discourses on educational quality *in relation to, and in combination with, efficiency discourses* is leading to improved learner achievement. For example, if a child is inducted into a complex scientific concept and process such as fermentation through reference to, or from the entry point of, his or her cultural experience of local beverage making, the scientific concept is easier to learn and grasp, particularly in contexts where learners are using second or third languages as their language of learning, as is the case for many African children in schools today (O'Donoghue, Lotz-Sisitka, Asafo Adjei, Kota & Hanisi, 2007). And, here, we should not forget the important insight provided by Vygotsky that the ability to communicate through language plays a determining role in the emergence of the capacity for free action, and, consequently, is intrinsically bound into the whole system of practical and mental activities that constitute our human way of life (Jones, 2008). Africa remains one of the few continents where teaching is conducted mainly in European languages (and the more difficult ones at that). Our observations are closely associated with, and are underpinned by, insights from sociocultural-learning theory, and we are finding strong resonances with this body of learning

theory and the observations we are making about the meanings and practices of quality education in African school settings. We are constantly reminded to reflect on the following perspective on learning provided by Vygotsky a number of years ago:

> Pedagogical experience demonstrates that direct instruction in concepts is impossible. It is pedagogically fruitless. The teacher who attempts to use this approach achieves nothing but a mindless learning of words, an empty verbalism that stimulates or imitates the presence of concepts in the child. Under these conditions the child learns not the concept but the word, and this word is taken over by the child through memory rather than thought. Such knowledge turns out to be inadequate in any meaningful application (Vygotsky, 1978, cited in Daniels 2002:54).

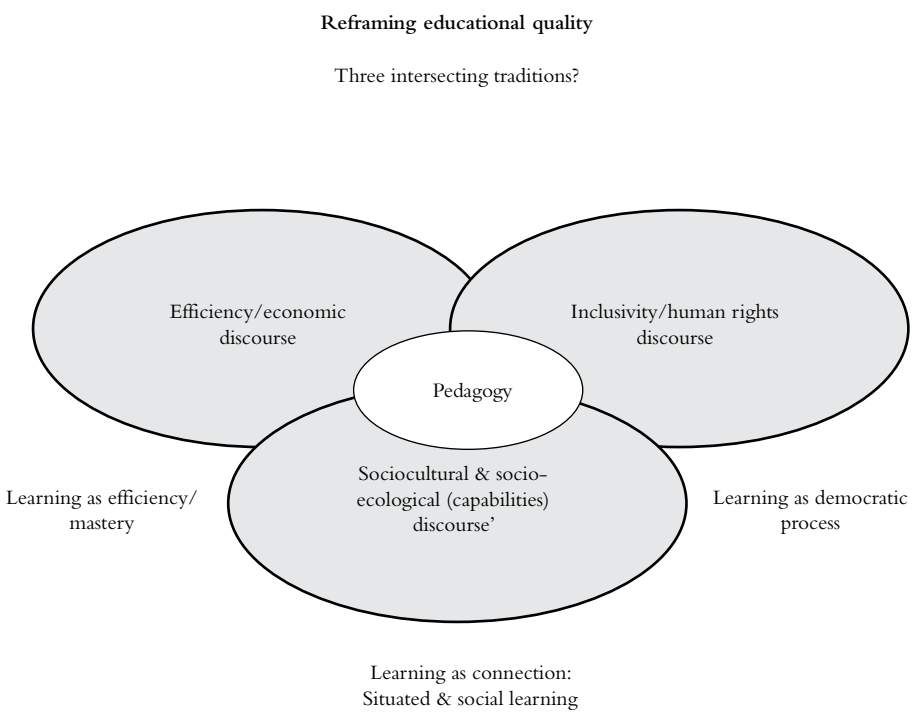
Vygotsky's important point is that 'scientific concepts are not assimilated in ready-made pre-packaged form' (Daniels, 2002:54). Vygotsky (1978) insisted that everyday knowledge concepts *must be brought into relationship* with scientific knowledge concepts in ways in which *they both develop*. Vygotsky's statement above therefore denies the possibility of 'direct transmission' of concepts. It drives educational thinking into the metaphor of 'learning as connection' (Lotz-Sisitka 2008, 2011) in which teachers and learners need to engage in forms of pedagogy and learning that assist learners to make connections between their everyday knowledge and the scientific knowledge that is on offer in schools '*in ways that they both develop*' (Daniels, 2002:54).

We have noted, too, that, in the United States of America (USA) and elsewhere, educational research is being conducted to assess the relationship between place-based education (contextually/socioculturally referenced education) and learner achievement. Smith (2013) comments that, even though this emerging evidence that place-based education (i.e. education which takes contextually located referents seriously) is significantly contributing to improved learner achievement, this area of research remains neglected in educational research. If this is the case in the USA, it is likely to be even more neglected in developing countries. This is a significant issue to consider in educational policymaking, and particularly in educational research that has an interest in learning and quality, as it may well be (based on early findings in our research) one of *the more important* aspects to research and understand in more depth if we are to fully understand how to orient teachers to providing quality education. We tend to take for granted that those countries where education is most effective are also those countries that define the cultural content and context of mainstream education models and approaches.

What is most important, however, is to consider this conception of educational quality *in relation to* the other more dominant conceptions of educational quality (as shown in Figure 1), and not to revert to a 'context only' model of educational quality. Further, it is important not to conflate the 'learning as connection' perspective below with contextualism in education, as contextualism can narrow education. The 'learning as connection' perspective shown in Figure 1 is important for *pedagogical processes that enable epistemological access and that allow for new meaning-making in the zone of proximal development* (Vygotsky, 1978), where everyday knowledge, concepts and experience are *brought into relationship with* scientific and more abstracted representations of knowledge, concepts and societal experience (Daniels, 2002).

Figure 1 shows that it may be necessary to consider the notion of 'learning as connection' (meaning: connections to sociocultural, social-ecological, contextual and historical dynamics of learners' life-worlds and experiences, and communities' valued beings and doings) while also giving attention to 'learning as mastery' (i.e. how to successfully complete educational tasks) and to 'learning as participation' (meaning: learners having a chance to voice their opinions and express their thoughts in an open, supportive learning environment). **These three conceptions of educational quality, when considered together, significantly deepen the manner in which educational quality is approached conceptually but also practically and pedagogically.**

Figure 1. Three intersecting discourses on educational quality (adapted and revised from Lotz-Sisitka, 2008)



Implications for Educational Research

The framework outlined in Figure 1 can also give rise to a range of new forms of educational research and to the development of research instruments that allow for more in-depth engagement with this way of thinking about educational quality. Some examples of the research tools and approaches that SADC researchers associated with the SADC-REEP research programme have developed to further interrogate this framing of educational quality include, but are not limited to, the following:

- Contextual-profiling research tools to ensure that researchers are able to develop a deeper insight into the context of research and practice (Lotz-Sisitka & Zazu, 2012);
- The deepening of engagement with situated and active-learning approaches using critical, realist ontological and dialectical transformative praxis insights (Schudel, 2013);
- The use of sociocultural research tools (e.g. cultural–historical activity theory tools) that allow for deeper contextual understanding of, and dialogue with, learners in schools (Silo, 2011);
- Foregrounding the manner in which sociocultural and structural factors influence curriculum debates and the use of teaching and learning methods (Kalumba, 2011);
- Working with problem-based and inquiry-based approaches to learning and curriculum development (Bholah, 2012; Shumba, Kasembe, Mukundu & Muzenda, 2008; Shumba & Kampamba, this edition);
- Working more closely with indigenous knowledge (Mokuku & Mokuku, 2003; Shava, 2010), heritage knowledge and practices (O'Donoghue, Shava & Zazu, 2014), and cultural artefacts and local knowledge (Namafe, 2008; Namafe & Chileshe, this edition); and
- Working more closely with Sen's (1990) capabilities theory[2] to guide thinking on how one might approach education and curriculum development, as Sen's theory allows for a probing of peoples' valued beings and doings as a platform for locating emergent curriculum and educational dialogue and development (Chikunda, this edition; Ketlhoilwe & Jeremiah, this edition).

There are many other such examples, and one of the synthesis challenges of this research programme would be to fully capture the depth and nuances of this engagement with educational quality and relevance in relation to the meta-framing of educational quality and relevance that was devised within the research programme (as captured in Figure 1).

Implications for Teacher Education

The implications for teacher education are potentially very interesting, particularly if teachers are given opportunities to consider *all of these conceptions of educational quality* as integral to their practice. Teachers need to be inducted into, and supported to work with, *all three concepts of quality* in order to guide their practice, and, perhaps even more importantly, **teacher education institutions and the lecturers and professors in teacher education institutions need to be oriented towards an understanding of these conceptions of educational quality**. It is noticeable in national and international discourses that governments tend to neglect the lecturers and teacher educators in professional development initiatives oriented towards educational improvement. The consequence is that teacher educators themselves continue to operate with marginal and poor understandings of how to improve educational quality in schools, with consequent knock-on effects for school systems.

Educational institutions, particularly in Africa and in other developing-country contexts, are also poorly resourced to conduct locally relevant educational research, with the consequence that the knowledge that is produced about education tends to follow the logic and dominant

conceptions of education and quality as produced in the West, or North, where educational research capacity is far higher. Knowledge producers influence the knowledge that is produced, and it is not difficult to identify that our concepts of educational quality are significantly influenced by the research orientations and trajectories of the World Bank, UNESCO and other large multinational research organisations, and by the research trajectories and interests of donor organisations, valuable as these may be. If we are to meet the challenges of achieving quality education that matters in the local context, it will be necessary to strengthen local research capacity, and particularly the research capacity of the classroom teacher, who needs to develop the skills and competences to understand how he or she is approaching educational-quality matters in schools.

While this may seem unnecessarily complex if one takes a narrow view that all that matters is successful grades and that teachers are merely technicians (as is often the case in international educational discourses that are oriented towards efficiency discourses), our research (even though it is small in scale and case-study based at this point) shows that, when given the opportunities, teachers in the deepest rural areas working in the most dire circumstances and conditions *do have the capacity to reflect on what they are doing, on how they are teaching, and on how teaching can be improved*. They understand the children they are working with, and they have insights into how education can be improved – as can be seen in the research papers that have emerged from this research programme to date (published in the 2008 *SAJEE* and in this edition of the *SAJEE*).

We have also found that, given the opportunities for 'making the connections' to learners' languages and cultures, and to local community interests, teachers' motivation improves, as does the relevance of the education they are offering. Further, we have found that, while this is the case, there is still a need to work with these teachers to ensure mastery of concepts and content as required by educational standards, and to give attention to pedagogies of inclusion. We find, however, that the contextual reference points provide us with better starting points for engaging the latter two conceptions of educational quality, as the entry point is epistemological and cultural relevance, which creates access to other forms of relevance, for example economic system relevance or political and social relevance (which education systems tend to favour in their discourses on educational quality).

Conclusion

In conclusion, therefore, this think piece argues that, in developing and providing teachers for Education for All (EFA), there is a need to consider how different conceptions of quality influence not only thinking and practice surrounding teacher supply, but also teacher education. As indicated above, early research insights gained from our research programme show that developing teachers' understandings of a *range of interrelated* concepts of quality may be the most efficient route to achieving success in education. Until teachers have a deep and full understanding of the meaning of educational quality and of how they practise for educational quality, investments in the supply of teachers may not reach their full potential. This deep and full understanding of the meaning of educational quality needs to be further extended

to teacher education institutions, including lecturers and professors, particularly in developing countries where EFA and educational quality interventions must also involve local research that allows for a deeper understanding of these issues.

The framework of 'interacting conceptions of educational quality' being developed by our southern African research network (represented in Figure 1) may provide some useful starting points for generating discussion on this matter at local, national and international levels. Of significance is that these 'interacting conceptions of educational quality' allow for giving attention not only to the mastering of subject knowledge and skills, and inclusion in the education system, but also to the development of life skills, citizenship, and orientation to the world of work, thereby substantially improving the relevance of education and enabling the reorientation of education and training systems as envisaged by the United Nations Decade of Education for Sustainable Development (UNDESD), and as necessary for the profound forms of societal change that will be needed for more sustainable, just and climate-resilient development pathways into the future.

Notes on the Contributor

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Endnotes

1. See 'Acknowledgements' above for a full list of these participants and institutions.
2. It is interesting to note that, while SADC researchers were working more with Sen's capability theory for education in conceptualising the 'learning as connection' perspective on educational quality, so were international researchers in the EdQual programme (see Tikly, Barrett, Nikel, & Lowe, 2010; Tikly & Barrett, 2013), although their work was not focused on ESD but on social justice and educational quality in low-income countries. See also Unterhalter (2007) who theorised these approaches in the context of gender education and Walker (2005) who is working with Sen's capability theory in higher-education curriculum contexts. This SADC-REEP work on ESD can therefore be seen to fall into a wider process of rethinking notions of educational quality and relevance.

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Towards Urban Sustainability
Learning from the Design of a Programme for Multi-stakeholder Collaboration

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Abstract

Owing to rapid urbanisation, cities are becoming a key locus for making sense of, and influencing, social and technological development. Urban sustainability is high on the research as well as on the development agenda. The complexity of modern cities often defies conventional governance mechanisms to promote sustainability, such as regulation, information and economic incentives. This has prompted a growing interest in innovative approaches based on collaborative learning in diverse groups of stakeholders in pursuit of sustainability. In this article, we wish to contribute to, and advance, the research and practice regarding urban sustainability by exploring the experiences of designing and facilitating a programme for multistakeholder collaboration, trust-building and concerted action in six cities in Europe, southern Africa and Southeast Asia. We apply an action research method called 'learning history' to understand the learning processes in the design and facilitation team and in two multistakeholder groups in Makana in South Africa and Malmö in Sweden. The findings illustrate how collaborative learning theory and systems thinking framed useful praxis for facilitating rich learning processes in these three teams. The article is presented in four sections: Section 1 provides the introduction and orientation; Section 2 provides a process description of the design of the SUS Programme; Section 3 provides learning histories; and Section 4 provides reflexive engagement on these.

Section 1: Introduction and Orientation

In 2010, the Swedish International Center of Education for Sustainable Development (SWEDESD) initiated the design of a programme intended to enable multistakeholder collaboration, learning, and concerted action in a number of cities in Africa, Asia and Europe. The intention was to contribute to, and advance, research and practice regarding urban sustainability. This article aims *to explore the experiences of designing the Supporting Urban Sustainability (SUS) Programme* (see also Bharti & Bansal, this volume). The intention is both to deepen the learning within the design and facilitation team[1] and to make the thinking, experimentation and arguments of the team available to others to critique, debate and potentially learn from.

The SUS Programme, which is ongoing, seeks to engage with two key global dynamics, the first being concerned with accelerating urbanisation (UN-HABITAT, 2012) *and* the second with the recognition that human activities have crossed, or are about to cross, critical ecological boundaries of the planet (e.g. Rockström, Steffen, Noone, Richardson, Crutzen & Foley,

2009). Cities have always been at the forefront of new ideas, new applications of technologies, new cultural movements, and social change. They can be understood to constitute significant nodes within networks for disseminating innovations (Snyder & Wenger, 2004). In parallel, in an urbanised world, cities are facing a number of interconnected crises ranging from loss of ecosystem services, to climate change impacts, to growing inequalities and financial instabilities (UN-HABITAT, 2012).

During the design of the SUS Programme, the design and facilitation team drew a boundary around a specific set of complex situations in urban development within which the SUS Programme might make a difference. The nature of these situations has been described as *wicked* due to their complexity (Rittel & Webber, 1973; Ritchey, 2007; Ison, 2010). Wicked situations are characterised by: uneven power relations involving a diversity of stakeholders, often from a multitude of sectors and comprising diverging interests; and complex causal inter-actions that are emergent, and difficult to determine or control. Confronted with such situations, stakeholders are seeking to deal with issues that may be difficult to define, are contested and ever-changing. To add to the complexity, the understanding of the nature, causes and solutions of problems in wicked situations varies among stakeholders (e.g. Rittel & Webber, 1973; Ison, 2010).

It has been argued that transformation of wicked situations defies simple policy solutions. Instead, comprehensive and context-specific approaches are needed where stakeholders build trust, as well as apply various forms of knowledge and ways of knowing, to jointly deconstruct and reframe their understanding of the situation and of the solutions needed. Under enabling conditions, this kind of *collaborative learning* can potentially lead to shared understanding of the situation and to shared ownership of concerted action among stakeholders and gradually transform the situation (SLIM, 2004; Verweij & Thompson, 2006; Steyaert & Jiggins, 2007; Ison, 2010). However, other experiences demonstrate the difficulties of getting such multistakeholder learning off the ground (e.g. Duit, Hall, Mikusinski & Angelstam, 2009, in Andersson, 2009:342; Scott & Gough, 2003). This article draws on *and* contributes to the growing literature on multistakeholder collaboration in complex sustainable development situations (e.g. Ison, 2010; Blackmore, 2010; Wals, 2007; Ison, Collins, Colvin, Jiggins, Roggero, Seddaiu, Steyaert, Toderi & Zanolla, 2011; Wei, Ison, Colvin & Collins, 2012), while also extending it into a new space, namely that of urban sustainability. Against this backdrop, the inquiry guiding this article is: *How can a programme be designed so as to enable multistakeholder collaboration, learning, and concerted actions towards urban sustainability?* In this article, we reflect on this inquiry through the lenses of three interconnected learning processes within the broader SUS Programme: learning within the design and facilitation team, and learning within each of the two multistakeholder teams in Makana in South Africa and Malmö in Sweden.

Theoretical framework

Action research cycles

From the outset of the SUS Programme, the design and facilitation team sought to be reflexive and to inform their practice by way of theory. In doing so, they wanted to engage in what is sometimes referred to as *praxis*. Freire (1970:51) defines praxis as 'reflection and action upon

the world in order to transform it'. It has been argued that action research is well placed both ideologically and practically to help develop effective praxis. This is because the researcher as an explicit (co-learning) subject in the research process contributes with research-based (or evidence-based) knowledge and experience to the transformation process. Action research also confronts the challenge of creating knowledge that is useful to people in the everyday conduct of their lives, that is, action research values knowing-in-action (Reason & Bradbury, 2008). The core process of action research involves cyclical iteration between reflecting and planning, experimenting with new and different forms of action, noticing what happens, and reflecting again (e.g. Reason, Coleman, Ballard, Williams, Gearty, Bond, Seeley & McLachlan, 2009; Reason & Bradbury, 2008). This cyclical rhythm of action research structured the work of the design and facilitation team and, later on, the city-based multistakeholder collaborations.

Although action research brings systematic discipline to people's actions and can help to develop good praxis, development and research processes cannot be predefined in detail, because they deal with the messiness of everyday life. Our worlds don't stand still as we engage with them, so our work emerges over time as those involved learn more about the issues at hand, try out new ways of acting, develop relationships, and gain confidence in their exploration (Reason *et al.*, 2009). As the design and facilitation team went through action research cycles, it gradually developed an emerging theoretical framework. Below is a brief description of two of the key concepts, *collaborative learning* and *systems thinking*, which will serve as a theoretical framework for this article.

Collaborative learning and systems thinking

Drawing on the literature on experiential learning, social learning, inquiry-based learning, organisational learning and transformative learning (e.g. Kolb, 1983; Wals, Van der Hoeven & Blanken, 2009; Loeber, Van Mierlo, Grin & Leeuwis, 2007; Collins & Ison, 2009; Argyris & Schön, 1996; Torbert, 2004; Taylor, 2007; Preece, 2003), the design and facilitation team chose to use the term *collaborative learning* to describe their developing, shared understandings of learning theory and praxis. Specifically, the design team came to use 'collaborative learning' to refer to an understanding of learning that emerges through interactions in which stakeholders with initially divergent norms, values and constructions of reality, over time progressively build trust, co-create shared knowledge and engage in concerted action. This is coherent with assumptions about learning in transformative learning research in which 'learning is understood as the process of using a prior interpretation to construe a new or revised interpretation of the meaning of one´s experience in order to guide future action' (Mezirow, 1996:162). Accordingly, collaborative learning can be described as emerging through a dialogic and action-based process in which stakeholders try to achieve an inclusive, systemic and shared understanding of a given set of policy and practice issues and of how to manage them in an ongoing, adaptive manner. It can also be argued that collaborative learning offers possibilities to orchestrate effective performances as part of the adaptive governance of common resources (Collins & Ison, 2009; Blackmore, 2010).

Scholars (e.g. Schön, 1983) have stressed the importance of values and beliefs for understanding learning processes. These scholars claim that, as actors engage in 'reflection-in-action' (Schön, 1983:54), cognition cannot be separated from values and beliefs, nor can

cognition be separated from action. Central to Schön's work is the idea that people act on the basis of what he calls 'theories-in-use', that is, a mental map of theoretical, normative and empirical considerations applied to solve a problem. Schön views learning as the process of reviewing such a map in the light of crisis and surprise. Unexpected misfits between the specificities of the problem situation and the theory-in-use may lead an individual to change the theories, beliefs and values that underlie his or her actions. It has been argued that the more complex a certain situation, the more learning becomes a question of sense-making or negotiation of meaning in groups, that is, collaborative learning (Wals *et al.*, 2009). The process of deconstruction of the ideas, conceptions and assumptions stakeholders have previously held and the embracement of new ways of understanding constitute a key process in collaborative learning, often referred to as 'reframing' (e.g. Wals, 2007).

Wals *et al.* (2009:28) argue that *dissonance* is an important prerequisite for collaborative learning. They ask: 'How can the dissonance created by introducing new knowledge, alternative values and ways of looking at the world become a stimulating force for learning, creativity and change?' They claim that the conflicts in a collaborating group and their underlying sources need to be explicated rather than concealed, since:

> …[by] explicating and deconstructing the oftentimes diverging norms, values, interests and constructions of reality people bring to a sustainability challenge, it not only becomes possible to analyse and understand their roots and their persistence, but also to begin a collaborative change process in which the kind of shared meanings and joint actions emerge that will ultimately help create a more sustainable world.

The concepts of single-, double- and triple-loop learning are relevant for the aim of this article, since they describe different levels of intensity and scope of learning. Pahl-Wostl (2009, drawing on Bateson's 1972 original work) has synthesised the work around these concepts. She claims that single-loop learning refers to a refinement of actions in order to improve performance without changing guiding assumptions and calling into question established routines. Incremental changes in established practice and action aimed at improving the achievement of goals might be results of this kind of learning. Double-loop learning refers to a change in the frame of reference and the calling into question of guiding assumptions. This implies reflection on goals and problem-framing, and assumptions of how goals can be achieved. Triple-loop learning refers to a transformation of the structural context and factors that determine the frame of reference. This kind of societal learning refers to transitions of the whole regime, for example a change in regulatory frameworks (Pahl-Wostl, 2009:358–359).

In research on learning there is a strong emphasis on the need to contextualise the research design so as to grasp the specific historical, cultural, political, environmental, economic and spatial conditions for learning (e.g. Blackmore, 2010). For contextualising the SUS Programme, we drew on systems thinking (e.g. Checkland & Poulter, 2006; Blackmore, 2010) for understanding the context of the participating cities as a basis for the design and facilitation of collaborative-learning processes. *Systems thinking* (e.g. Checkland & Poulter, 2006; Ison, 2010; Blackmore, 2010) developed during the 20th century as a critique of reductionist thinking.

In reductionism, it is argued that knowledge and understanding are generated by breaking phenomena down into their constituent parts and then studying these simple elements in terms of cause and effect. In systems thinking, the belief is that the world is best understood systemically. This means that phenomena are understood to be emerging properties of an interrelated whole. With systems thinking, it is argued that meaningful, valid knowledge and understanding come from building up whole pictures of phenomena, including how these phenomena interrelate, and not by breaking them down into parts (Flood, 2008). As regards the aim of this article, it is important to distinguish hard from soft systems thinking. According to Checkland and Poulter (e.g. 2006), hard systems thinking advocates an approach to systems as having, from the human perspective, an independent standing in the world. Crudely speaking, this suggests an ontological and epistemological realism according to which the world is accessible, that is, knowable, as relevant information not subject to knowledge systems, interpretations or language in use. In contrast, soft systems thinking suggests that it is the social construction of the world that is systemic (e.g. Flood, 2006; Checkland & Poulter, 2006).

Methodology

In describing and understanding the work of the design and facilitation team and of the two selected multistakeholder groups in Makana in South Africa and Malmö in Sweden, an action research method called *learning history* is applied in this article (see Reason *et al.*, 2009; Gearty, 2008). This method has been selected for exploratory reasons, because it carries the potential for deepening the learning in innovative groups and for supporting the diffusion of learning to other groups and organisations (Roth & Bradbury, 2008; Gearty, 2008). It seems to be well suited to studying systems thinking and collaborative learning in the context of wicked situations. Crucially, as the name suggests, a learning history is a story-based approach. By including the messiness of human endeavour, the potential for learning from others' experiences and contexts is retained. Roth and Kleiner (1998) suggest that the potential for learning in any situation is increased if one has access to the thinking, experimentation and arguments of those who have encountered a similar situation. They propose using learning history as a way of getting beyond distilled best-practice guides that imply change as a linear sequence of carefully executed causes and effects. As research on transformative learning suggests, the making of meaning, or learning, involves an aspect of 'opening that leaves us unable to seek firm grounds, to find legitimation for our actions and our practices'; hence the learning-history method may help us capture the sudden, non-linear and 'in some ways unpredictable' change of forms in transformative learning processes (Steinnes, 2004:270). The voices of those involved are included as direct quotes in the learning histories. This keeps the narrative close to the original experience and brings it to life for the reader, increasing his or her learning potential. In the histories, the researchers reflect and comment on the narrative, note themes and make links to theory (Bartunek & Louise, 1996). As with other forms of action research, knowledge based on rational argument and analysis is combined with other kinds of presentational knowing such as art, poetry or story. The result is intended to be an accessible, engaging account that works on multiple levels. According to the readers' interests, situation and indeed preferred mode of working, they can concentrate on the elements of the account that may seem relevant, while ignoring others (Gearty, 2008).

As with all methods, there are traps when applying learning history, including the risk of telling stories in which protagonists behave in idealised ways (Snowden, 2001). Another trap is that of the heroic victory narrative in which a myth arises around one person in the account, thus excluding the possibility for any non-hero to do anything similar (Gearty, 2008). A third trap is what Snowden has called 'retrospective coherence', that is, when a story is told in which all actions seem to have been mindfully taken in the service of achieving a carefully designed process towards a desirable end. When this happens, chance, luck and serendipity are not acknowledged and everything reverts to the logical view of change as a sequence of well-planned and controllable steps (Snowden, 2004, in Gearty, 2008:86). That rarely corresponds with the messiness of human endeavour.

An important basis for the narrative methodology in this article is the distinction between first- (for me), second- (for us) and third-person (for them) research developed by Reason and Bradbury (e.g. 2008). This distinction has been applied by researchers to create a framework in order to ensure the methodological rigour of action research endeavours (e.g. Reason & Bradbury, 2008). In this article, one of the authors (Martin Westin) engages in first-person research, seeking to understand his learning process when designing the SUS Programme. Martin's learning history, presented in Section 2, describes his experiences of the design process. Furthermore, the authors of this article engage in *second-person* research alongside the participants in the SUS Programme in the two selected cities: Makana in South Africa and Malmö in Sweden. The learning histories that have been elicited through interactions between the researchers and these two multistakeholder groups are presented in Section 3. Additionally, in Section 4, the authors of the article engage in *third-person* research by seeking to link the learning histories to the theoretical framework presented above, and to articulate lessons learnt regarding future design of multistakeholder collaboration, learning and concerted action towards urban sustainability.

The data in this article has been collected mainly through two processes: (a) as an integral part of the action research cycles during the design and facilitation of the programme; and (b) through interaction among the researchers and the multi-stakeholder groups in Makana and Malmö in 2012 after the first set of learning activities in the SUS Programme. In the first phase of research, the lead researcher (Martin Westin) worked with data generated during the Programme and originating from: planning documents; concept papers; educational tools; the programme learning management system; journal writing and records from city team discussions and the seven workshops during the programme process in 2011; strategic inquiry plans; personal learning journals; the cities' contributions to the programme web platform; and the learning history which each city team developed jointly. The lead researcher developed stories, and identified themes, patterns and links to theory on the basis of this data set. This resulted in three learning histories: (a) about the design process (Section 2); (b) about the process in Makana (Section 3); and (c) about the process in Malmö (also in Section 3).

In the second phase of the research process, the lead researcher shared the histories with the co-researchers, the design and facilitation team, and the multistakeholder teams in Makana and Malmö. The design and facilitation team and the city teams then read through the histories and made comments and suggested changes. In the next step of the process, the lead researcher,

together with the co-researchers, compiled the final versions of the histories. In terms of third-person research, three of the researchers (Martin Westin, Alexander Hellquist and John Colvin) had been part of the design and facilitation team, while the fourth researcher (David O. Kronlid) entered into the research process when the histories had been elicited. The third-person research took shape through a dialogical process in which the researchers blended their experiences and perspectives in order to draw out the lessons learnt for future design and facilitation of collaborative learning towards urban sustainability.

Following this introductory section, we present the learning history about the design process of the SUS Programme in Section 2. Thereafter, in Section 3, the learning histories about the work done at Makana and Malmö towards urban sustainability, are presented. In the concluding section, Section 4, the histories are linked to the theoretical framework and lessons learnt are articulated.

Section 2: Designing the SUS Programme

The initial design of what would later become the SUS Programme started in April 2010. In this section, I[2] chose to focus on the formative sequence of events in the design process during the period April to December 2010. I joined the SWEDESD team after agreeing with the Director and Scientific Leader to lead the development of a programme on 'Sustainable Cities'. At this stage, I had worked with educational development at the Swedish International Development Cooperation Agency (SIDA) for about three years. SWEDESD was by then a recently established centre, within the sphere of Swedish development cooperation, charged with the mission of contributing to capacity development in the field of education for sustainable development (ESD). The Centre was to collaborate with organisations in countries where Sweden is engaged in development cooperation. Together with the SWEDESD Director and the Scientific Leader, I worked out an initial framing of the programme and laid down a process for continuing framing and development. We wanted to assign quite some time to openly exploring ways in which this programme could contribute to urban sustainability, given SWEDESD's profile and strengths. The first project plan covering the period April 2010 to April 2011 had the aim of developing the framework of the programme. It included consultations and communications, building partnerships, drawing up a research proposal, arranging two 'expert seminars', and developing the programme outline. During the first couple of months, I met with key professionals, attended seminars and conferences, and had frequent discussions with the SWEDESD team. It was an intensive period with much discussion of our original framing.

By August 2010, the organisational structures for the design had been established in the form of a partnership of seven organisations under the leadership of SWEDESD[3], a design and facilitation team backed up by the Director and the staff of SWEDESD, and an independent consultant (John Colvin). New relationships had been formed and old ones had been deepened. These relationships influenced the design process greatly. A mail from me to John illustrates how the new relationships inspired me:

Wow! I have spent a couple of hours to start looking into the material you shared with

> me and it is so relevant for my and our work! The entry points are so many that I hardly know where to start. Anyhow it is very clear to me that it would be great to have you on board as a dialogue friend during the development of our programme. (Martin to John in a mail in June 2010)

The individuals brought in their experiences, interests and habits into the process. This introduced new momentum as well as tensions. An intensive process to lay down the structure and content of the programme started with a view to inviting participants from cities in Africa, Asia and Europe towards the end of the year. Gradually, the tensions between design principles, theoretical traditions and narratives started to surface. These tensions also affected the dynamics among the people involved in the design. At this point, we had formulated the main characteristics of the programme in a draft announcement intended to be advertised as a means to invite participants. Here, we said that the programme would contribute to capacity development in urban settings by facilitating individual learning revolving round 'a sustainability project'. However, this initial framing met with resistance and a period of reframing was about to commence. In October 2010, a workshop was organised to establish relations with a group of experts in collaborative learning, thereby enabling inputs on the continued design of the programme. These experts provided inputs on the design of the programme, including the development of knowledge resources, ways of recruiting participants, and building a community of practice among the participants. Their strong recommendation was to apply design principles such as action orientation, iteration, participation, context sensitivity, co-evolution and reflexivity.

The workshop left me with the realisation that we needed to strike a balance between what we were comfortable with and what was needed in order to make a difference. How could the more common way of fully pre-specifying the structure and content of the programme and subsequent implementation be reconciled with the iterative and context-specific approach catering for the needs of each city, as suggested by the experts? As one of the team members said during the reflections after the workshop 'It [the workshop] brought our planning into disarray!'

After the workshop, I realised that we needed to reframe the programme design based on our learning. The SWEDESD team held an internal workshop facilitated by John as our independent consultant. The objectives of this workshop were to undertake more detailed design and planning for the 2011 programme and to contribute to team development, including a better understanding of our roles and responsibilities. We also wanted to support our individual learning and competencies, including programme design and facilitation. During the workshop, we experienced differentiation and tensions in the team in relation to the balance between open-ended, explorative engagement and linear, fixed planning. For example, a team member advocating linear, fixed planning said 'It is still not clear what we are selling', while a team member who argued for a more iterative design said: 'This kind of adaptive and iterative programme is more difficult to work with but this approach is needed if we are to practise what we preach.' I was concerned and wrote in my journal: 'Tensions in the team about what kind of programme we are developing. How can we move our positions?'

After the workshop, John and I decided to draft three alternative generic designs of the programme, the purpose of which was to enable an informed choice of direction based on our learning thus far. The three alternative designs were chosen to illustrate how the choice of the underlying theory influences the design, structure, methods and content of the programme. In this, we drew heavily on systems thinking, especially the distinction between hard and soft systems thinking (see Section 1). These traditions gave us a language for thinking around and discussing the choices facing us. Design Alternative 1 was framed as an open iterative learning process with emerging structure (in line with soft systems thinking), while Design Alternative 2 was framed as a linear sequence where ends and means were formulated at the start of the programme (in line with hard systems thinking). Design Alternative 3 was framed as a mix between soft and hard systems thinking, allowing some design elements to be linear and defined in advance, while space was also provided for iterative exploration and emerging structure.

We agreed to carry on designing the programme according to the third design alternative, thus striking a balance between a soft and hard systems perspective on design. This middle way was also seen as a way of drawing on the expertise in the SWEDESD team, which was unlikely to be fully utilised with a clear soft systems approach.

Table 1. Original framing as compared with reframing

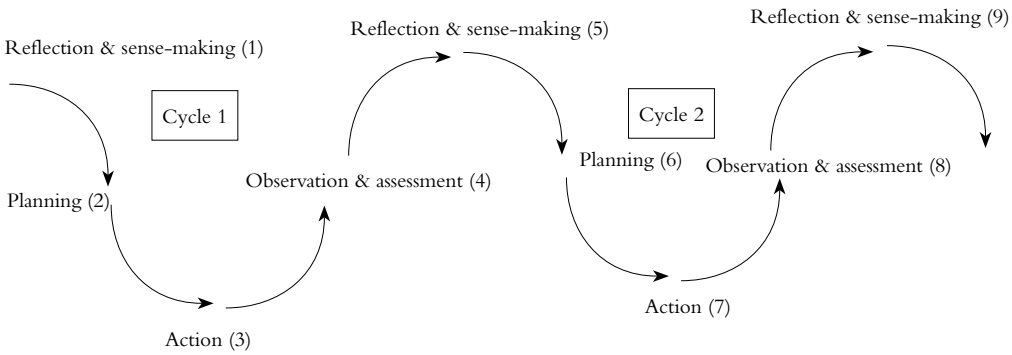
	Original framing	**Reframing**
Objectives	Capacity development	Capacity development
Impact	Sustainable poverty alleviation	Sustainable poverty alleviation
Participants	Individual decision-makers	Teams of urban stakeholders
Main focus	Sustainability project	Strategic inquiry
Learning structure	Not clearly articulated	Learning cycles
Selection process	Open call for applications	Dialogue with urban organisations
Underlying theory	Not clearly articulated and discussed	Mix of hard and soft systems, as well as collaborative learning

When looking at the differences between our original framing before the workshop in October and the subsequent reframing, it appears that the objectives and intended impact remained the same, while the means to reach the objectives and impact changed. The reframing meant that we placed increased emphasis on collaborative learning, and this led to shifting the choice of participants from individuals to teams of stakeholders. With the reframing, the main focus of the programme changed from a 'sustainability project' to a 'strategic inquiry'. This reframing was inspired by the critique of 'projectification' (e.g. Ison, 2010). We thought that using the term 'project' and the underlying practice tradition might make it difficult to contribute to ongoing work in the cities and that we would run the risk of creating 'islands of development' which would disappear when our outside support was withdrawn. Instead, we moved away from our habits and comfort zones and chose the term 'strategic inquiry' as the pedagogical focus of the programme. Here, we draw on the tradition of action research based on inquiry (e.g. Torbert, 2004). The word 'strategic' was chosen to emphasise the city-wide nature of the stakeholder

collaboration and was also meant to imply action. We assessed that the strategic inquiry approach would make it easier to integrate the SUS Programme into current activities in the participating cities, while reframing and adding new value to the ongoing processes. The open-endedness of the inquiry process is intended to facilitate collaborative learning and to allow for joint action in shorter cycles of planning, action and reflection.

The reframing also led us to a more clearly articulated structure for the participants' learning. We decided to invite the participants to go through experiential learning cycles so as to pursue their inquiries. The cyclical learning process we designed for the participants is visualised in Figure 1.

Figure 1. Pursuing a strategic inquiry through learning cycles



Our application of experiential learning theory was based on the idea of cycles of: (a) reflection and sense-making; (b) planning; (c) action; and (d) observation and assessment. Participants' learning would be driven by reflection on experience in order to identify how a situation or future actions could be improved, and then using the knowledge to actually make improvements. Applying lessons learnt to future actions then provides the basis for another cycle of learning (Kolb, 1983).

The learning and reframing in the design and facilitation team additionally resulted in changes in the process by which we engaged with and selected participants from our partner cities. In the original framing, it had been foreseen that we would go out with an open call for individual applications, while the reframing laid down a dialogical process with city representatives to identify multi-stakeholder groups who would be invited to join the programme. This change was a logical implication of the shift from individual to collaborative learning.

Before the reframing, the design and facilitation team and I had not clearly articulated or discussed our theoretical standpoints. During the formative phase linked to the October workshop, we drafted the three alternative designs. This enabled us to articulate our theoretical assumptions in the language of soft and hard systems and collaborative learning theory (see section one).

Section 3: Towards Urban Sustainability in Makana and Malmö

In this section, we describe the cycles of action and reflection in Makana and Malmö during the SUS Programme. We focus on the first year of the SUS Programme, 2011, when the teams went through the same rhythm of learning cycles over three phases: an engagement period, a development period, and a formative evaluation period.

Makana: Urban agriculture and empowerment

Through established relations with Rhodes University, Grahamstown, South Africa, SWEDESD initiated a dialogue with Makana Municipality (which includes the city of Grahamstown) on an engagement in the SUS Programme. An exploratory mission from SWEDESD to Makana early in 2011 resulted in a joint commitment to the SUS Programme. Following a stakeholder mapping in the city, a team consisting of a variety of players from the public sector and civil society was selected to join the programme. The anticipated work revolved around an ongoing, pro-poor, green economy scheme focusing on urban agriculture and economic opportunity for people living in poverty in Makana.

At an initial 'engagement' workshop (which also included teams from Mangaung in South Africa and Arusha in Tanzania), the Makana city team identified two potential situations which could form the basis for its strategic inquiry: (a) restoring a culture of agriculture for the benefit of the poor in Makana Municipality; and (b) education and training programmes in healthy living for people living with HIV/AIDS and other chronic diseases within Makana. During further elaboration of this inquiry, the Makana team decided to combine the two previous options and to develop an inquiry which would look at various ways of bringing 'culture back into agriculture' and of 'supporting healthy lifestyles', particularly for people suffering from HIV/AIDS, using land for pilot projects related to organic urban farming, tree plantations, medicinal plants, etcetera. Poverty alleviation and reduced pressure on planetary boundaries would be key objectives of its inquiry. This was summarised in the following strategic inquiry: *How can we restore a culture of agriculture for the benefit of the poor in Makana Municipality?*

Initial actions, following the engagement workshop, included identification of relevant stakeholders, workshops to elaborate on the inquiry, and activities to anchor their work in the city administration. During the residential period in Sweden, which took place two months after the initial engagement workshop, the Makana team worked intensively to shape its inquiry further, with a special focus on how to broaden and strengthen stakeholding. Broader ownership of the team's inquiry was needed to increase the potential for city-wide effects of its work. Links between ecosystem services and people living in poverty were identified, through a participatory mapping method, and action plans were made.

In the next development phase of the team's work, starting in September 2011, land was secured and cultivated; buildings and equipment were put in place; workshops were held; and home gardens were established and further cultivated. The team sought to contribute to reorientation of agricultural systems towards modes of production that are highly productive, highly sustainable and contribute to the progressive realisation of the human right to adequate food. It paid special attention to establishing forms of decision-making based on

consultative processes involving a broad range of stakeholders, including non-literate and highly marginalised sectors of society. The style of consultation drew on Xhosa traditions of grassroots democratic practice.

At a review workshop in November 2011, the team reframed its strategic inquiry based on its learning during the initial stages of the SUS Programme. Its new strategic inquiry became: *how can we create sustainable, diverse livelihood nodes making green economy and food production feasible?* This new phrasing marked an increased interest on the part of the team, and of the larger stakeholder group, in scaling up and enabling sustainable business models to be developed out of its initial achievments. A quotation from a Makana participant illustrates the importance the team placed on the collaborative process: 'One thing we learnt is that we have grown a lot together as a group. I am very happy with this'.

Malmö: Reconnecting urban and rural

During the early stages of programme design, SWEDESD initiated a dialogue with the city of Malmö. This initial contact revealed a sense of common purpose and common understanding of the importance of creating enabling conditions for collaborative learning among stakeholders in pursuit of urban sustainability. During the period June to November 2010, a series of meetings took place to explore possibilities for collaboration. The dialogue involved top-level politicians, senior decision-makers in the municipal administration, leaders from civil society, and representatives from academia. Following a decision by these Malmö stakeholders to engage with the SUS Programme, the subsequent dialogue during the period November 2010 to April 2011 focused on identifying ongoing processes in Malmö which might be supported or reinforced by the SUS Programme and on establishing a suitable city team with participants from various organisations in Malmö.

Initial probing by decision-makers in Malmö led to a focus on how Malmö could grow inwards while preserving green areas. This framing included a conflict between, on the one hand, a will to attract new citizens and grow on one side and, on the other, to prevent urban sprawl threatening the rich agricultural land bordering Malmö. Based on this focus, a team gradually formed consisting of a mix of the political levels, civil society and decision-makers in the municipal administration. In addition, an influential group of senior decision-makers in the city was formed to back up the core team throughout the process.

The Malmö team was reflexive throughout the SUS Programme. It engaged intensively in mutual deliberation in order to develop the focus and boundaries of its strategic inquiry. When the team started its collaboration at the engagement workshop in April, a first reframing was deliberated when it changed its focus from the original framing on 'the green and dense city'. Instead, it focused on a shared concern around the trend of unsustainable production/consumption in Malmö, reflected in an increasing ecological footprint – and the failure of critical thinking and of questioning consumption. It agreed to pursue the following inquiry: *How do we work together to address the needs of the citizens of Malmö within a sustainable global footprint, while improving local ecosystem services?* The team also shared a concern about the growing inequalities among citizens of Malmö. Initial activities by the team, after the first engagement workshop, included involving more stakeholders, learning from existing data, exploring

possibilities of integrating its inquiry with existing city programmes, and identifying tools such as eco-budgeting for assessing the value of ecosystem services. The team discussions were intensive and it questioned and reframed its original understandings, as illustrated in this quotation from a team member: 'Do we want to tackle an easy issue or the real problem? Sometimes the goal is not everything, sometimes the road is important. What if we would open up a discussion with a wider group of people and by that dialogue get what it is we should focus on?'

Before and during the residential period in June 2011, the team started to sharpen and reframe its inquiry again. Gradually, community gardening came into focus and links between urban and rural Malmö became more important. After working intensively and through a series of rephrasings, the Malmö team agreed on the following strategic inquiry: *How to recreate ecosystem services and enhance poverty alleviation which can be mediated through a core of active collaboration between rural and urban issues and stakeholders?* In parallel with shaping its inquiry, the team worked on its division of responsibility and roles.

Following the residential period, the Malmö team engaged in anchoring its ideas in members' respective organisations; exchanged ideas with stakeholders in Berlin on urban farming; organised a meeting between rural farmers and urban cultivators and growers; initiated a process on rural development; diffused its learning into city development plans; and organised a stakeholder meeting on urban agriculture.

Section 4: Links to Theory and Lessons Learnt

In this concluding section, we link the learning histories of Sections 2 and 3 to the theoretical framework described in Section 1, and we offer some of our lessons learnt to the reader. By doing so, we revisit the aim of this paper to: *explore the experiences of designing the Supporting Urban Sustainability Programme.* We start by reflecting on the learning histories through the lenses of systems thinking and collaborative-learning theory. At the end of this section, we summarise our experiences of designing and facilitating multistakeholder collaboration towards urban sustainability.

Exploring the learning histories

Hard and soft systems thinking

When we reflect on the learning histories of Sections 2 and 3, the distinction between hard and soft systems thinking helps us to understand how the implicit or explicit theoretical assumptions underlying a programme influence the approach, methodology, content and structure. A design based on hard systems thinking would view the development, implementation and evaluation of the SUS Programme as a linear process in which clear objectives, activities and expected outcomes are set at the start of the programme and are then gradually implemented by following the original plan. By contrast, soft systems thinking would view the design process as an ever-changing flux of situations in which ends and means are unclear, particularly at the front end of the process. Then the design of the SUS Programme would be defined as a cyclical process of dealing with complex situations, guided mainly by experience, reflexivity

and intuition. This would result in an open-ended and iterative approach to the design, where assumptions and directions are questioned and changed throughout the programme cycle.

In the learning history set out in Section 2, it was described how the design and facilitation team drew on the distinction between hard and soft systems thinking when drafting three alternative designs: Design 1 based on hard systems thinking; Design 2 based on soft systems thinking; and Design 3 with a mix of the two. Eventually, the design and facilitation team chose to pursue Design 3. This design recognised the complexity and messiness emphasised in soft system thinking, while allowing certain elements of the programme to be designed at the front end, according to hard systems thinking. The middle way between hard and soft systems thinking enabled the design and facilitation team to overcome the tensions among members around what kind of programme they wanted to develop. The hard and soft systems traditions gave them a language through which to discuss their differences and agree on the path forward. By developing three alternative designs, the team managed to produce a narrative which enabled it to find a middle way acceptable for the whole design and facilitation team. This design was also seen as the most effective way of utilising the capabilities in the partnership around the SUS Programme. It reminds us of a specific way of understanding the goal of inquiry as indicated by Rorty (1999:25):

> We cannot regard truth as a goal of inquiry. The purpose of inquiry is to achieve agreement among human beings about what to do, to bring consensus on the end to be achieved and the means to be used to achieve those ends. Inquiry that does not achieve co-ordination of behaviour is not inquiry but simply wordplay.

Collaborative-learning theory

Drawing on our developing understanding of collaborative learning, we can view the processes described in the three learning histories as parallel learning cycles of action and reflection, guided by three interlinked inquiries (e.g. Torbert, 2004; Kolb, 1983). As we saw in the first learning history, the design and facilitation team came to understand its work in terms of an inquiry into how to develop its own *praxis*, focusing on how to develop skills, activities and tools which could effectively support and guide learning processes among multiple interdependent stakeholders. For the city teams in Makana and Malmö, their inquiries came to be shaped around a will to further urban agriculture and an ambition to strengthen the linkages between urban and rural areas. Reflecting on the learning histories, we can see that structuring the process as learning cycles seems to have resulted in open, systematic and iterative processes which allowed the teams to collaborate, build trust, and act based on a shared purpose. This was evident in the Makana team when it intensively engaged in actions to further develop its urban agriculture scheme, and in the Malmö team when it jointly engaged with a wider group of urban and rural stakeholder to further its inquiry.

Through collaborative-learning theory, we have also identified that the process of *reframing* became central to the stakeholder collaboration in the three teams. Several instances of reframing are described in the learning histories. The lead researcher describes how the inputs of the expert workshop prompted a process of questioning his original understanding and

gradually reframing the programme design. Additionally, the learning history of the Malmö team described how the team reframed its inquiry at several stages during the programme. It started with the move from 'the green and dense city' to unsustainable production and consumption, which was followed by a gradual shift to a focus on urban agriculture and the links between the urban and rural areas. In Makana, we saw how the team started with two inquiries, on urban agriculture and on healthy living, which subsequently collapsed into one inquiry. As its learning cycles progressed, the team converged on a reframing during the later stages of the 2011 programme, focusing more on sustainable livelihoods.

We have observed that an important part of the reframing process, for example the deconstruction and reconstruction of the framing of the inquiry situation in Malmö and the lead researcher's reframing of his original understanding of learning design, was metareflection in order to become aware of one's own frames (Wals & Heyman, 2004). This coheres with Schön's (e.g. 1983) writing about learning as the process of reviewing *theories-in-use* in the light of *crises* and *surprises*. Unexpected events and unexpected mismatches between the theories-in-use and the inquiry situations led to a questioning of the original understanding and to gradual adjustments of the theories-in-use.

When looking at the intensity and scope of the learning described in the histories, we can see that there are examples of both single- and double-loop learning (see Section 1).[4] When the lead researcher learnt to apply hard and soft systems thinking, it opened up new possibilities for his praxis. The action to draft three alternative designs to facilitate a dialogue in the team on the directions to take can be understood as an example of praxis based on double-loop learning. As we saw in the learning history, the dialogue on the three alternative designs enabled the design and facilitation team to utilise its dissonance and find a joint way forward. A sequence of events in the learning history of Malmö can also be explored through the lenses of single- and double-loop learning. Through its learning cycles, the Malmö team gradually increased its understanding of how to involve a wider group of stakeholders in its work. At the first engagement workshop, the team intensively discussed how to organise its joint work. Ideas ranged from establishing clear SMART (Specific, Measurable, Attainable, Relevant and Time-bound) objectives, in line with hard systems thinking, to keeping the inquiry process open and inviting others to co-construct knowledge, in line with soft systems thinking. Through the subsequent learning cycles, the team explored this tension further and eventually opted for arranging a rather open-ended workshop with a wider group to jointly explore possibilities for collaboration between urban and rural stakeholders. To a certain extent, this action can be understood as originating from double-loop learning, since it opened up new avenues for the team's praxis.

Conclusion

In this article, we have shown how hard and soft systems thinking, action research traditions and collaborative-learning theory helped us to explore the design and early development of the SUS Programme. As we now reflect on our experiences of this process, we would like to summarise and draw out some lessons learnt with the potential to help us and others engaging in this field of praxis. In doing so, soft systems thinking helps us to refrain from suggesting an

either–or solution to designing collaborative learning programmes for urban sustainability. Rather, we would like to offer these conclusions in order to deepen our own learning of designing multi-stakeholder collaboration and to share this with others.

Action research helped us to develop our praxis

When reflecting on our experiences of engaging in action research, we can see that this research orientation helped us to develop our praxis. The shaping of a joint *inquiry* for the design and facilitation team provided us with a shared purpose, and the *cycles of action and reflection* gave us a structure to further our understanding of collaborative-learning design. The *learning-history method* helped us to deepen our own learning and enabled us to share this learning with others interested in this field of praxis. The distinction between *first-*, *second- and third-person research* enabled us to structure a research process were our experiences could be explored through a diversity of methods, including first- and second-person learning history and third-person research dialogue among the authors of this paper. Last, but not least, the action research tradition helped us to move away from our comfort zones and to trust emergence.

Systems thinking helped us to make design choices

Systems thinking was useful for us when we needed to work with the dissonance in the design and facilitation team regarding the balance between linear and open-ended design. Through the language of hard and soft systems thinking, we could clarify how our choice of underlying theory would influence the design. By making the implications of the choice explicit through drafting three alternative designs, we enabled a discussion in the design and facilitation team and reached an agreement on the way forward.

Collaborative-learning theory helped us design multi-stakeholder endeavours

When revisiting the programme design, we can see that collaborative-learning theory helped us to understand the relevance of bringing together a diversity of stakeholders to tackle the complexities of urban sustainability and (for the design and facilitation team) learning design – the rationale being that no single player can possess the knowledge and resources needed to tackle complex and contested urban situations. Drawing on collaborative learning theory, we also realised the importance of enabling learning in a multi-stakeholder context based on dissonance in terms of norms, values, knowledge traditions and interests. This directed our focus towards enabling deconstruction and reframing of the stakeholders' theories-in-use. It became equally important to design a process for building trust and developing shared purpose, and to overcome the risk of dissonance overload resulting in destructive conflicts.

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Endnotes

1. The design and facilitation team was responsible for leading the development of the SUS Programme. It consisted of Martin Westin (Programme Coordinator), Alexander Hellquist (Programme Specialist), Shepherd Urenje (Programme Specialist) and Dr John Colvin (Independent Consultant). This group collaborated with a wider group of stakeholders, including members of the wider SWEDESD team and a partnership of organisations comprising Programme, the International Centre for Local Democracy, the World Wide Fund for Nature (WWF) (Sweden), Global Action Plan International and Stockholm Resilience Centre.
2. This learning history is told by Martin Westin, who coordinated the design of the SUS Programme.
3. The Swedish International Centre of Education for Sustainable Development (SWEDESD), the Centre for Environment Education (CEE) based in India, the Southern African Development Community's Regional Environmental Education Programme (SADC-REEP), the Stockholm Resilience Centre (SRC), the Swedish International Centre for Local Democracy (ICLD), Global Action Plan International (GAP Int'l) and the World Wide Fund for Nature (WWF).
4. To study triple-loop learning is beyond the scope of this article, since researching institutional change requires a longer time perspective.

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Collaborative Learning for Ecosystem Services in the Context of Poverty Alleviation
A Case from India

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Abstract

Unplanned and unregulated urbanisation and industrialisation has led to large-scale degradation of the environment, including that of water bodies in India (Mukherjee, 2009). Communities and governments have, over time, tried innovative approaches to the development and management of water bodies. Often, these approaches are focused on physical restoration, ignoring the human component – especially the dependence of people on the water body for their livelihood and sustenance. The ecosystem services for poverty alleviation (ESPA) approach seeks to tie together the various social and environmental requirements in a holistic manner and, in the process, recognise the interdependence between humans and nature. The Supporting Urban Sustainability (SUS) Programme focuses on an ESPA approach in urban settings using the methods of collaborative learning.

The purpose of this article is to illustrate how an emerging theory, ESPA, can be institutionalised through a collaborative-learning process. The research is qualitative in nature. It explains the local Ahmedabad case study in order to provide insight into the SUS Programme activities, and then takes a broader view of collaborative learning across the other participating cities in the SUS Programme. The data for the case study on Ahmedabad city was collected during the implementation of the SUS Programme at the site, while the data on collaborative learning was collected from city team members engaged in the SUS Programme across a number of SUS Programme sites through a survey questionnaire. The latter data was then analysed by grouping narratives with reference to various aspects of collaborative learning from the participants' points of view. The outcomes could thereafter be used to support the development of collaborative-learning projects elsewhere, and would also be useful for further developing the work done during the Ahmedabad case study.

Background

Globally, the number of people living in cities has now surpassed the population in rural areas. In India, urban dwellers represent 31.16% of the total population (Census 2011), which is less than the world average of 52.1% (UN, 2012). Cities are facing major challenges in maintaining and restoring the environmental ecology on which they depend. Communities and governments have, over time, tried to find innovative approaches to the development and management of water bodies that provide ecosystem services for cities. The Ministry of Environment and Forests (MoEF) of the government of India formulated a National Lake Conservation Plan (NLCP) in June 2001. The objective of the scheme was to restore and conserve the urban and semi-urban water bodies of the country. The activities covered under the NLCP were primarily concerned with physical and infrastructural development – diverting the sewage discharge, solid-waste

management, water-body cleaning, strengthening of bunds, and so forth (Bansal & Bharti, 2012).

Development and management of water bodies in Indian urban contexts, as at the Bhoj Wetlands, cannot always be effectively solved through conventional approaches, which are expert-driven and not participatory by nature (Mukherjee, 2009). What is needed are context-specific collaborative approaches leading to greater sustainability where stakeholders can evolve solutions after constructing a shared understanding of the situation. The SUS Programme attempts to develop an alternative approach to development by adopting the ESPA approach.

Supporting Urban Sustainability (SUS) Design and Development

The SUS Programme was initiated in 2010 by the Swedish International Centre of Education for Sustainable Development (SWEDESD) in cooperation with the Centre for Environment Education (CEE), India, and the Southern African Development Community's Regional Environmental Education Programme (SADC-REEP).

While dealing with urban sustainability in a holistic manner, the SUS Programme is focused on using the ESPA approach in urban settings. The ESPA approach aims to improve the lives of poor people in developing countries by filling knowledge gaps that currently limit the understanding of how ecosystem services can contribute to the alleviation of poverty. The approach is based on a 'theory of change', which emphasises the importance of dialogue with stakeholders, acknowledging multiple viewpoints and the recognition of power relations, and recognising the political, social and environmental realities in the context (Vogel, 2012). People are at the centre of all ESPA projects and the approach stresses the sustainable alleviation of poverty as a central goal of sustainable ecosystem management. It seeks to tie together, in a holistic manner, various requirements with reference to social and environmental issues, in the process recognising the interdependence between humans and nature.

The objectives of the SUS are twofold: firstly, to understand how ESPA can contribute to sustainability in urban settings; and, secondly, to initiate an ESPA project in various cities. The first objective is related to capacity-building and knowledge creation within the cities as well as in the organisations supporting the Programme. The fulfilment of this objective requires learning at individual level (in the short term) and at the organisation level (in the medium term). The second objective is concerned with concrete change on the ground in the participating cities in terms of a medium- to long-term time frame.

The key elements of the SUS Programme were as follows:

- *Collaborative approach:* The SUS Programme was built on collaborative learning. This key concept was introduced naturally to the participants through 'learning by doing'.
- *Strategic inquiry:* Each city was required to develop a 'strategic inquiry' addressing a situation related to the objectives and content of the Programme. The development of a 'strategic inquiry' is a process whereby participants learn through investigation to inform a proactive problem-solving approach in order to effect change in existing practice. In the SUS Programme, the 'strategic inquiry' was developed by providing support for scientific practice (knowledge-sharing and case studies) and by the creation of a culture

of inquiry (including open communication and the evaluation of case studies). The strategic inquiry was intended to address an issue of shared concern that needed to be explored and resolved.

- *Cyclical process:* The learning process in the SUS followed a cycle of: planning in workshops; action in the cities; and assessment, reflection and adapted planning in subsequent workshops and discussions. This cycle was continued until the concept was internalised by all team members.
- *Multistakeholder set-up:* Teams were formed of members representing various organisations, including local government, civil society, the private sector and academia.

Phase 1 of the SUS Programme was introduced in six cities: Ahmedabad, India; Arusha, Tanzania; Dhaka, Bangladesh; Makana/Grahamstown, South Africa; Malmo, Sweden; and Mangaung/Bloemfontein, South Africa. Cities were selected on the basis of existing partnerships involving SWEDESD, the CEE and the SADC-REEP.

Collaborative Learning

Collaborative learning is defined as an instructional method whereby stakeholder teams work together on an assignment (Diaz, Salmons & Brown, 2010). Collaborative learning, in contrast to cooperative learning, may be an unstructured activity and is thus organic in nature. As discussed by Selin and Chavez (1995), environmental managers need new skills to move from their expert-opinion role in traditional environmental management to an empowerment role as a mediator, catalyst or broker in the new order. They further state that managers comfortable with the hierarchical decision-making processes of public agencies are finding it difficult to cope with the lateral decision-making approaches needed to sustain effective collaboration. Environmental practitioners therefore need to move beyond their comfort zones and adopt more flexible organisational policies and procedures in order to facilitate collaborative solutions to urban challenges. There is no set model or pattern as to how collaborative practices develop (Courtney, 2007).

Collaborative learning is considered to be a critical tool for capacity-building among stakeholders in order to address complex situations. Moreover, it is essential to have diversity in terms of stakeholders for the purpose of collaborative learning. This enables the pooling of different forms of expertise and the establishment of platforms where divergent views can be considered and where the partners can engage in rich, intense and stimulating exchanges with one another. The key elements of effective collaboration include the designation of roles and structures to enhance collaboration and parity, as well as the systematic recognition and celebration of joint work and the contribution of each partner. The critical factors which are important for collaborative learning include the development of 'working relationships', 'organisational structures', 'a common purpose and goal', 'open communication', 'clear roles', and active participation in, and contribution to, planning, implementation and evaluation of the programme (Kuter & Koc, 2009). At the same time, it is very important to create conditions conducive to collaborative learning so as to overcome boundaries among stakeholders.

Practitioners and scholars in the field of collaborative learning argue for open-ended, interactive and reflexive design processes, thereby allowing space for mutual inquiry between designers and participants (Gotland University, 2011). Reflective studies of collaborative learning for urban development projects are relatively uncommon.

Objectives

The purpose of this article is to illustrate how an emerging theory (ESPA) can be institutionalised through a collaborative-learning process. The article places in perspective the learning about ESPA gained through the collaborative approach as attempted by the SUS Programme, from the 'participants' point of view, in order to share the experience so that such initiatives can be replicated within other urban development projects. The learning from such collaborative processes is expected to help resource managers, practitioners, researchers, policymakers, academicians and government officials gain a better understanding of the challenges faced in seeking local solutions to local problems.

Methodology

This research was carried out in order to examine the collaborative dimension of the SUS Programme in using the ESPA approach for urban development projects and was essentially qualitative in nature. To obtain in-depth and meaningful data, the study firstly sought to describe one case study of the SUS Programme, namely the Ahmedabad city case, to show how the Programme was set up and what some of the results were (see also Westin, Hellquist, Colvin & Kronlid, this volume). Secondly, it aimed to provide a broader perspective on collaborative learning as experienced by all the participants within the boundaries of the wider SUS Programme (i.e. all the participating city teams). The participants in all six city teams were contacted through group emails, followed by personal emails. After considerable follow-up, responses were received from nine participants, covering three cities (out of the six cities in the Programme). The local city team members (Ahmedabad team) were contacted telephonically, followed by a personal interview which enriched the database and the perspectives on collaborative learning. The pretested, semi-structured, open-ended questionnaire addressed the participants' views regarding various aspects of collaborative learning, including: formation of the teams; responsibilities; areas of conflict; agreements and disagreements; processes followed for identification and development of strategic inquiries; prior knowledge of ESPA; internalisation of learning from this Programme; post-programme use of the skills developed; and what were perceived as the benefits of collaborative learning. The data was analysed through grouping of the narratives with reference to various aspects of collaborative learning. To maintain confidentiality, the participants have been numbered as P1 to P9. The responses received have been analysed and are reported in later sections.

The SUS Ahmedabad team consisted of professionals from: the Ahmedabad Municipal Corporation (AMC), the urban local body responsible for city governance; the Centre for Environment Education (CEE) working in the field of environment education; CEPT

(Center for Environmental Planning and Technology) University, an academic institution; the Environmental Planning Cooperative (EPC), a consultancy organisation working in the field of urban planning, policy research and advocacy; and the Self Employed Women's Association (SEWA), an organisation supporting self-reliance and full employment for women.

The Ahmedabad Case Study

Ahmedabad, located in western India, is the seventh-largest city in the country and the commercial capital of Gujarat State. It has a population of 5.57 million (Census 2011), of which about 35% live in slums according to a 2003 study (CEPT University, 2003) – unfortunately more recent data are not available. It lies in an arid climatic zone with sandy soil. The mean temperature ranges from 41.3 °C in summer to 26.3 °C in winter. The city receives an average annual rainfall of 782mm. Though relatively flat, the city is dotted with a number of water bodies holding rainwater. Many slums in Ahmedabad are located around these water bodies. These settlements often have poor sanitation and infrastructure provision, which leads to further deterioration of the water bodies. The number of water bodies decreased from 200 to 210 in 1960 to 81 in 2002 (Dhulia, 2003). Of the latter number, 48 currently exist within the Ahmedabad city boundary. Most of the water bodies in the AMC area are shallow, with depths less than 3m. As the city is located in a hot, arid zone, these water bodies dry up prior to the arrival of the rainy season. Large numbers of these water bodies are being used for the disposal of sewage, for the dumping of solid waste, and for open defecation in the surroundings, thus leading to a deterioration of water quality.

Profile of water body

The Saijpur water body is located in the Saijpur Bogha Ward (administrative unit) of Ahmedabad in the north-eastern part of the city, in a predominantly residential area. It is flanked by Naroda Road to the west and National Highway No. 8 to the east. This rain-fed water body is spread across an area of approximately 11 000m^2.

The water-quality tests carried out by the AMC for the Saijpur water body showed that the water was highly degraded, with a biochemical oxygen demand (BOD) as high as 45mg/l^1, a chemical oxygen demand (COD) at 187.49mg/l^2, and a fecal coliform concentration at 900MPN/100ml^3. As the water quality was extremely poor, there was no evidence of the biodiversity that would normally be expected to be associated with such a water body. From comparison of the Google images for March 2005 and May 2010, it was observed that the size of the water body in 2010 was approximately less than half its size in 2005. The main reasons for this were encroachment by informal settlements (having low access to water and sanitation) and a decrease in surface run off reaching the water body due to construction and other physical developments in the neighbourhood. During site visits by the Ahmedabad team, it was observed that the banks of the water body were steep and eroded. Moreover, the surroundings of the water body were being used for open defecation by the residents living in the vicinity. In addition, the local area lacked the presence of green areas, recreational areas, community space and children's play areas.

Most of the households in the neighbourhood did not have any permanent source of

employment. The focus-group discussions revealed that the men from the households surrounding the water body were generally employed in nearby industries as casual workers. Some of the women worked as domestic help and some as street vendors. A few were engaged in home-based activities like embroidery, tailoring work and handicrafts, and used the open land around the water body for domestic and economic activities. Elders in the surrounding communities did not have any livelihood options, as they could not commute long distances to work.

Stakeholders

Many groups had a stake in the restoration of the water body: the community living around the water body; the Ahmedabad Municipal Corporation (AMC), the local urban body responsible for providing amenities for, and for the civic needs of, the population living within its jurisdiction; the architecture agency hired by the local body to prepare the design for the development of the water body; non-governmental organisations (NGOs) (like SEWA) working for the economic development of the women in the neighbourhood; and the SUS team, which wanted to build an ESPA component into the water-body restoration plan.

Conceptual plan

The conceptual design evolved after a number of discussions among the team members, local communities, the officials of the local body and the consultant hired by the AMC. The interventions suggested by the team can be grouped under five main headings: Physical interventions; Ecological development; Social development; Livelihood aspects; and Operation and management (three of which are discussed below). Each of these aspects could be treated as a separate component, but were closely integrated with the others.

Physical interventions

The physical interventions included de-silting of the water body, the diversion of storm water towards it, the construction of groundwater recharge wells, the diversion of the sewerage system away from the water body, the upgrading of water and sanitation infrastructure for the surrounding communities, the creation of parking areas and the reservation of space for informal business.

Ecological development

Ecological development included the introduction of native vegetation, fruit trees and nesting trees, as well as the introduction of aquatic species in the water body.

Social development

Social infrastructure included the development of walking trails, green spaces, a children's play area, a community space for senior citizens and the preservation of the existing temple. To develop income-generating activities for the urban poor living in the vicinity of the water body, it was suggested that they be involved in the operation and maintenance of the water body through community-based organisations (Bansal & Bharti, 2012).

Significant achievements and current status

The significant achievement of the concept plan is that no informal settlers will be evicted when the water body is restored using the ESPA approach. This is different from the conventional resettlement and development approach adopted for water bodies in the city. At Saijpur, it is proposed that the surrounding communities be included in the maintenance of the area, thereby creating a sense of ownership of the asset and developing livelihood opportunities. The local government body has made budgetary provision for the redevelopment and tenders have been called for in respect of the restoration of the water body. During the regional-level workshop to monitor the progress of the SUS Programme, the concept plan for development of this water body as per the ESPA approach was presented and was accepted by the various stakeholders present. This shows the significant outcomes of the India case study, which were achieved through collaborative-learning processes promoted by the SUS Programme.

The Inquiry into Collaborative-learning Processes

Through the above summary of the Ahmedabad SUS case study, the authors wish to place before readers the history of the development of a conceptual plan addressing strategic inquiry in an urban setting in an Indian context, using the ESPA approach and collaborative learning. As this strategic inquiry was developed under the SUS Programme through the collaborative-learning approach, the reflections on the process of collaborative learning, and not just the outcomes of the strategic inquiry, are important. To assist us to reflect on collaborative learning in the Ahmedabad case context, it is helpful to reflect on collaborative learning in other case contexts, for which responses were received from P1 to P9 via the email communications. These are reported on below.

The research therefore not only documents aspects of the Ahmedabad case (above), but also focuses on collaborative-learning processes in other city teams in the wider SUS Programme, where the strategic inquiry was taken up as part of the SUS Programme. An attempt has been made to analyse and relate the responses from all the city teams, although these cannot be generalised. Based on this relational analysis, the authors have suggested certain initiatives that are required to be taken in order to internalise collaborative learning in the ESPA approach at case study sites. These insights are helpful for developing the work on the Ahmedabad city case further.

Team dynamics

Team formation

The Ahmedabad city team was formed after an open invitation to many individuals and institutions. This led to the establishment of a committed, small group of professionals with diverse backgrounds who were interested in experimenting with the ESPA approach. The other city teams also aimed to have members from different backgrounds. The views of the participants about team formation are quoted below:

P4: 'The Environmental Management Office of the Municipality has a working relationship with the University (Environmental Learning Research Centre) and I was nominated on behalf of my center. Two other team members from departments in the Municipality, directly related to ecosystem services, namely agriculture and horticulture, were nominated. The fourth member was from a local NGO working with communities on vegetable gardens and a fifth person was nominated to represent the voice of the local youth.'

P8: 'I was nominated (by the University where I work) for the city-level meeting, organized by the local partner. It was only in the later meetings that the core working team [was] formed.'

Formation of the city teams was achieved through a process of selection and filtration based on the interests of the institutions, on time commitments, and on the personal interests and commitments of the individuals nominated. Having members from different organisations with varied experience and exposure led to the desired diversity by the teams for the purpose of collaborative learning.

Team strength

Since teams were formed of individuals having different skills and experience, this led to groups of individuals with a range of core competences. As some of these team members had not interacted with one another at a professional level prior to the SUS work and were complete strangers to one another, it took considerable time in some cases for them to be able to work together as a team.

P4: 'Determining the strength of each member was rather difficult at the beginning. Yet another process of learning… .'

P9: 'Yes, each member represented a strong institution with the relevant role in the team.'

Though, initially, the teams took longer than expected to start working together, frequent team meetings helped each individual to get to know their partners better, to appreciate the strength of other team members, and to work together towards the common objective. This, however, made the whole process a little slow.

Team conflicts

Personal differences, as well as differences in approach and in previous experience, often led to considerable debate and, sometimes, to conflict within the teams, temporarily slowing down the learning process. As the strategic inquiries were developed and discussed at various team meetings, a sense of ownership and commitment to reach the common goal emerged.

P4: [As the process unfolded], 'huge personality differences played out, almost causing a rift in the team. At times it felt like the strong ones were running with the ball, and carrying others. Most of the strong areas were realized when the project was actually happening; people with practical skills stood out.'

P2: 'Got to know team members over time … ground rule followed was to give time to all to talk.'

P6: 'We had several conflicts where we tried to act [by] listening and talking about our different point of views. We had some small meetings, [and walked] around, [during which] we tried to reflect on the process.'

P1: 'Lots of discussions and sometimes frustration, but always understanding and/or compromise in the end.'

P9: 'Points of conflicts, if any, were negligible since there was a general consensus on the goals of the inquiry.'

In such conflict situations, adhering to the ground rules, that is, respecting everybody's opinions, giving time to all to voice their concerns, listening to everyone, interchanging the responsibilities, and keeping records of the meetings and of the decisions taken, and so forth, helped to defuse the conflicts. Building the team is no doubt the most important part of collaborative learning. For the team to work together, it needs to appreciate its collective and individual strengths. This is a slow process and needs to be built into the design of any collaborative-learning process. The identification of clear, shared goals helped some city teams in staying together.

Responsibilities

Some teams were able to achieve a clear division of responsibilities among the team members, while in other teams it was difficult to assign responsibilities. For some teams, the responsibilities changed as the need arose, which is evident from the following:

P3: 'In different activities the responsibilities changed, usually quite [clearly] each time.'

P9: 'The responsibilities were very flexible; however, as the team was very versatile and multidisciplinary, it did not matter.'

P8: 'Responsibilities were distributed as per the capacity of each member.'

P1: 'As all team members were busy in their individual daily work, the SUS Programme added more responsibilities, which were sometimes difficult to complete.'

Some teams adopted a flexible approach to the sharing of responsibilities at each stage. Teams that had been able to identify and allocate clear responsibilities, and follow them through, were able to reach the goal that the team had defined for itself.

Learning process

As indicated above, the SUS Programme was designed to facilitate learning, through the ESPA approach, by encouraging the participants to arrive at a strategic inquiry in the context of their local environment.

Knowledge-building

The participants, coming as they did from diverse academic backgrounds, work responsibilities and different levels of exposure to innovative approaches, had in some cases absolutely no prior knowledge of ESPA, while others reported being aware of the ES (ecosystem services) and PA (poverty alleviation) components, although not necessarily as combined in ESPA. During the SUS Programme, the ESPA approach was introduced to the participants through a series of workshops, discussions, study tours and inspirational visits.

> P5: 'Was not aware at all about ESPA – directly landed [in] it.'

> P1: 'I had not thought much about the connection between ES and PA in cities, only in the countryside. I had worked and studied both ES and PA but never the combination – I still think it's quite revolutionary! In all its simplicity, I think it's an important part of our planet's future challenges.'

> P9: 'These were good introductory sessions to the concept of ESPA, [but] more in-depth deliberations would have been useful.'

At the beginning of the Programme, the objectives that the SUS Programme sought to achieve were not very clear to most participants. Some participants found it difficult to understand what an ESPA approach meant or how strategic inquiry is to be indentified and developed. However, over time, the objectives became clear. The study tours and inspirational visits were highly appreciated. The fact that the larger SUS team consisted of subteams from different cities helped in the understanding of issues related to ecosystem services in diverse socio-economic and geopolitical contexts through the reflection sessions following each activity.

> P3: 'In the initial phase of the Programme, it was rather difficult to understand. But as the programme proceeded, further clarity was [achieved] through interaction among team members and teams from other cities, and through interacting with programme facilitators.'

> P4: 'At the beginning I was a bit confused, but as I started working with my team, reflecting [on] the notes from the workshop and through the interaction, things started to fall in place.'

P8: 'We were learning by doing.'

The site visits and study tours were much appreciated. However, some participants felt that it would have been beneficial to increase the amount of time spent on understanding the theoretical components of ESPA through case studies. The participants and the teams found that the knowledge-building workshops had a high impact on learning.

Cross-learning

The SUS Programme was designed in such a way that the participants constantly worked on the development of their 'strategic inquiry' and presented these developments to other city teams. During the workshops, frequent regrouping with participants from other teams helped the participants to develop a sharper understanding of their own strategic inquiries. Each team was given an opportunity for professional interaction with all other city teams, one by one, during the workshop by presenting their strategic inquiry, scope and methodology. This process was further strengthened by having critical inputs from other city teams. The pairing of each city team with another city team, which was to act as an evaluator, helped in restructuring the inquiry, targets and methods which each team had outlined. Each team's 'critical friends' from other teams would provide comments on the project development based on their understanding and experiences in similar contexts elsewhere. To quote the participants:

P1: 'Always good to know what others are thinking … interesting and rewarding … . Made us transform loose ends into [a clearer] common objective.'

P3: '[Having] critiques from friends was innovative and helpful in identifying gaps in the strategic inquiry and sharpening further.'

P6: 'It was one of the highest learning points in the entire programme where critical reflections from other teams helped us [sharpen] our strategic inquiry.'

P9: '... among international teams, these were useful in discussing commonalities in strategies and situations.'

Teams often used anecdotes from their own work environments and learning to review the work of other city teams. This led to better understanding and development of the strategic inquiries and the goals of each team. This process was valuable and was welcomed by the participants. It also helped to develop close peer bonding and encouraged learning across and between the teams.

Learning together

Regular follow-up meetings (post-workshops) among the city team members helped to build the necessary support and comradeship within the local teams. The SUS Ahmedabad team attended meetings according to team members' availability (for all the participants, the SUS

was an extra work responsibility). Local members attended these meetings because of their personal interest therein, because of their commitment to the learning process and because of the pleasure of exploring a new field – and this despite the fact that most of the meetings (e.g. of the Ahmedabad team) were held late in the evenings, with site visits being held on public holidays. Clearly, the participating institutions and members were not all able to find time for the SUS activities during regular working hours.

P3: 'Given varied schedules, unforeseen tasks and health issues, I did miss around 3–4 meetings.'

P2: 'Lack of availability for group meetings was due to other urgent demands. Also, sometimes I could not attend the group meetings, as they were held late in the evening and far away from my home. [There was] no compensation for extra time and work.'

P8: 'Sometimes other personal work needs to be attended to; it is very difficult to commit time at the cost of my family… .'

P1: 'Availability of members was an issue – [there were] major time constraints. It was difficult to meet, as everyone had their work responsibilities.'

The city institutions participating in the SUS had not really committed to the Programme. The formal role of the city intuitions was not clear at all. Also, the ownership of the projects (which were being developed for the benefit of the cities) by the city governments was low. For example, in Ahmedabad, and parallel to the SUS activity, the city government had identified a local consultant for the development of this water body, who had adopted a far more conventional approach and one very different from ESPA.

Strategic inquiry – the maze

Each city team developed a 'strategic inquiry' by building on the understanding it had about the city (see Westin *et al.*, this volume), the important issues in the city, and the issues that required intervention and had relevance from the environment and poverty-alleviation perspective. Most of the city teams struggled to identify this strategic inquiry. This was partly due to the fact that the city team was required to develop its strategic inquiry very early in the Programme. At this stage, the teams were not clear about the objectives of the SUS Programme or of the ESPA concept, nor were they clear about the targets for their specific strategic inquiry. With reference to the clarity of objectives for development of a strategic inquiry, one of the participants commented as follows:

P1: '[The] formulation of [the] strategic inquiry went back and forth.'

Further, as regards clarity concerning the development of the strategic inquiry, it was mentioned:

P3: 'Not so clear … at least not in the beginning.'

That participants struggled to define their strategic inquiry can be inferred from the following:

> P2: 'Low clarity … new field … .'

> P9: 'Gradually the intentions became clear.'

Another participant mentioned that the development of 'strategic inquiry' was a gradual process and attributed the final understanding of the process to the inspirational visits to Sweden. As the teams initially had low clarity of what was expected as an outcome of the SUS Programme, some of the teams initially designed over-ambitious strategic inquiries, as reflected by the following:

> P8: 'We were working on our strategic inquiry, which included the conceptual-stage design. However, midway we realized that there [were] no resources available to translate the concept into an implementable project. This disheartened some team members and they lost interest.'

After the strategic inquiry was developed and the conceptual proposal to address it was submitted to the city government, there was no clarity on whether, or how, the city government would take this further. Given these uncertainties and limitations in terms of the procedures available to them, there was apprehension among city team members that this project would remain a mere academic exercise. It was stated by one participant:

> P7: 'We have no control [over] what the local body does with the concept prepared and presented by our team … though the concept was very much appreciated during the meeting.'

The struggle to identify a common 'strategic inquiry' was partly due to the fact that each team member came from a different organisation having a different work environment and varied organisational goals and responsibilities. The potential and the boundaries of strategic inquiry need to be defined in the introductory phase of the Programme. Despite the fact that, in Ahmedabad, the final concept was presented to the stakeholders and the city government, and was appreciated by the local body's representatives, the local body and the consultant appointed remained free to develop the Saijpur water body in line with their own understandings and priorities, without recourse or reference to the ESPA-derived conceptual plan developed through the SUS Programme. This points to institutionalisation issues associated with collaborative-learning initiatives aimed at social–ecological changes.

Long-term gains

The SUS Programme had developed a timeline for pursuing the strategic inquiry in each city. This was developed by the team members in each city, depending on what they wanted to achieve and how they wanted to achieve it. Some team members believed that, although they had limited opportunity to implement ESPA in the short term, the exposure to ESPA through

the collaborative exercise was useful and helped them build a firm knowledge base. To quote team members:

> P9: 'The gain was very subtle and could go unnoticed by an external agency.'

> P8: 'Though the team did not have a chance to implement the proposal in totality, it managed to sensitize the local officials and professional community.'

The development of the project using the ESPA approach, and following it through, was in some cases a gain for the city government. Areas of the cities which were not in focus previously have now emerged into prominence, as a lot of attention has been focused on such areas as a result of the project. As mentioned by participants:

> P5: 'The eastern part of the city has gained, … . People in that area have gained as new developments are proposed.'

> P4: 'The experience gained from the program has broadened my outlook in identifying issues related to urban sustainability. It has provided an insight [into] the process to be followed for an action-oriented approach to bring about positive change in the development process of the city. The process also introduced me to various subject experts, which helped me further enhance my knowledge and understanding.'

Evidently, there has been professional gain at individual level and also at the city level. However, to internalise the gains, the pilot projects need to be implemented on the ground. For the gains of the SUS Programme to be visible, the Programme needs to have clarity on the implementation strategies.

Role of the facilitator

Teams which had the support of a hands-on facilitator, where the facilitator would organise the meetings, provide updates and generally hold the team together, seem to have achieved the targets that they had set for themselves. Facilitating open communication and keeping morale high among team members were important. This is very evident from the achievements of the Ahmedabad team, where the team was able to arrive at a conceptual plan for implementation using the ESPA approach, which was then submitted to the AMC. Facilitators' contributions can be judged from the comments that the teams made about them:

> P7: 'The facilitators played an integral role in the process of inquiry and in arriving at the conclusion. Their patience was admirable, and also the effort to motivate individuals to be involved throughout.'

> P9: 'Hats off to the facilitators for all the facilitations in working towards maintaining cohesion in the group and playing the role of prodding the team members towards the finish line.'

Conclusion

Through the case study, and the analysis of collaborative learning across sites, this study argues that cross-sectoral and cross-cultural collaborative learning is potentially a strong tool for the introduction of new approaches, like ESPA, into sustainable urban development projects in diverse socio-economic, political, environmental and climatic contexts where multiple stakeholders are to be involved. Particularly in projects which have a component of exposure through site visits and study tours, learning takes place at an accelerated pace and the participants are able to apply the new approaches to challenges in their local environment. A committed team with members coming together with different professional backgrounds and experiences can help to develop a shared and profound understanding of the new approach. However, such teams are also challenged by different viewpoints and experiences, which have the potential to give rise to conflict situations. Such diverse teams also potentially have a heightened ability to apply the learning to their local environment. The respective roles and expectations among the team members, although not always clear at the beginning, may start unfolding as professional trust and confidence in one another are established over time. This needs to be constantly reinforced by way of open communication among the team members. The various city teams also learn from the experiences and contexts of the other teams.

Nevertheless, to internalise ESPA as an approach to sustainable urban development projects, more officials from urban development agencies and municipal corporations should be encouraged to take up the twin issues of ecosystem services (ES) and poverty alleviation (PA) in a comprehensive and combined (ESPA) manner. The key to successful, long-term changes in approaches to urban development lies in involving a wide range of professional and other interests in local development debates and in forming large, coherent city teams so that colleagues from different backgrounds learn, plan and implement innovative approaches together, with a key emphasis on the role and responsibility of the city in enabling sustained implementation of group-based ideas.

The key stakeholders in any city-based change initiative need to clearly define and develop a common understanding of what they want to achieve through the collaboration. This collaboration then needs to be formalised by way of a formal agreement that attends to the issues of institutional buy-in, prioritisation and longer-term implementation support if they are to be fully implemented and sustained. In order to internalise and replicate these collaborative-learning methods using new approaches for sustainable urban development projects, it is necessary that the projects are implemented on the ground and that the outcomes are visible and are appreciated by all stakeholders. Awareness of such initiatives and their benefits needs to be publicised to encourage the take-up of the approach by others in different contexts.

Notes on the Contributors

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Endnotes

1., 2. and 3. In India, the water quality criteria are based on the designated-best-use of water body. This particular water body is not to be used as a source of drinking water, therefore, it should comply with the following criteria:

1. BOD should be less than 3 mg/l.
2. COD standards are not defined.
3. Total coliform organisms should be less than 500 MPN/100ml.

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Bridging and Enriching Top-down and Participatory Learning
The Case of Smallholder, Organic Conservation Agriculture Farmers in Zimbabwe

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Abstract

This article discusses the combined use of top-down and participatory-learning approaches during the course of a 42-month organic conservation agriculture project that is being implemented in eight districts of Mashonaland East Province in Zimbabwe. The initial 18-month project was extended by a further 24 months in order to build on what had been achieved by deepening organic conservation agriculture practices, by increasing the understanding of, and access to, markets, and by expanding farmer agency. The top-down approach involves farmer representatives, known as 'access farmers' in the project, undergoing training at training centres and then returning to their respective farmer associations to train other farmers in what they have learnt. Participatory learning includes farmer-to-farmer learning within and among associations, and trainers learning from, and acting on, farmer experiences. Expansive learning, which combines, and goes beyond, both approaches and allows for joint learning, innovation and agency, has been used to support the associations to learn about, practise and benefit from organic conservation agriculture. This was stimulated by change laboratory workshops being conducted with each of the 32 farmer associations formed during the first 18 months of the project. The main argument in the present article is that combining these seemingly opposite approaches to learning is feasible and is essential for accelerating practice-oriented changes in agriculture. The concept that appears to enable this linkage is dialectics.

Introduction

Two main schools of thought have shaped how knowledge, values, skills and practices in agriculture are learnt and applied in Zimbabwe and southern Africa. One school of thought is generally called the 'top-down school' and is characterised by the Research-Design-Disseminate-Assimilate approach. In this approach, researchers are the more knowledgeable 'others' who generate knowledge, which is then passed on to farmers through extension workers. The farmers are supposed to assimilate the knowledge and use it to change their practices. The other, and more recent, approach, called 'participatory learning', emphasises joint learning among peers. In participatory learning, people learn about their needs and opportunities, preconceptions and biases about people's knowledge are challenged, knowledge is shared, and learning is interactive (Mukute, 2010).

This article discusses how these learning approaches have been bridged and enriched during a project, Livelihood Security in a Changing Environment: Organic Conservation Agriculture, that is being implemented in Mashonaland East Province in Zimbabwe (between

2010 and 2015). The bridging and enrichment of the two seemingly contradictory approaches to learning have been made possible by the conceptualisation of learning in a theory called 'cultural historical activity theory' (CHAT) after the work of Yjro Engeström (1999; 2007). The project goal is to facilitate smallholder farmer learning and the practice of organic horticultural production under irrigation, as well as organic conservation agriculture in rain-fed, dry-land farming, so that farmers are able to produce for household consumption and income generation. The initial 18-month phase of this research project involved establishing and supporting 32 organic-farmer associations in partnership with several non-governmental organisations (NGOs), the Zimbabwe government's Agricultural Training and Extension (AGRITEX) Department, and the present researcher, who has experience in working with CHAT. After 18 months, and as part of the initial scaling-out process, eight more associations were established with direct support from the more established and successful 'pioneer' associations.

The objectives of this article are to show:

- How CHAT has provided the necessary theoretical framework for combining the two seemingly contradictory approaches to learning; and
- How linking and enhancing top-down and participatory-learning approaches have accelerated the learning of, and changes introduced in, agricultural production and marketing practices by the farmer associations participating in the project.

Learning Approach for the Project

'Learning' refers to all processes leading to permanent capacity change, which could be physical, cognitive, emotional or social and are also not based exclusively on biological maturation (Illeris, 2003). There are two layers of interaction in learning: between the learner and the environment; and within the learner. The latter covers the inner mental processes of acquisition and elaboration through which impulses of interaction are linked to earlier learning. Learning results in within-the-person changes that modify the way in which the person interprets and modifies the world, that is, how the mind looks at the world, interprets it and acts on this (Edwards, 2005). Learning is therefore concerned with both internalisation and externalisation.

The project's approach to learning has three main aspects, namely:

1. Training of farmers by 'experts' in the different subjects for organic conservation agriculture and marketing (For purposes of the project, the farmers who are trained by experts are called 'access farmers'. One of the major roles of these access farmers is to acquire knowledge and skills from the more knowledgeable trainers in organic conservation agriculture and marketing, as well as to internalise and share these with fellow farmers in their respective associations using what may be described as a top-down approach. The need for farmers to learn and practise organic conservation agriculture created the knowledge gradient that made it essential to adopt this form of knowledge movement. Fambidzanai Permaculture Centre (FPC), which negotiated access to the districts and facilitated access-farmer selection, conducts centre-based and on-site

training in technical aspects of organic production and conservation agriculture. The Zimbabwe Organic Producers and Promoters Association (ZOPPA) trains farmers in organic standards and certification, and facilitates market links and the dissemination of information. Practical Action Southern Africa conducts farmer training in participatory markets systems development, while AGRITEX provides ongoing technical support services for farmers in their respective villages and wards. Through GardenAfrica, farmers included in the project have their organic pesticides tested for efficacy by Kew in the United Kingdom, and their soils tested by local research stations in order to determine what they lack.);

2. Participatory learning in which the farmers learn from one another's knowledge and experiences in what may be called 'farmer-to-farmer learning' or 'horizontal learning' (On their own, individual farmer associations periodically meet to identify and solve problems and to learn from one another's experiences. One of the main roles of access farmers and other farmer representatives from the associations is to take issues from the associations to the project partners for possible solution in what has been called 'bottom-up (or participatory) learning' in the development field (Chambers, 1997).); and
3. Participatory action research in which farmers take a leading role in the generation of knowledge, solutions and innovations to overcome obstacles to organic conservation agriculture and its associated benefits (The farmers draw on their knowledge and experiences, as well as on those of specialists and stakeholders, in order to change their agricultural practices and gain access to agricultural markets in the country. They also deal with challenges directly through their associations and wider district and provincial representation structures so as to improve the context in which their learning and agency takes place. A researcher (the present researcher) with experience in CHAT facilitates farmer association workshops so as to stimulate innovation and agency development among the farmers).

Theoretical Framework for Analysing the Project's Learning Approach

The study used CHAT-informed conceptualisations of learning and their hierarchical levels of interrelated human activity to illuminate and explain how the seemingly opposite approaches to learning – top-down and participatory – were combined and enhanced in the organic conservation agriculture project under review. The relevance of drawing on CHAT was inspired by the understanding that it offers a bridging theory for participatory and top-down learning and research methods (Mukute, 2010).

Conceptualisations of learning in CHAT

Scaffolding

Scaffolding supports the top-down learning approach in the project. In scaffolded learning, a more knowledgeable 'other' assists the learner to move to a new level of understanding and mastery (Tarulli & Cheyne, 2005). This learning is concerned with how knowledge is

acquired, internalised or appropriated by the learner. The main learners in this case are members of the organic-farmer associations in Mashonaland East Province in Zimbabwe. The 'more knowledgeable others' are trainers from the participating organisations. At another level, learners are the 16 government-employed agricultural extension workers (AEWs) who received organic conservation agriculture training, as their own college training had focused on high, external-input agriculture, which does not emphasise ecological sustainability. Farmer-to-farmer learning, if viewed as learning by means of which the more knowledgeable farmer teaches the less knowledgeable farmer about a specific topic or theme, can also qualify as scaffolded learning. However, in everyday language, it is called 'horizontal (participatory) learning'. The training methods that are used to support scaffolded learning include: lecturers, handouts, look and learn or exchange visits, and demonstrations.

Cultural interpretation of learning

Cultural interpretation of learning is concerned with linking everyday experiences and scientific concepts using instruction so that the learner can move from 'situated everyday understanding' to mature scientific concepts whose application is not limited to a specific situation. An important part of this form of learning is its linking of cognition (the mind), context and practice, thereby making the learning more relational and sociocultural (Simovska, 2008). Learning at this level is also concerned with acquisition, internalisation and appropriation of new concepts by the learner. In this project, this form of learning was largely supported by outreach and extension activities that were performed by trainers, as well as by linkages that farmers made with other potential sources of knowledge. Through learning methods such as observation, farmers identified variances between what they had been taught and had implemented, and the expected results, in areas such as compost-making, yields, and pricing of their produce. The trainers assisted the farmers to explain variations. Scientists, on the other hand, conducted soil testing and analysis. The testing of the efficacy of organic pesticides provided farmers with explanations regarding the successfulness or otherwise of their practices. The learning and training methods used in this approach included observation, testing, trials, bottom-up and top-down information flow, on-site teaching, and demonstration.

Collectivist/societal interpretation of learning

The collectivist interpretation of learning involves joint learning, joint action (agency) and the externalisation of the knowledge that the learner has acquired. Participation is manifested through which multiple voices as different points of view, interests and traditions of learners (Engeström, 1999), who also become agents, interact. Knowledge and experiences from different sources are valued and tapped into, including traditional, local, indigenous and scientific sources. The purpose of learning goes beyond mastery, which tends to be the focus of scaffolded and cultural learning, to include generation of new knowledge, new solutions, and innovations, thus shifting the focus from internalisation to externalisation. The collectivist interpretation of learning also allows for the utilisation of plural ways of knowing and learning, and provides for individual and joint research among farmers, and between farmers and their stakeholders. For the project, this meant drawing on the knowledge and experiences of:

- Farmers regarding their social and ecological context;
- Farmers as acquired through training provided by the project;
- Farmers resulting from practising organic conservation agriculture, conducting market surveys and interacting with agricultural suppliers and buyers of produce;
- Key stakeholders and specialists, who provided advice and solutions based on the farmers' needs; and
- Stakeholders, who participated in, and beyond, change laboratory workshops in which obstacles to association interests and objectives were identified and tackled.

Two key principles that were used to stimulate expansive learning were double stimulation and ascending from the abstract to the concrete. The learning methods used included focus-group discussions and plenary sessions in change laboratory workshops, empirical and historical analysis of emerging challenges, modelling of solutions to challenges being encountered by farmers in practising organic conservation agriculture and marketing agricultural produce, implementing, assessing and improving the solutions/innovations, and scaling them up through farmer-to-farmer extension.

Change laboratory workshops constitute an expansive-learning methodology developed by Engeström (2007) and his colleagues, and are designed to bring practitioners and researchers together to surface challenges and contradictions and to use distributed cognition to generate and implement solutions that transform practices. Such methodology is based on the two principles of ascending from the abstract to the concrete, and double stimulation (Virkkunen, 2013). Through abstraction, people make meaning from their experiences and use this as the basis of knowledge creation and of innovation. Double stimulation seeks to make subjects – in this case, farmers – the masters of their own lives. In double stimulation, the subjects are put in a structured environment in which the researcher provides active guidance towards the construction of a solution to a challenge and the development of agency (Virkkunen & Newnham, 2013). The first stimulus is the challenge that is being faced by the subject, and the second is a conceptual tool that the subjects (sometimes with the assistance of researchers and other interested actors) use to mediate their understanding of the challenge and to develop a solution (Engeström, 2007).

Hierarchical structure of human activity

Another useful conceptualisation associated with learning in CHAT is the hierarchical structure of human practice or activity. The hierarchical structure of human activity's dialectical linkages between goals and operations seemed to offer possibilities of extending the explanation as to why combining the mastery of techniques and tools used in organic conservation agriculture and the actions towards the attainment of the goals of organic farmers and their associations is proving successful. Virkkunen and Newnham (2013:37) describe the dialectical relationships between these layers of human activity as follows:

> The relationships between activity, action and operation are internal and dialectical. The joint activity is realised through individuals' actions but individuals' actions also form the

joint activity. In the same way the objective of the action determines what operations are needed, but on the other hand, the available operations affect what kind of objectives can be set and reached.

Object of an activity

Leont'ev (1978), one of the founding theorists of CHAT, described systemic levels of human activity that are hierarchical. At the highest level is the object of an activity or practice that carries the societal motive. The object of an activity is infinite and can never be fully achieved. For example, the object of sustainable agriculture as a human activity or practice is social justice, economic viability and ecological sustainability.

Goal of actions

At the middle level lies the goal of actions in the activity or practice as constructed by a specific individual or by groups of individuals. The intentional aspect of the goal covers 'what must be done', and actions towards a goal are finite and the goal can be achieved. The individual or groups of individuals could be farmers, marketers, researchers, conservationists, land planners, policymakers, and so on. The origin of an action is found in the individual or group's relations with others. For example, in order to make a profit, the farmer or his or her association should pursue this goal in relation to suppliers of inputs and to consumers of the produce. For instance, an agricultural activity or practice comprises agricultural actions such as saving seed, improving breeds, producing agrochemicals, tilling the land, planting seed, weeding, value addition, packaging, and so forth. In our case, the goal of the action is being viewed from the perspective of farmers who, and organic-farmer associations which, are intended to contribute to the societal motive and associated outcomes. The goals of farmers and farmer associations are to improve the agricultural resource base for the increased and sustainable production of healthy, safe and nutritious food for consumption and for sale at a profit. Such actions are oriented towards the conscious attainment of a goal in a particular place and at a particular time. In the present case, the place and time are defined by the project under review in Mashonaland East Province in Zimbabwe.

Operations (the how) under certain conditions

At the bottom of the hierarchy are operations that are concerned with how actions are to be performed under certain conditions. Operations are actions that become automated routines through repetition and rehearsal and that sometimes become embedded as, or in, tools and techniques. They enable the achievement of a goal but do not determine it. Compost-making, water-harvesting, making natural pesticides, double-digging, and transect walks to observe the ecological landscape are some of the examples in organic conservation agriculture that qualify as operations. These are essential for organic production and marketing, but mastering one or the other does not necessarily lead to the attainment of the farmers' goals. At the same time, the actions needed for organic certification under conditions where land has been subjected to agrochemicals before (or is surrounded by such land) are different from those necessary where the land and its surroundings are virgin or have been fallow for several years.

Research Process

Data generation

Data was generated by means of multiple methods and sources in order to enhance its robustness. The data-generation methods are summarised below:

Document analysis

The researcher analysed over 15 documents, which included: the Project Proposal; biannual and annual reports by implementing partners; implementing partners' quarterly reflection reports; workshop training reports; an end-of-project report; an article on action research involving farmers; a summary of proceedings at an end-of-project workshop that was attended by implementing partners, farmer association representatives, AGRITEX and other governmental officials, a United Nations Food and Agriculture Organization (FAO) official, and other organic producers; and a formative evaluation report on the project compiled in September 2012.

Implementing partner reflection and review meetings

The researcher attended some of the quarterly reflection and review meetings that were held by implementing partners. Each implementing partner, including the researcher, presented progress reports on any matters that needed the attention of others. As a result of the meetings, some replanning was done and some strategies were revised and improved as necessary. The meetings revealed the changing pace at which different levels of learning and agency development were taking place in the project.

Change laboratory workshops

The researcher facilitated change laboratory workshops with virtually all 32 farmer associations that were established at the beginning of the project. The change laboratory workshops were attended by members of the associations as well as by local AEWs. The first round of workshops was attended by 441 farmers and 26 AEWs, while the second round of workshops was attended by 249 farmers and 19 AEWs. Although there were some similarities between the challenges faced by each association, there were often different explanations for the challenges. The main challenges involved learning, production and marketing.

Data analysis

Drawing on Danermark, Ekstrom, Jakobsen and Karlsson (2002), the researcher used inductive, abductive and retroductive analysis to make sense of data. Inductive analysis allows one to make sense of the data generated by clustering it into categories. The main categories that the researcher used related to the project's learning approaches of top-down and horizontal (participatory) learning, as well as participatory action research (knowledge and innovation generation). Abductive analysis takes place when a researcher uses theoretical lenses to make sense of data by recontextualising the data using theory and/or contextual lenses to seek the best possible explanation. In this study, CHAT conceptualisations of learning and the hierarchy of human activity (see above) were used to make sense of data using an abductive approach,

alongside inductive analysis that allows for pattern-seeking in the data. Retroductive analysis, which entails determining the explanations of what must be the case for things to be the way they are, was used to draw conclusions about combining the learning approaches under review.

Contributions of the Different Approaches to Learning during the Project

This section of the article focuses on addressing the second objective of the article by showing how the project profited from framing the learning interventions in a manner that linked and enriched top-down and participatory-learning approaches.

Top-down learning

The access farmer, having been accepted on the project, then selected peers to form an association. The primary role of access farmers, or others identified within each association, was to receive training from the project 'experts', usually at a training centre away from their areas, and then convey that knowledge to fellow farmers in their respective associations. Such local training has largely been conducted in the horticultural gardens or the dry-land agricultural fields, and, occasionally, at local public facilities such as schools and community halls. As mentioned above, selected AEWs (16) from the eight participating districts also received training in the sustainability aspects of agricultural production. The eight farmer associations that were established after August 2012 have received organic conservation agriculture and associated marketing training from the more established associations and from AEWs in their respective wards, and by attending 'refresher' courses, and are now fully incorporated in the ongoing training and on-farm support.

Top-down farmer training by the more knowledgeable other

Much of the training of access farmers (and others who served in their place) has been conducted at the FPC training centre, which practises organic conservation agriculture on its premises and has the necessary board and lodging facilities. The initial training, which was conducted for a week per topic every month, covered the following practical and theoretical coursework: Training for Transformation and Introduction to Permaculture; Ecology; Water Management; Soil Management; Natural Pest and Disease Management; Agri-planner; Small Livestock Management; Nursery Management; Participatory Market Development; Beekeeping and Organic Honey Production; Integrated Pest Management; and Processing and Value Addition. Sixteen AEWS, who worked with the 32 organic-farmer associations, attended a one-week workshop at the same centre, which workshop was intended to help them learn about organic and conservation farming concepts and practices, as their own tertiary training was based on conventional, high external-input agriculture. Table 1 provides an example of how a one-week, centre-based training workshop was planned (and implemented), with access farmers as the trainees (FPC, 2011).

Table 1. One-week workshop plan on soil-improvement training by FPC

Workshop topic	Soil management
Aims and objectives	Aim: To work with natural systems and enhance biological cycles within the farming system involving micro-organisms, soil flora and fauna, plants and animals. Objectives: • To introduce the main components of soils and show how variations in these components influence soil properties and management; • To describe soil management operations and their implications for plant growth; • To encourage soil maintenance and increase its long-term fertility; • To provide farmers with the skills and associated knowledge necessary to plan an organic soil management regime and operate their production effectively; • To interpret and determine the role of manures and composts; and • To encourage soil protection from erosion, sun and wind and keep a good topsoil that is rich in moisture and soil biota which are essential for creating healthy, living soil.
Training methods	• Lecture; group work and presentations; group tutorials; demonstrations; practical assignments; question-and-answer sessions; and role play.
Practical (workplace) assignments	• Access farmers implement at least three soil-fertility amendments strategies in their horticultural gardens; • Access farmers support the construction of a thermal compost by each association member measuring 2.25m by 2.25m by 1.6m; and • Access farmers and association members plant mulching crops to encourage organic, nutrient-rich gardens.

ZOPPA conducts workshops on organic standards, certification, compliance monitoring and marketing for farmer associations in their respective wards. Each standards workshop lasts for three days. The training workshops are aimed at enabling farmers to acquire knowledge and skills concerning organic-production standards, compliance with international organic standards, and the setting up of local compliance systems, such as the Participatory Guarantees System (Nyakanda, 2013). ZOPPA also conducts inspections of farmers' gardens and assesses them for compliance. Associations that comply receive a Zimbabwe Organic Label from ZOPPA. By the end of 2011, four associations had qualified, thus allowing them to tap into the organic niche market in Zimbabwe, which is currently underdeveloped. ZOPPA Organic Label certification also opens up possibilities for marketing to eight neighbouring countries in which the label is recognised (Nyakanda, 2013). The other 28 associations meet all the certification requirements but are using land where agrochemicals have been used in the recent past. They are still going through the conversion period (three years). In order to recognise their efforts and motivate them, ZOPPA has introduced another category of certification called 'Zimbabwe Natural'. At the same time, the associations have begun seeking and using 'virgin' land after learning from others. Consequently, the next ZOPPA inspection, which will be conducted before the end of 2013, is likely to result in more associations being registered under the

Organic Label. One of the main challenges faced by ZOPPA in the project is how to increase the number of organic associations that can then become members when they comply and are certified (without additional funding). It is tackling this challenge by implementing a train-the-trainer course on organic standards.

The access farmers from the different associations approach the site-based training differently: some condense the one-week training into a whole day of training while others spread the training over several mornings. The decision on the timing and spread of on-site farmer-to-farmer training is made by each association. Some handouts, initially written in English, have been produced and distributed to those who attended centre-based training for use during subsequent field-based training by farmers. A common practice found within the project is that the farmer-to-farmer training is conducted within a week of receiving centre-based training, while the ideas are still fresh in the mind.

Some of the improvements that have been made to enhance local scaffolded learning are the following:

- Each training workshop summarising 'take home points' for access farmers to use in the on-site training;
- The production of handouts in the vernacular language, together with the necessary supportive visuals;
- Teaching more complex topics directly to the farmer associations and not through access farmers or association representatives (who attend centre-based training); and
- ZOPPA training two farmers in each district to become trainers in organic standards so that these trainers can help expand the membership by training interested groups of farmers in their respective districts, with little or no funds needed. (ZOPPA retains responsibility for compliance monitoring and formal certification.)

The trainers also conduct support visits in order to provide backup for association members, and give the necessary on-site technical support to members of each association. One of the most important benefits of these visits is that trainers are able to give more context-specific advice, thus augmenting generic, centre-based training.

Contributions of the top-down learning approach

An analysis of project outcomes suggests that the top-down learning approach is making an important contribution to farmers' knowledge and to their abilities to produce organically and to market their products effectively. The access farmers constitute an important link between centre-based training and site-based training. They have helped in the creation of a multiplier effect, as each access farmer or someone from his or her group trains as many as 30 other farmers. This has resulted in the training of about 800 farmers in organic conservation agriculture. There is considerable evidence to suggest that training farmers through other farmers is creating impact, with potential to increase local resilience. Project reports (McAllister, 2011; 2012; FPC, 2011) reveal that top-down training in organic conservation agriculture and associated marketing has increased farmers' technical knowledge and skills, especially with regard to:

- Improving soil fertility using locally available resources that do not harm the natural environment;
- Improving water availability under agro-ecological conditions in which water is seasonally a scarce resource that undermines production and productivity;
- Stimulating the cultivation of a diversity of crop species and raising a range of goat and chicken breeds, as well as with regard to crop rotation, soil enrichment using biological means, and balancing pest–predator relations;
- The production and application of biological pest control tools and techniques in relation to producing safe food in line with the provisions of organic farming; and
- The application of the Participatory Guarantee System in organic farming, which has made possible the organic certification of some farmer associations and has enabled them to label and market their produce as organic.

Bottom-up learning

A certain amount of learning and change has also been taking place from the farmers to the trainers. Much of this kind of learning occurs during support visits, when trainers hear and obtain explanations about some of the local knowledge and innovations. Trainers have reported that much of the learning has involved pest and disease control using local plants. Another interesting aspect of learning from farmers has been that relating to water resource management. For example, one association reported that, while swales and associated microwater-harvesting systems were helpful for increasing water supplies in specific gardens, they were inadequate for effective recharging of the water table. Related learning has been that, when some farmer associations generated income, they used it to buy water pumps for increasing the areas under irrigation. Consequently, the water tables began to fall and the irrigation could not be sustained. The lesson that was learnt from this was that it was critical for the associations and other members of the community to embark on watershed management. The trainers, through the implementing team, have responded to this emerging challenge by developing and implementing training on watershed management. This example shows how bottom-up and top-down learning are feeding into each other.

The main benefits of bottom-up learning has been the valuing of local knowledge systems by the trainers and the adjustment of training content to address new and emerging insights.

Horizontal learning

Learning among farmers continues to take place within each farmer association and between farmers associations, especially those that are physically close to each other. Farmers have periodically met in their associations to share experiences, to assess opportunities and challenges, and to plan together. During FPC training, access farmers and farmer representatives have also shared their experiences and challenges with a view to learning from one another.

Horizontal learning within and between associations

The contributions of farmer-to-farmer learning within their associations include the following:

- Passing on newly acquired knowledge, skills and techniques through talks and demonstrations on-farm;
- Sharing traditional, local and indigenous knowledge about how to manage crop and livestock diseases and pests;
- Conducting observations and assessments of their crops, livestock, fields and gardens, and identifying challenges and obstacles that need to be understood and overcome;
- Conducting informal transect walks and identifying land and water resources that can be tapped into for organic conservation agriculture; and
- Drawing lessons and insights from project experiences and sharing them with others for possible up-scaling.

Contributions of horizontal learning

Horizontal learning among farmers has been critical in creating a multiplier effect, which, in turn, has been important for the development of a critical mass of farmers practising organic conservation agriculture. Another important contribution of horizontal learning among farmers is that it has enabled the contextualised application of acquired, appropriated and internalised knowledge and skills. At the same time, it has fed back into the top-down training, especially when acquired knowledge has not produced the desired results. In this way, linkages between everyday experiences of farmers in the project and 'mature scientific concepts' have been made. For example, some farmer associations have had their soils tested for acidity and fertility in order to explain their performance as well as enable them to search for effective solutions. Similarly, some of the biological pest control tools have been tested for efficacy and potential harm to the environment and consumers. These two examples show how the interaction between top-down and horizontal learning has helped to both deepen and speed up the learning processes in the project.

Horizontal learning has been reported to have motivated fellow farmers to practise what had successfully worked in other farmer associations. Knowing that other farmers like themselves could do it created a positive attitude to practising organic conservation agriculture and helped build farmer confidence in themselves, thus contributing to the development of agency.

Participatory action research

The main tools that are being used for mediating the understanding of the challenges and the development and implementation of solutions are the expansive-learning cycle (after Engeström's work with CHAT) and the Farmer Learning and Innovation Forum (Mukute, 2010; Mukute & Lotz-Sisitka, 2012). The expansive-learning cycle provides a tool that shows how farmers in each association can jointly make meaning of their experiences, as well as jointly surface challenges that they face in learning and practising organic conservation agriculture, modelling and testing solutions, and improving the solutions and making progress towards their respective goals of more, nutritious and safe food, an improved agricultural resource base, and higher incomes from organic and conservation farming. The Farmer Learning and Innovation Forum tool provides guidelines on how to make space for joint learning, innovation and agency development among farmer groups such as associations.

Participatory action research by farmers and organic associations

Farmers and farmer associations in the project use change laboratory workshops as a space and process for initiating their joint learning, innovation and agency development. With the help of an interventionist researcher, each association identifies and prioritises major challenges in achieving its goal; models and implements solutions, and moves towards the attainment of its goals. In order to do this, each association draws on the knowledge and experience of its members and stakeholders, including the knowledge that is appropriated through top-down learning and horizontal learning. In addition, the farmer associations embark on solution-searching journeys to find new solutions that go beyond what they learnt in the past. They also exercise their individual, collective and relational agency in order to implement the developed solutions. Figure 1 shows the main actions that have been taken by each of the 32 organic farmer associations as part of the earlier participatory action research process.

Figure 1. Participatory action research process as implemented in the OCA project

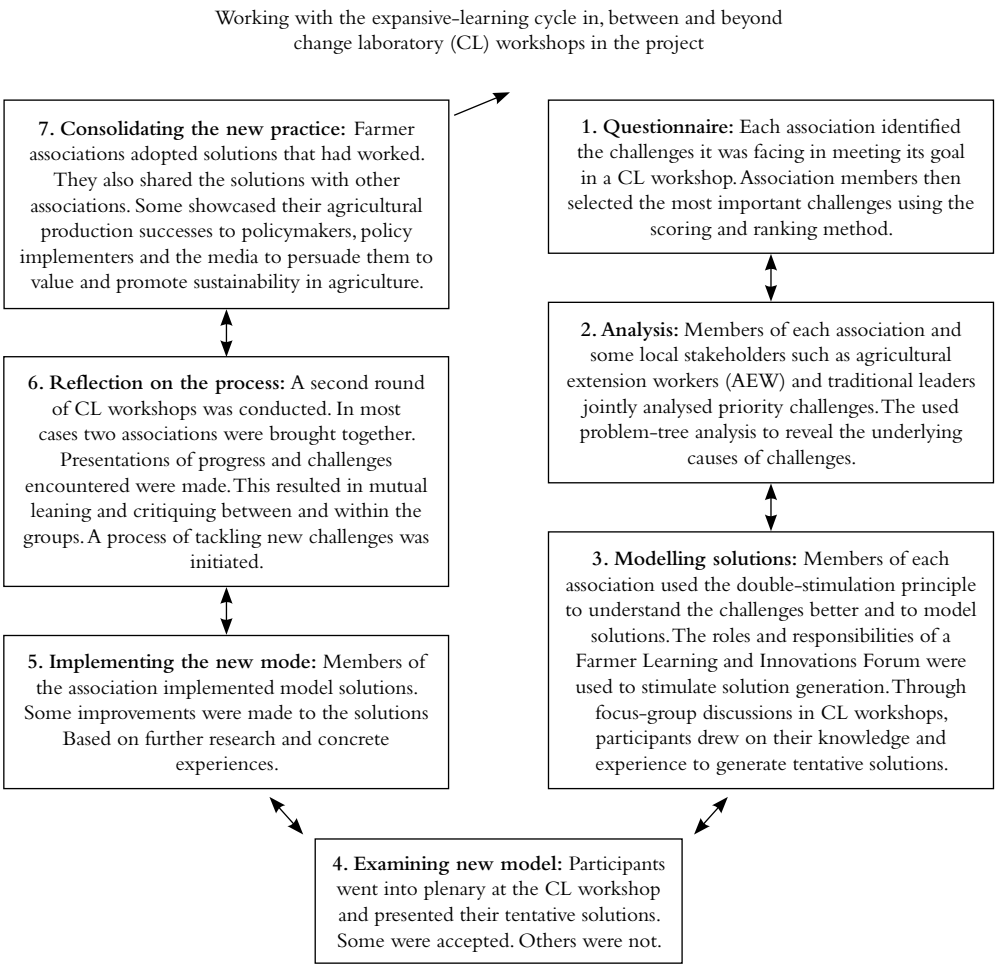

Table 2 is an example of how participatory action research (following the expansive-learning cycle) was facilitated for one association in the project.

Table 2. An example of how one farmer association moved along in the expansive-learning cycle

Stage	Results produced
Questioning in change laboratory (CL) workshop in order to reveal challenges	• Market and transport to the market; • Implements; • Prices; • Cheats at the market; • Seed; • Security of gardens from livestock; and • Transport.
Priority challenge analysis in CL workshop	Security of gardens from livestock: The challenge arises because villagers do look after cattle and goats in the dry season and there are no paddocks to help control livestock movement. Since the introduction of goats in the area, it has been nearly impossible to establish orchards. The community has no by-laws to compel herding cattle throughout the year.
Modelling solution in CL workshop	Persuade the headman to put in place by-laws that compel livestock herding throughout the year (including tethering of goats). The by-laws should include appropriate fines. Livestock owners should ensure that they keep their animals in kraals at night. Farmers should seek loans and build stronger structures to prevent livestock from breaking into their gardens. In the meantime, live fencing should be established.
Examination of model solution in and outside workshop	The main culprit is a powerful person, who historically assisted the people and whose help is needed for transporting produce at a favourable price. There were existing by-laws that actually provided for fines if livestock strayed into gardens at night. Livestock herding throughout the year is likely to be resisted in the community because of labour requirements. Multiple strategies were needed to tackle the challenge without straining community relationships.
Implementation of solution (actions)	• Protected gardens by using barbed wire and thorny bushes, and by erecting live fences; • Introduced the selling of troublesome cattle; • Implemented livestock management by-laws and fined some offenders US$ 25 per animal per case; and • Drafted a letter to the Member of Parliament (MP) whose goats were causing the most trouble. Delivered the letter through the associations' leadership, which included a traditional leader. Consequently, the MP hired personnel to look after the goats and repaired paddocks where his livestock were kept.
Review of solution and search for new, critical challenge	• The implemented solution resulted in increased horticultural production for consumption and for sale. It also resulted in increased self-confidence within the association, which had succeeded in negotiating with community members and leaders; and • The marketing challenge became more important and urgent.

Contributions of participatory action research

Drawing on Mukute (2012), the processes and outcomes of participatory action research – which research is strengthened by following the expansive-learning cycle and by the use of change laboratory workshops – have already made the following main contributions to the project under review:

- The farmer associations have been able to organise themselves, identify and address new challenges, tap into opportunities, and respond effectively together (Box 1). This includes the implementation of the Participatory Guarantee System1, and the search for solutions to major challenges during and between participatory action research/change laboratory workshops;
- Many farmer associations have been able to tap into system reserves by identifying idle (virgin or reverted) land and obtaining permission to utilise it in order to produce safe and nutritious food for consumption and sale, and by bypassing the three-year conversion period in order to become registered organic producers. Some associations have shared information on indigenous ways of treating certain livestock diseases;
- Nearly all farmer associations have used their collective capacities and have found new ways of dealing with production and marketing challenges that they have been confronted with. The learning that they generated through the project has inspired them to experiment; and
- Farmer associations have learnt from one another through horizontal learning, which has been achieved by way of joint meetings during some of the change laboratory workshops, exchange visits, and the mentoring of newly established associations by the older ones. One of the innovations that has been adopted to speed up the process of organic certification is the search for and use of virgin and 'reverted' land on which agrochemicals have not been applied for several years. Exchange visits and discussions facilitated between community leaders have led to improved access to such land for most of the associations.

CHAT-informed Analysis of the Values of the Learning Approaches

Table 3 uses abductive analysis by employing the CHAT lenses to try to reveal how the different learning approaches in the project complemented each other in the realisation of the project objectives. The focus is on how the learning approaches are enabling farmers and their associations to move towards the achievement of their goals, which are virtually identical.

Table 3. Learning approaches and some of their immediate results

Project's learning approach	Associated learning actions in the project	Interpretations of CHAT learning	Link to hierarchy of human activity
Farmer training by, or learning from, others	• Farmer acquisition of new knowledge on the following topics: Training for Transformation and Introduction to Permaculture; Ecology; Water Management; Soil Management; Natural Pest and Disease Management; Agri-planner; Small Livestock Management; Nursery Management; Participatory Market Development; Beekeeping and Organic Honey Production; Integrated Pest Management (IPM); and Processing and Value Addition; • Farmer application of new knowledge in agricultural production, value addition and marketing by farmers; and • Farmer search for explanations from the trainers and research institutes based on farmer application, observation and experiences in the project.	Primarily scaffolding and cultural interpretation of learning aimed at implementing pre-existing solutions	Mastering tools, techniques and operations of OCA – the how of practising organic and conservation agriculture Understanding why the operations work under certain conditions (e.g. why composts do better in shade or pesticide mixes are more effective when mixed with soap)
Participatory learning – learning among and from farmers	• Farmer observation of successes and failures arising from the application of newly acquired knowledge in agricultural production and marketing; • Farmer sharing of successes and failures as experienced during the project; • Farmer's search for specific answers to specific issues and challenges being experienced in the project (e.g. compost-making, record-keeping and pest management); • Farmer agricultural trials, experimentation and marketing studies in the field; and • Farmers sharing their knowledge and insights with trainers.	Primarily scaffolding and cultural interpretation of learning aimed at implementing pre-existing solutions Societal interpretation of learning associated with farmer generation and sharing of knowledge and insights	Using mastered techniques and tools to conduct actions that contribute to farmers' goals Using experiential learning to move towards farmers' goals
Participatory action research – farmer joint learning, innovation, and action with others	• Joint farmer, stakeholder and researcher identification and analysis of main obstacles to improving OCA practice and associated marketing of produce; • Joint farmer, stakeholder and researcher modelling of solutions to fundamental challenges in the OCA, and marketing practice solutions in CL workshops; and • Farmer examination, implementation and review of model solutions between and beyond CL workshops.	Primarily societal interpretation of learning aimed at tackling systemic causes of experienced challenges by creating new solutions – combining incremental improvements with a holistic and long-term development of the practice	Drawing on learnt and mastered operations, knowledge and skills derived from elsewhere and the energy arising from the goal to embark on actions towards a goal in the context of the object of the activity of sustainable agriculture

Conclusion

In conclusion, this article describes the emerging results of the project in relation to the three-dimensional object of the organic conservation agriculture project by drawing on several reports (FPC, 2011; McAllister, 2012; Mukute, 2012; Samhutsa, Sigauke & Zheke, 2012). The three (interrelated) dimensions of the object are social justice, economic viability and ecological sustainability.

Social justice: The project has promoted self-reliance and food security among members of the associations by providing and supporting the application of: technical knowledge on agricultural production and marketing and on the growing of a range of crop varieties, including vitamin-rich vegetables in a social context where nutritional security was highly necessary. It has also contributed to the development of group cohesion among association members and has stimulated the development of productive and constructive relations between the associations' members and AGRITEX, FPC, ZOPPA, traditional leaders and district leaders. These relations are important assets for joint learning and action. Social justice and self-reliance have been fostered when the learning and practice processes tapped into the local knowledge systems, as well as local relationships and resources.

Economic viability: From a starting point of below-subsistence-level productivity, the project has enabled the members of the associations to increase income from horticultural production. Association members interviewed in four of the eight districts revealed that their monthly income levels during the dry season (from April to November) ranged from US$ 40–60 in one district, to US$ 100–150, to US$ 200–400; and to over US$ 400. Incomes from the sale of agricultural produce have been used to improve the livelihoods of members of the associations. Those interviewed indicated that they had bought agricultural assets such as garden tools and livestock, had paid school fees and had built a house.

Ecological sustainability: Farmers have become better able to look after their agricultural resource base by increasing soil fertility and by managing pests and diseases using ecological means. This took place in their agricultural fields as well as on their rain-fed agricultural plots. They were also able to tap into and preserve indigenous crop varieties and small livestock breeds, which contributed to the conservation of agro-biodiversity. Small-water harvesting and the revival of derelict water infrastructure have been implemented in the context of worsening water scarcity in the dry season, as well as in the context of climate change. Using ecological solutions, farmers have significantly increased their yields despite 50% lower rainfall than expected.

Experiences during the course of the project suggest that combining learning approaches in a deliberate and carefully thought-through manner can in fact enrich the learning. It can also support practitioners such as farmers to innovate and to change their practices swiftly and comprehensively in moving towards their goals of prosperity and protection of the agricultural production base. The training of farmers in a top-down way has enabled them to acquire knowledge, skills and techniques that they have included in their operations, which, in turn, has helped them to achieve their goals. There has also been some bottom-up learning as the trainers learn from farmers, especially during field visits. This has sometimes resulted in changes to what

is taught and how it is taught (e.g. the introduction of watershed management). Horizontal learning has enabled farmers to identify obstacles and opportunities, some of which could be tackled using technical knowledge, with others being addressed by building appropriate social relations and by the facilitation and exercising of agency, which could not be taught during the project. Change laboratory workshops were particularly important in bringing together the different approaches to learning, thereby assisting farmers to move towards the achievement of their goals and a deliberate focus on creating new solutions and innovations associated with the achievement of the goals. Dialectics, the concept that underpins CHAT conceptualisations of learning and the hierarchical human activity, appears to have enabled the combination of seemingly contesting approaches.

Notes on the Contributor

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Endnote

1. The Participatory Guarantee System provides consumers with a credible guarantee that the produce is organic. It is participatory, in that the verification process involves the direct participation of representatives of farmers, consumers and other stakeholders.

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Learning for Climate Change Adaptation among Selected Communities of Lusaka Province in Zambia

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Abstract

This research was aimed at surveying perceptions of climate change and educational themes that would be contextually relevant for climate change adaptation. It locates within the United Nations' Educational, Scientific and Cultural Organization's (UNESCO's) Balaclava recommendations on Climate Change Education for Sustainable Development (2013). Uncertainty as to how residents of selected households understood the causes and effects of climate change as well as the content structure of learning for climate change adaptation constituted the problem. Using social constructivism, hermeneutics, survey design, semi-structured interviews and constant comparative analysis, the article shows that the challenges of climate change are comprehended in diverse ways. It also shows that drawing knowledge from diverse sources or cross-disciplines can evoke behavioural and social change that is critical in order to nurture best thinking and practices regarding adaptation.

Background, Statement of the Problem and Contextual Relevance

Climate change education (CCE) is an important process in building community resilience to, and coping strategies for, climate change (Gangwar, 2010). In order to adapt to the multifaceted nature of climate change through education, the focus should be on how to respond to societal challenges and needs (Tanner, Lockwood & Seballos, 2012).

Zambia is one of many countries threatened by the potential and actual effects of climate change. The mean temperature in Zambia has steadily increased over the last 40 years. It was 21.57 ºC between 1960 and 1990, but projections indicate that it will be an average of 25.86 ºC between 2070 and 2099. Moreover, the annual average rainfall was 2.75mm/day between 1960 and 1990, but, between 2070 and 2099, it is projected to decrease to 2.61mm/day owing to climatic changes (Ministry of Tourism, Environment and Natural Resources [MTENR], 2010).

Uncertainty as to how residents of selected households understood the causes and effects of climate change as well as the content structure of learning for climate change adaptation constituted the research problem. The MTENR (2010) and others have undertaken extensive research on, and produced considerable documentation in respect of, climate change, but they all focus on scientific approaches as intervention strategies; there is little evidence of a focus on learning or social learning as an intervention approach. This, therefore, provided the rationale for this research, the findings of which may be useful to the Ministry of Education, the MTENR, environmental researchers and others.

This research situates within the 2013 UNESCO Balaclava framework of Climate Change Education for Sustainable Development, which recommends drawing knowledge for climate change education from diverse sources. There is a need to cross-breed and cross-fertilise the ideas from diverse epistemological contexts in order to build communities' adaptive capacity with regard to, and resilience to, climate change (UNESCO, 2013).

Research Purpose and Questions

The purpose of this research was to conduct a snapshot survey of how residents of selected households perceived the causes and effects of climate change. Premised on respondents' perspectives on the causes and effects of climate change, *socially constructed perspectives* on educational themes that would be contextually relevant for climate change adaptation were solicited through interviews.

Some of the guiding questions in the survey were as follows: What causes climate change among selected communities? What effects of climate change do communities experience? The following was the key question in the interviews: *What priority issues and topics would be relevant in learning for climate change adaptation, and why?* It should be noted that the survey responses on the causes and effects of climate change formed the basis on which respondents suggested different educational themes that could constitute learning for adaptation.

Conceptual and Theoretical Framework

According to Hein (1991), *learning* refers to the continuous acquisition of new knowledge, as well as developing the ability to engage in new environmental behaviour and practice. *Learning* is a social and contextual activity because it is associated with the connection with other human beings and with acquaintances with the surrounding environment. *Climate change adaptation* implies adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (CARE, 2012). In the context of this article, climate change adaptation is defined as a socially initiated and contextually relevant way of coping with the effects of climate change. According to CARE (2012), *learning for climate change adaptation* refers to the acquisition of new knowledge and practices in order to develop and apply innovative approaches so as to generate best practice for adaptation. Owing to the stochastic nature of climate change temporally and spatially, the acquired knowledge and practices need to be contextually relevant and responsive to the immediate needs of the affected communities. In this article, *learning for climate change adaptation* is used interchangeably with adaptation learning or learning for adaptation or climate change education. The word '*communities*' is being used to refer to residential areas that were surveyed in this study. *Social constructivism* as a concept and theory guiding this research is expanded on in the following section.

Social constructivism emerged through the work of Lev Vygotsky, who drew attention to the manner in which language and culture shape learning (Hein, 1991). It has been developed as a wider sociological theory that applies the general philosophical framework of

constructivism to social settings (known as 'social constructivism'/'social constructionism'). Social constructivism recognises that groups construct knowledge of the world for one another, collaboratively creating a small culture of *shared knowledge* with *shared meanings* (Derry, 1999). This epistemological theory assumes that knowledge is constructed through human activity, language, culture and experiences and this is a social process. Knowledge is therefore seen as a human product that is culturally constructed. Learning does not simply involve understanding knowledge of what is seen to be the 'true' nature of things, nor is it remembering what are perceived to be fixed or perfect ideas. Rather, it also includes a personal, connective and social construction of meaning out of the bewildering array of sensations and inputs which have little order or structure for the individual besides the explanations that are constructed by and for them via social interactions and meaning-making processes (Hein, 1991). This theoretical lens enabled me, as researcher, to bracket 'external' academic notions (e.g. how scientific institutions construct knowledge of climate change) and, via a hermeneutical research process, to focus mainly on the respondents' construction of knowledge. Some insights into the sociocultural processes of knowledge construction in a climate change context can be gained from the work of Fumo, Sauda, Smart and Foumane (2008), Gordon (2008) and Madison (2007), who show that perceptions of climate change differ. For example, Madison (2007) analysed cultural understandings of climate change and found that, in Kenya, respondents thought it was caused by disobeying elderly people, while, in Zambia, they said it was caused by witchcraft.

According to UNESCO (2009), climate change is an interdisciplinary challenge and, therefore, education to address it needs to tap into diverse forms of knowledge. Nevertheless, Petra and Dietrich (2010) bemoan the absence of learning tools that explicitly encourage adaptation processes. They argue for adaptive and anticipatory learning, because it can make vital contributions to adaptation. However, they scarcely mention what would constitute learning in order to make it adaptive and anticipatory.

CARE (2012) proposes a *learning*-for-adaptation approach that is people-centred and which combines successful strategies from decades of development experience with scientific knowledge on climate change. The approach focuses on building adaptive capacity at the household and individual level by developing resilience of livelihoods and reducing disaster risks. CARE's framework of adaptation learning shows that tackling climate change through education has much to learn from experiences that are different from already existing ones, that is, there is an element of social innovation necessary in climate change education.

McKeown and Hopkins (2010) ask penetrating questions as to what must constitute learning for change in the context of adaptation to climate change. Like UNESCO (2009) and CARE (2012), they recognise that learning for adaptation to climate change requires engagement of interdisciplinary themes. Generally, they posit that learning for change in the context of adaptation to climate change should involve *issue analysis* as a 'generic' process that can be applied to a wide range of environmental, social and economic problems. McKeown and Hopkins (2010) further advocate for encapsulation of *community and personal decision-making* where every member of the community collaborates in co-creating an action plan to address problems. *Political process* is another aspect deemed by McKeown and Hopkins (2010) to be significant in climate change education. They argue that climate change is inherently political and, therefore, that learners need

an understanding of political processes embedded in decision-making and policy formulation for adaptation. They argue that a mechanical understanding of climate change gained only from textbooks and classroom knowledge-sharing cannot be of much value unless contextual ties and connections with community experiences are established. These perspectives provide some insight into the spirit and substance of climate change education.

McKeown and Hopkins (2010) further argue that climate change presents an array of effects, including environmental refugees. Therefore, 'learning to live together' with people of different cultures requires *intercultural sensitivity and competences*. They add that effective learning for climate change adaptation should include aspects of *social justice*, because we live in a world full of gargantuan inequalities – inequalities that are likely to be widespread in the face of climate change. Last, but not the least, they propose a *behaviour change*-oriented approach to learning for adaptation, adding that behavioural change would address the indifferent consumerism that has contributed to environmental changes. However, based on long-standing critiques of education that have focused on behaviour-change approaches (e.g. Robottom 1987), it can also be said that behavioural change is not sufficient if not complemented by social change. In this regard *behavioural change, seen in the context of social change,* would be better than the consideration of behavioural change alone. Such an approach also brings social-learning processes into focus (Lotz-Sisitka, 2012). McKeown and Hopkins recommend that good climate change education should focus on lifelong learning, as opposed to confining it to primary and secondary school education only. It should be a programme for all age groups.

Volume 26 of the *Southern African Journal of Environmental Education* (*SAJEE*) includes various think pieces on climate change education research. Some of the ideas presented by various scholars are worth noting in the present article. For example, Ogbuigwe (2009) argues that, despite much scientific and technological research as well as policy development, there is still not a clear capacity to present climate change facts and issues in a manner that influences behavioural and social change. She therefore advocates a cross-disciplinary approach to deal with climate change in education. Like CARE (2012) and UNESCO (2009), she also emphasises alternative practices that can best change existing practices. These alternatives could potentially be sourced from contextual and diverse lived experiences of communities as proposed in this article. Kronlid (2009) also construes climate change and education within the sustainable development framework, noting that learning takes place in spaces of capabilities and that learning conditions are likely to be improved if learners' spaces of capabilities are expanded and enriched. The present article argues that drawing from diverse sources of knowledge and practices is what would actually expand and enrich people's capabilities to adapt. In fact, Namafe (2009) emphasises that climate change education should respond to societal needs and incorporate cross-disciplinary issues in order to build human agency and positive individual and social change. Moreover, Lenglet (2009) states that climate change education should go beyond mere learning instructions about climate change, its existence and causes, and its potential and actual consequences. It should venture into interactions between climate change, human and social formations as well as a *variety of learning experiences*, thereby allowing individuals and communities to acquire competencies, knowledge and predispositions for being active participants in co-creating a sustainable future and climate change adaptation.

Methodology and Research Approach

Paradigmatic orientation

This article is located within the research tradition known as interpretivism or hermeneutics. Interpretivism is directed at understanding phenomena from an individual's perspective and at investigating interactions among individuals, as well as the historical and cultural contexts that people inhabit (Creswell, 1994). The *ontological assumption* underlying this research tradition is that reality is not 'out there', but rather exists in inner human beliefs and is conditional on human experiences and interpretations. Moreover, reality is not independent but is socially or culturally constructed and can have varied meanings depending on a particular practice context (Kukla, 2000). Interpretivism meshes with the philosophical core of deconstructive post-modernism, which rejects any sense of the 'real', because the objects and meanings that constitute our existential 'reality' are social constructions. The ontological position of interpretivism is relativism, which is the view that reality is subjective and differs from person to person (Guba & Lincoln, 1994). Therefore, during the data-collection process and analysis, this researcher was open to respondents' multiple beliefs, knowledge and practices as they were expressed, and these were freely allowed to emerge in and through the research process. There are some problems, however, with a relativist ontological position in research on issues such as climate change, and these will be commented on towards the end of the article. Guba and Lincoln (1994) suggest that *epistemology* deals with the nature of knowledge, for instance how people know and how they know what they know. *Subjectivity* was a key epistemological assumption in this research. Using the epistemic lens of interpretivism, knowledge was constructed through intersubjective dialogue between the researcher and key respondents from various households. The researcher was conscious that, in such a research paradigm, there are multiple realities for all phenomena that require multiple theories of knowledge in order to fully understand them (Lotz-Sisitka, Fien & Ketlhoilwe, 2012).

Research design and selection of respondents

This qualitative research study employed hermeneutic survey research design in order to facilitate succinct interpretations of respondents' views premised on their lived experiences. A small-scale hermeneutic survey enabled the capture of just a representative fraction of the target population, much as a camera takes a single-frame photograph to represent larger landscapes (Leedy & Ormrod, 2001). Lenglet (2009:95–96), in his review of different research approaches that can possibly be used in climate change education research, states that 'surveys of climate change education practices and understanding perceptions and beliefs among different actors and actants are useful tools for gathering information for determining the "lay of the land" when climate change education initiatives are being proposed and introduced'.

The survey sample of 165 households was drawn from a larger population of 178 081 households in Lusaka Province, Zambia (Zambian Central Statistical Office [CSO], 2003). Targeting households, as opposed to residents (who numbered in the millions), relatively reduced the population and helped in the selection of the survey sample.

As indicated, the survey sample comprised 165 households. From each selected household, one respondent over the age of 17 was chosen to respond to the questionnaire. This age group was deemed to be shrewd and experienced enough to provide informed responses. Cluster sampling was used to divide residential areas into relatively small clusters of households. A probability sampling approach (*simple random*) was used to select specific households from each cluster of a residential area (Leedy & Ormrod, 2001).

Sampling involved five levels, with the first level being used to gather statistics on communities in Lusaka Province. The second level involved a simple random selection of 165 communities. The third level involved the division of simple randomly selected communities into clusters, with each cluster containing a manageable number of households. The fourth level involved the simple random selection of clusters from communities. The final level involved simple random selection of households from each randomly selected cluster and, thereafter, respondents were chosen. For the purpose of obtaining respondents' construction of reality, the researcher deliberately did not include policymakers, educators and others in the sample.

Methods of data collection and ethical issues

Semi-structured interview and survey schedules were used to collect primary data because they made it possible for follow-up questions to be put in order to gain greater insight into certain responses from respondents. They also allowed for sufficient flexibility so that different respondents could be approached differently while still covering the same areas of data collection (Leedy & Ormrod, 2001). Some reflective and unstructured discussions and observations were also incorporated for validation purposes. Secondary data was obtained from reports, journals and books in order to support the primary data.

To safeguard the interests of the respondents, ethical issues were considered. These included obtaining permission from relevant community authorities before conducting surveys and interviews. The researcher requested respondents' consent and conformed to the cultural norms and values of each community visited so as to gain the confidence of the respondents and the general community.

Data validation and analysis

Methodological triangulation was used to validate the primary data. This involved the use of multiple qualitative methods of data collection, such as the use of a survey guide, interview, informal discussion and unstructured observations, to analyse a research question from multiple angles (Patton, 2002). Iterative questioning through the variation of techniques enabled the comparison of responses and reflexive checking of their consistency.

This research used constant comparative analysis, which involved the classification of words and phrases that related to the same content, into major themes (Leedy & Ormrod, 2001). The aim was to allow prevailing patterns, themes and phrases of results to emerge rather than be controlled by predetermined factors. The emerging themes and ideas were manually coded, synthesised and transcribed into percentages as descriptive statistics.

Limitations

Owing to limited financial resources and time, the researcher undertook a small-scale survey (n=165) which, though providing only a snapshot, could serve as the basis for further research. Moreover, updated statistics on households in Lusaka Province were inaccessible. Therefore, only the 2000 census statistics in respect of households were used to determine the sample size, when, in reality, households had mushroomed within the ten-year period between the national census and the research. Moreover, lessons based on lived experience may no longer be meaningful if contexts change.

Results and Findings

Survey data

A survey guide was used to capture perceptions of the causes and effects of climate change, as presented in Tables 1 and 2 respectively.

Based on Table 1, it was found that the causes of climate change were perceived from a diversity of angles, including the biophysical, spiritual, political, sociocultural, economic, and behavioural, amongst others. Among these, spiritual understanding was widely distributed in almost all the communities, showing a strongly held perception that God was the source of climate change. Although not very frequent in Lusaka, Kafue and Luangwa districts, deforestation was cited as a common cause (13.3–33.3%) of climate change in Chongwe District. Both intraspatial and interspatial variations and similarities in the perceptions of the causes of climate change were common. Table 1 also reveals numerous erroneous perceptions or misperceptions about the causes of climate change; in fact, a large proportion of the perceptions on the causes of climate change were erroneous perceptions or misperceptions (e.g. climate change is caused by 'deciduous trees', 'biblical prophecies being fulfilled', 'God', 'leap years', 'mountains', 'alien beings', 'urinating in public by men', 'valleys', 'women from Monze Town', 'witchcraft' and 'women wearing pairs of trousers'). Another cluster of responses may be said to be potentially indirectly related to the causes of climate change, depending on the situation, and would need to be qualified, such as 'government' (i.e. where governments fail to make policies that address carbon emissions)', 'deforestation' (reduction of carbon sink potential)', the 'sun' and the 'ozone layer' (more sunlight penetrating due to breaches in the ozone layer), and so on. Very few respondents related the cause of climate change to increases in greenhouse gases. This actually confirms the International Union for Conservation of Nature's earlier finding that while some communities in Zambia were aware of climatic change, their knowledge about why it occurs is not widespread (IUCN 2007).

The responses regarding the perceived effects of climate change on the community's well-being and activities were generally more accurate and entailed fewer misperceptions than the responses concerning the perceived causes of climate change. Major categories of responses related to an increase in health risks, increased crop failure, impacts on farming practices and activities, and impact on water security, as can be seen from Table 2.

As shown in Table 2, perceptions of how climate change will negatively affect communities' health and well-being emphasised escalating diseases such as malaria, cholera, diarrhoea, and others (including HIV/AIDS, which may not be directly related to the impact of climate change). For example, between 18% and 40% of the responses from three communities in Lusaka District attributed the increase in malaria cases to climate change. Perceptions around heat stress, and changes in farming and household practices associated with increased heat, were also noted. This actually influenced some interviewees to suggest that health-oriented priority issues or topics be included in adaptation learning. Table 2 also shows that, across districts, there was an understanding that climate change would lead to increased temperatures, and there appeared to be a clear understanding that this would have impacts on crop production, livestock, water security and other associated issues. There was also a strong perception in the Lusaka District that climate change would lead to increased flooding, with associated increases in cholera cases and an increasing shortage of clean water. In the Luangwa District, perceptions of increased temperatures were related to perceptions of increased crop failure, less farming, and increased poverty. These results reveal possibilities for the initiation of adaptation learning programmes.

Semi-structured interview

The semi-structured interview allowed for probing of different educational responses to the perceived causes and effects of climate change, as shown in Tables 1 and 2. A range of suggested educational themes were distilled from the data via thematic categories focusing on education related to the main existing disciplines of agriculture and natural resource management, health, history, and culture and artefacts. Additionally, the researcher was able to gain insight into the scope of education and training suggested, and to establish if the educational responses proposed were focused more on environmental education, education for sustainable development and/or climate change education specifically; although it is recognised by UNESCO (2013) that climate change education involves environmental education and is part of the wider framework of education for sustainable development. Table 3 shows the results of the interview responses.

According to Table 3, agriculture and natural resource management-related topics and priority issues of livestock and crop production, flood management (in Lusaka Province) and forest management were proposed the most among communities. Proposed educational priority issues and topics were influenced by the perceived effects of climate change (flooding, crop failure and loss of agricultural production capacity), and the perceived causes of climate change (deforestation). For example, all communities surveyed in Lusaka District expressed concern about increased flooding and its subsequent effects. Therefore, they prioritised flood and health-related themes for adaptation learning. The diversity of educational themes suggested by respondents generally show that cross-disciplinarity is an important facet of learning for climate change adaptation. As can be seen from Table 3, education programmes were also suggested for a range of recipients, including adults, children, and businesses, with it being proposed that such education also be part of life skills and literacy education. The type of education most requested was climate change education (amongst environmental education and education for sustainable development), as shown in Table 3.

Table 1. Perceived causes of climate change among respondents from selected households in Lusaka Province

Perceived causes of climate change	Percentage (%) Responses																			
	Luangwa District						Chongwe District					Lusaka District						Kafue District		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Absence of clouds	–	–	–	–	–	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–
Air pollution	–	–	–	6.25	10	–	–	10	13.4	–	–	15	8.3	9.1	–	–	–	–	–	40
Alien beings	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–	–	–	–
Ancestors are not happy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–
Aridity	–	6.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Beer drinking	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	–
Bible Prophecy	14	–	–	–	–	–	–	–	–	–	–	–	16.6	–	–	–	–	–	–	–
Bush burning	–	13.3	–	6.25	–	–	–	–	13.5	–	25		–	–	–	–	–	32	–	10
Change of seasons	–	–	–	–	–	8.3	–	–	–	20	–	16.6	–	–	–	–	–	16	–	–
Charcoal burning	–	–	–	6.25	–	–	20	–	20	30	–	–	–	–	–	–	–	–	22	12
Clouds	–	–	10	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Deciduous trees	–	–	–	6.25	–	–	–	–	–	–	–	–	–	–	–	–	10	–	–	–
Decreased temperature	–	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–
Deforestation	–	–	–	12.5	–	16.6	25	25	13.3	30	33.3	–	8.3	–	–	–	–	–	14	8
Environmental illiteracy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
Firewood collection	–	13.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Global warming	–	–	–	–	–	8.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
God	7	6.6	10	12.5	10	16.6	–	5	–	–	–	–	–	9.1		30	20	20	8	–
Government	–	–	–	–	–	–	–	–	–	–	–	–	–	36.4	12.5	20		4	–	–
Green house gases	–	–	–	–	–	–	20	–	5	–	–	10	8.3						–	–
I do not know	7	6.6	–	–	10	–	20	15	–	–	–			9.1	–	10	–	12	–	–
Increased floods	–	–	–	–	–	–	–	–	–	–	–	30	–	–	50	5	–		–	–
Increased rainfall	–	–	10	–	–	–	–	5	–	–	–	–	–	–	–	–	–	–	4	–
Increase in sin	–	–	–	–	–	–	–	10	6.7			–	–	–	–	–	–	–	12	–
Industries	–	–	–	–	–	–	–	5	–	–	–	10	10	18.2	–	–	–	–	–	16
Leap years	–	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 1. (cont.)

Perceived causes of climate change	Percentage (%) Responses																			
	Luangwa District						Chongwe District					Lusaka District						Kafue District		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Location of the area	–	6.6	–	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Loss of catchments	–	–	–	6.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Luangwa River	–	–	–	6.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Motor vehicles	–	–	–	6.25	–	–	–	10	6.7	–	–	–	24.6	–	–	–	–	–	–	8
Mountains	14	20	10	6.25	10	25				–	–			–	–	–	–	–	–	–
Municipal waste	–	–	–	–	–	–	–	–	6.7	–	–						20	16	6	–
Natural cause	–	–	10	–	–	–	–	10	–	–	–	–	–	18.2				4		–
Oceans	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–
Open burning	–	–	–	–	–	–	–	–	–	–	–	25	–	–	–	–	10	16	–	–
Ozone layer	–	–	–	6.25	10	–	–	–	–	–	–	10	–	–	–	–	–	–	–	–
Poor drainage	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	40	–	–	–
Poor government policies	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Poor sanitation	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Population increase	–	–	–	6.25	–	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–
Rise in temperature	–	–	10	–	10	8.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Shifting cultivation	–	–	–	–	–	–	–	–	20	–	25	–	–	–	–	–	–	–	–	–
Soil erosion	–	–	–	6.25	–	–	–	–	–	–	–	–	–	–	–	15	–	–	–	–
Sun	14	20	–	–	10	8.3	–	–	–	20	–	–	–	–	12.5	15		4	6	–
Urinating in public by men	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12.5		–	–	–	–
Valleys	21	6.6	10	–	–	8.3	–	–	–	–	–		–	–	–	–	–	–	–	–
War	–	–	–	–	–	–	–	–	–	–	–	8.3	–	–	–	–	–	–	–	–
Wind from Mozambique	7	–	–	6.25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Witchcraft	–	–	–	–	–	–	–	–	–	–	16.6	–	–	–	–	–	–	–	–	–
Women from Monze town	–	–	–	–	–	–	–	--	–	–	–	–	–	–	12.5	–	–	–	–	–
Women wearing trousers	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 2. Perceived effects of climate change among residents of selected households in Lusaka Province

Perceived effects of climate change	Percentage (%) Responses																			
	Luangwa District						Chongwe District					Lusaka District						Kafue District		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Able to cultivate new crops																		1.7		
Aridity	-	4	5.4	6.1	7.1	6					8.4							5	13.5	
Boosts soil moisture																			1.3	
Change of seasons							8	-	6.7	8.3	8.4							6.3		
Change of vegetation											12.6									5
Closure of flooded schools													5.5							
Crop failure	4.4	8	5.4	12.1	-	14			6.7		16.8							8.4	3.8	12.5
Decreased fishing activity	6.6	-	-	3	-	2														
Decreased rainfall	-	-	-	-	-	-	-	5	28.3	-	17					4		2.5		
Decreased temperature											4.2							5.1		
Displacement of people												3								
Drying up of crops	4.4	-	8.1	9.1	-	4														
Drying up of rivers									13.3											
Early departure of rains																		7.6	11.3	
Fear of uncertainties							8									6				
Food shortage	6.6	4	-	-	-	8	17	10										0.8		
Increased beer drinking															10				2.5	
Increased cholera cases												10	11		10	10		2.5		
Increased deforestation								10												
Increased diarrhoea	6.6	-	-	3	28.6	10									10		5.8			
Increased drought	4.4	8	8.1	3	7.1	4							5.5							
Increased floods								20			4.2	43	22	35	15	18	23.6			
Increased HIV/AIDS	-	-	2.7	-	7.1	-												0.8		
Increased hunger	9	8	5.4	12.1	21.3	8		15		25								4.2	5	
Increased loss of soil fertility	4.4	4	5.4	-	-	4		15	13.3											22.5

Table 2. (cont.)

Perceived effects of climate change	Percentage (%) Responses																			
	Luangwa District						Chongwe District					Lusaka District						Kafue District		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Increased malaria incidences	6.6	4	10.8	-	14.2	4		10	26.7	8.3				40	20	18		15.8	2.6	20
Increased malnutrition											8.4									
Increased poverty	2.2	-	13.5	9.1	-	6			13.3	16.6		10							3.8	
Increased rainfall	-	8	-	-	-	4			6.7				22		10		23.6	0.8	3.8	15
Increased temperature	9	4	10.8	12.1	7.1	6		10		8.3	4.2	10	11	10	10	8		10	5	25
Increase in pests (i.e. Ntata)																			5	
Late onset of rainy season							17	-	-	-	12.6							4.2		
Little or no farming	4.4	12	8.1	9.1	-	8	17	15												
Loss of livestock	2.2	-	-	-	7.1	2					12.6	7			10			10	16.3	
Loss of people's lives												7								
Loss of property												10				10				
Mental disturbances																2				
No source of monetary income due to crop failure	2.2	4	5.4				8						11							
Promoted organic gardening																			1.3	
Pupils miss school lessons		-	-		-															
Recharging of aquifers																			1.3	
Seasonal overlaps													11	15				4.7	3.8	
Shortage of clean water																6	23.6		7.6	
Shortened rainy season	4.4	16	8.1	3	-	2														
Skin & eye diseases	2.2	-	-	9.1	-	6	8													
Spending nights outside our houses owing to excess heat	8.8	8																		
Washing away of earth roads	2.2	-	-	6.1	-	-														
Tsunamis															5			8.4	12.5	
Water scarcity	9	8	2.7	3	-	2					8.4									
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 3. Relevant educational themes for climate change adaptation

Suggested educational themes	Description	Priority issues & topics	Percentage (%) responses																		
			Luangwa District						Chongwe District					Lusaka District						Kafue District		
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Agriculture & natural resource management	Irrigation	15																			
		Fishing	15					20														
		Pest control			10	10																
		Livestock & crops	25	40	30	50	40	40	25	20		20	30							36	35	
		Water																		20		
Main existing disciplines		Flood management								10				35	37.5	27	60	65	33			
		Forest management								30	40	40	40								25	
		Chemical management										10										40
		Fire control											20								30	
		Soils							25	20				30								
		Waste management																10	17			
	Health	Baby care															10					
		Personal hygiene & sanitation			10		40							20	12.5	18		25	17	44		
	History, culture & artifacts	Morality					20			10					10							
		Traditional norms																			10	
		Crafts				10					10											
		Anthropology											10									
		Beer drinking															10					
	Adult education									10	10											
Scope of education and training	Civic education																					
Scope of education and training	Life skills education		10			10											20					
	Literacy education							20			20											
	Children's education for adaptation		15	20	10																	
	Business education				30	10		10														
New subfields of education	Environmental education					10			12.5			20		15								20
	Climate change education			20	10				37.5		20				25	45			33			40
	Education for sustainable development							10														
TOTAL			90	80	100	100	100	100	100	100	100	100	100	100	85	90	100	100	100	100	100	100

Source: Field data, 2011) (Responses <10% and 'I do not know' not included in table.

Summary

Understandings of the causes of climate change

With reference to Table 1, the causes of climate change were understood from different perspectives. *Biophysically*, respondents thought that climate change was caused by seasonal changes, geographical location, loss of catchment areas, and natural processes. *Politically* oriented views showed that climate change was caused by the government and its poor policies. Those who understood the causes of climate change from a *sociocultural* context, associated climate change with witchcraft and indicated that the ancestors were frustrated by the moral decay in the communities. *Morally and spiritually*, climate change was thought to have occurred because of an increase in sin, a rampant increase in beer drinking, and owing to the fact that women were dressing in trousers or that men were urinating in public. Others thought climate change occurred because of God's power and as a fulfilment of biblical prophecy. Moreover, *economic activities* such as charcoal burning, deforestation, automobile and industrial activities were thought to have contributed to air pollution and greenhouse gases that depleted the ozone layer. From the *behavioural* perspective, it was thought that climate change occurred because of environmental illiteracy or men urinating in public places. As noted in the preceding section, and specifically with regard to the discussion of Table 1, there was a wide range of *misconceptions*, namely that climate change was caused, for example, by alien beings, clouds, and women from Monze Town (also see the other factors noted above). This clearly and urgently calls for education to clarify what may or may not cause climate change. Some respondents mistook the effects of climate change for its causes, citing increased rainfall, flooding and increased temperature as causes, when, in reality, they are the effects of such change. These outcomes are similar to earlier research findings of Fumo *et al.* (2008), Gordon (2008) and Madison (2007). However, this is not to say that this research is generalisable.

Understandings of the effects of climate change

Climate change was thought to have affected various sectors. *Environmentally*, climate change was considered to have led to an increase in temperature (most widely known among communities), loss of vegetation, droughts (especially in Luangwa District), floods (especially in Lusaka District), and the early departure of rainfall, among others. These results are similar to earlier research findings by Fumo *et al.* (2008). With respect to the *agricultural and natural resources context*, climate change was thought to be contributing to loss of soil fertility, increased crop failure, the presence of animal pests, loss of livestock, water scarcity and a decrease in fishing activities due to the drying up of rivers. These responses were very notable in the rural communities of Luangwa and Kafue, and partly in Chongwe District, where respondents also bemoaned *social* challenges such as increased food shortages, hunger and poverty. Other notable social effects included displacement of people, especially those in Misisi Compound where, sometimes, schools closed owing to flooding. *Health* maladies such as skin and eye diseases, increased malnourishment, malaria and cholera cases were also blamed on climate change, when, however, these could be related to a complex of interrelated factors and not climate change only.

Conversely, some respondents from Kafue District expressed satisfaction that climate change presented some *opportunities*, such as the boosting of soil moisture and the recharging of aquifers, which made possible the cultivation of new crops and organic gardening. Also worth noting is a *misconception* on the part of respondents from Kafue and Lusaka districts that climate change is brought about by *tsunamis*. As much as this could be possible in coastal areas such as Mozambique, Namibia and others, it does not apply to Zambia because of it being a landlocked country; but these perceptions may be related to recent news items on the impacts of tsunamis on India, Japan and other Eastern countries. Climate change education needs to be alert to such issues too. It was interesting to note that perceptions of causes were generally less accurate than perceptions of impacts. This may be related to the emphasis on adaptation responses in Zambia, which fail to provide education that allows people to develop in-depth understandings of causes. However, it was not possible to fully determine this in the present research.

Educational Themes: Priority Issues and Topic for Adaptation

Existing educational disciplines

Agriculture and natural resource management

Over 80% of the Zambian economy, and particularly the communities studied, depends on climate-sensitive agriculture and natural resources (MTENR, 2010). Agriculture and natural resource management, with emphasis on irrigation, fishing, gardening, pest and chemical control, crop production, livestock management, and soil and water conservation, are indeed relevant in learning for adaptation to climate change in such a context. As noted earlier, learning conditions are likely to be improved if learners' spaces of capabilities are expanded and enriched (Kronlid, 2009). The diversity of priority issues and topics on agriculture and natural resource management as highlighted in Table 3 and Figure 1 can potentially partly expand peoples' capabilities and competences to cope with the potential and actual effects of climate change on agriculture and natural resource management. Variations in priority issues and topics under agriculture and natural resource management clearly show the need for contextual and flexible adaptation learning. This confirms McKeown and Hopkins's (2010) open acknowledgement that climate change education varies from one geographical area to another, depending on local ecological, social and economic challenges. From this, we can also see that we cannot effectively plan such programmes independently of the lived experiences of people.

Health

From Table 3 (see also Figure 1), it can be seen that health-based educational issues and topics were also deemed to be relevant in a broader portfolio of adaptation learning. Health education involves communication designed to improve health literacy and personal hygiene, and to develop life skills that are conducive to community and environmental health (UNESCO, 2009). Respondents noted that climate change has a propensity to expedite the spread of diseases. They therefore deemed health-related topics and issues such as waste management, good practices regarding malaria prevention, personal hygiene and sanitation to be contextually

relevant in learning for adaptation. This resonates with Namafe (2009), CARE (2012) and Tanner, Lockwood and Seballos (2012) that climate change education should respond to societal needs and should not only focus on the science of climate change. However, as shown in the section on perceptions of causes and effects, there is a need to support communities to develop accurate understandings of the causes of climate change and its potential effects so that their responses can be practised with understanding.

Culture

Culture-related priority issues and topics such as morality, traditional values, anthropology and beer drinking (shown in Table 3 and in Figure 1) were also deemed to be contextually relevant in learning for adaptation. The exact relationship between such moral issues (e.g. beer drinking or women's dress practices) and climate change would need to be probed in greater depth, as some perceptions may be founded on inaccuracies or misperceptions. However, intercultural learning is crucial in the face of climate change, especially in view of the fact that, in future, climate change may lead to an increase in the number of environmental refugees. It is therefore very important to learn about intercultural values, competences and sensitivity. Rather than simply dismissing responses as inaccurate, they should be carefully probed with participants in order to explore their meaning and logic and so establish the validity of the responses in relation to wider knowledge. This, however, does not mean that all responses should be accepted as 'correct' or 'accurate' (e.g. women wearing trousers has nothing to do with the causes of climate change).

McKeown and Hopkins (2010) propose that behavioural change is key in climate change education. Behavioural and social change are arguably related to moral concerns. Moral-oriented education for adaptation can indeed develop people's moral obligation and sharpen their inner potential to do the right thing so as to reverse environmental changes. Although the beer-drinking issue may be too trivial in some contexts to be incorporated into learning for adaptation, it was locally deemed to be relevant in adaptation learning, and there may therefore be a need to 'follow the logic' of the respondents before simply dismissing the response as being trivial. Namafe (2006), for example, argues against a parochial adherence to one perspective of beer drinking, because it has both destructive and constructive sides. Through beer-drinking education for adaptation, communities could, for example, learn how to sustainably make use of beer to partly adapt to climate change-related psychological and socio-economic stresses and how to avoid overindulgent use. The two *field voices* recorded below justify the need for engaging with beer-related issues in climate change education.

> *Kuno kumankara manzi yambiri chifukwa mvula iloka manyingi. Nthawi zina, bantu ba mooba bamamwena mumanzi.* (We experience a lot of floods because of heavy rainfall. Sometimes people who drink beer drown in flood waters. – Respondent, Kalikiliki Compound, Lusaka District)

Sitingalime chifukwa mvula siiloka mushe. Zuba yachilamo kupya na vakudya sifikula. Apa nikumwa chabe mooba kwasila, tilibe chochita. (We cannot farm because of inadequate rainfall. There is intense heat, and crops are stunted. So we will just be drinking beer, because we have nothing to do. – Respondent, Kafue District)

Scope of education and training

Based on respondents' experiences, the *scope of education and training* for climate change adaptation should includes priority issues and topics such as adult and civic education, life skills and literacy education, entrepreneurship, as well as early childhood education. Teaching climate change adaptation especially to adult members of communities requires a careful application of adult- and civic-learning theories and principles (i.e. behaviourism and social constructivism), otherwise it will not be an easy task to change them from their conservative, yet unsustainable, practices to more sustainable ones. Moreover, observed misconceptions about climate change as reported on above require literacy to create an accurate awareness of climate change. Given the stochastic nature of climate change, learning to adapt to it requires alternative life skills such as entrepreneurship that can reduce overdependency on climate-sensitive agricultural activities. This entails a reflexive way of being and of doing things that would possibly be different from the way in which things were done before the advent of climate change (Lotz-Sisitka, 2010).

Newly emerged subfields of education

Among recently emerged subfields of education are education for sustainable development (ESD), environmental education (EE) and climate change education (CCE). ESD is a form of education that aims at educating a person to adopt a sustainable type of thinking, a skilful way of being and of doing things, and to be one with a deep sense of social issues and with moral–ethical values (McDonald, 2008). The deep meaning of ESD is the reason why McKeown and Hopkins (2010), UNESCO (2013), Lenglet (2009), and others propose an ESD framework for climate change education. Unfortunately, in the case of the present research, ESD as a pertinent pathway to adaptation found popularity only in Mphuka Village of Luangwa District. Nevertheless, and as noted above, the educational themes and topics discussed above, as well as the forms of education, are inherently linked to ESD. *EE* for climate change adaptation was also deemed to be contextually relevant. EE and ESD are inextricably linked, as ESD emerged from the field of EE. Further, EE has also reoriented within a stronger focus on sustainability; ESD and EE are thus similar in many respects. Given their systematic and systemic nature, they are able to create a common interface among different fields of education, which leads to *quality learning in diversity* for adaptation. As shown in Table 3, some responses show that CCE should be just one of the components of learning for adaptation. However, everything that has been discussed above can be seen to involve processes of CCE that are a relevant part of ESD and/or EE if viewed within a broader sustainable development framework as has been the case in southern Africa. Figure 1 shows a model of CCE as developed in and through the present research.

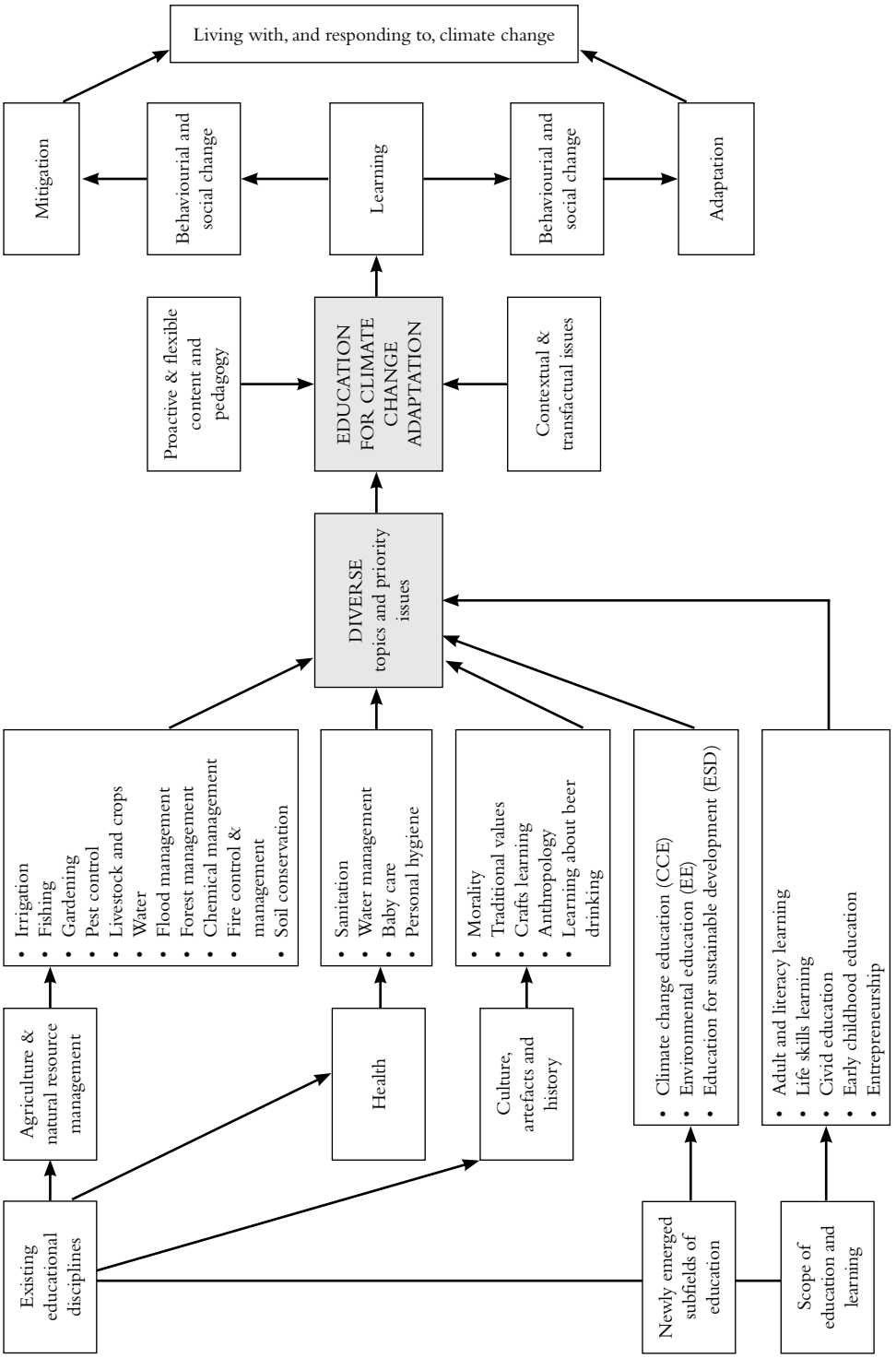

Figure 1. Proposed framework of learning for climate change adaptation among selected communities in Lusaka Province

(Source: Field data, 2011)

Conclusion

This article has shown that climate change cannot be understood from a linear perspective, because there are diverse ways in which people understand it, depending on their social *contexts*. It has also been noted that CCE may mean different things, depending on how climate change affects different communities, and depending on their prior knowledge and perceptions of climate change. Drawing knowledge for CCE from *diverse cross-disciplines* in order to contextualise such knowledge in diverse contexts of climate change causes and effects may help to frame educational responses that can lead to behavioural and social change and to the application of collaborative social-learning processes that are critical, analytical and capable of enhancing *foundational*, *functional* and *reflexive competences* that would nurture best thinking and practices for adaptation.

As shown in this research, CCE, especially at community level, should consider the diverse views and perspectives of communities regarding the causes, effects and possible educational responses. It should also draw on knowledge from *diverse* and *cross-disciplines* in order to address misconceptions effectively and enrich learners' capabilities and adaptive capacities. It should focus not only on climate change *factuality* (empirically testable facts), but also on *transfactuality* (true facts, though not testable). Given the stochastic nature of climate change, CCE should also be premised on topical and pedagogical *flexibility* in order to address the ever-changing landscape of climate change issues. CCE needs to be *proactive* rather than *reactive*. As demonstrated in Figure 1, diverse forms of knowledge need to be engaged in and through diverse learning programmes so as to individually and socially prepare people to live with and adapt to some of the more *certain* and some of the more *uncertain* effects of climate change. *Contextual relevance* is also crucial in CCE because of the multiple impacts of climate change on diverse scales and levels.

And, finally, as shown in this research, it may not be fully feasible to accept a constructivist *ontology* as the foundation for CCE and/or research, as the constituents and effects of climate change (e.g. climate variation and climatic cycles, droughts, cyclones, floods, etc.) are real phenomena and *do* exist (outside of our knowledge and/or experiences of them even). They are in themselves therefore not completely socially constructed; but *our perceptions and knowledge of them are*. As shown in this research, such perceptions and knowledge are not always gained through immediate experience (as shown by the listing of tsunamis as an effect of climate change – these have not occurred in Zambia, but they have occurred elsewhere, and, probably via the media, Zambian respondents were able to construct this response). Thus, one may rather suggest that it is possible to accept a constructivist *epistemology* in CCE and research, combined with a more realist (if still fallible) *ontology*. This may also help to establish what are misconceptions as reflected in perceptions (e.g. there is very little truth in seeing women from Monze as a cause of climate change). Accepting this would be inaccurate and would have the negative consequence of seeding dystopia and discrimination against women from Monze. Thus, the educator, too, has an ethical–moral responsibility to correct such misconceptions in CCE settings, whilst recognising that views *are* socially constructed and need to be carefully analysed and culturally and socially understood (as discussed in the case of beer drinking and climate change). While views are, importantly, socially constructed and can be usefully

read through hermeneutical lenses, not all views are equally valid in a given situation or knowledge context. Factuality (e.g. there are well-established, known causes of climate change), combined with transfactuality and in-depth analysis of social constructions, can help with such interpretations, as also shown in this research.

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Developing Capability and Agency through a Poverty-reduction Approach to Community Education and Sustainability in Botswana

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Abstract

Women in the Tswapong Region of Botswana depend on natural resources for their livelihood. These resources are seasonal and are often affected by unreliable rainfall patterns. Botswana government policies create sustainable, natural resource management opportunities. This article is based on research investigating how women in rural communities, and in the specific context of the Kgetsi-ya-Tsie (a community trust), who are dependent on arable agriculture and on natural resources are making an effort to reduce poverty. The research also sought to understand what constitutes quality and relevant education for the promotion of sustainable development in such a context. The research examined how women in the eastern part of Botswana exploit natural resources for subsistence and commercial reasons. It also examined the different skills employed by women to cope with economic and social challenges and to promote sustainability. Furthermore, the research explored the women's/communities' conceptions of quality and relevant adult education, capabilities, agency, and adult-education pedagogies in order to promote social change relating to poverty-reduction strategies among rural women. Data for this article was generated through a questionnaire, a research schedule, focus-group discussions, document analyses, interviews and observation. The results of this research show that the benefits of promoting social change relating to poverty-reduction strategies are increasing annually, although some challenges are reducing the enthusiasm of some members of Kgetsi-ya-Tsie. During the research, it emerged that the knowledge that is shared and learnt in communities of practice is social capital. Women connect at various levels, without the constraints of a formal structure, in order to acquire skills that enable them to be more resilient to environmental and economic challenges. They share their expertise and experiences, and they learn from one another through different ways of solving the problems they face, developing new capabilities, leveraging best practices, standardising practices, and increasing their talents. Poverty reduction requires multifaceted approaches by those affected and by government institutions offering opportunities for assistance. However, what has not emerged clearly from this ongoing research is how power is distributed among women in relation to strategies for coping with poverty and organisational practices.

Introduction

Discourses on gender issues and natural resource utilisation for sustainable development are topical issues that cannot be avoided. For instance, it is stated that, wherever poverty occurs, statistics indicate that women are more likely than men to be poor (UN, 2013:1). Consequently, the Botswana government has introduced several policies and projects to empower women to participate in economic activities that could reduce, if not eliminate, poverty among women,

particularly poor, women-headed households. Women, especially poor women, are often blamed for degrading the environment in trying to make a living from the available natural resources. Recognising this, the government of Botswana has initiated the formation of community-based organisations (CBOs) through the Community Based Natural Resources Management Policy (CBNRMP) (Republic of Botswana, 2007). The CBNRMP promotes sustainable utilisation of natural resources. The Policy encourages local communities to participate in natural resource management. In response to this Policy, women from 26 villages in the Tswapong area have formed a community-based trust to sustainably manage natural resources within their area. The Trust, known as *Kgetsi-ya-Tsie*, is a women's CBO involved in the management of natural resources. The name '*Kgetsi-ya-Tsie*' is derived from a Setswana proverb, which reads: *Kgetsi ya tsie e kgonwa ke go tshwaraganelwa*. Translated, this means: 'If we are united we can succeed.' The purpose of the Trust is to assist rural women to empower themselves, both socially and economically, by more effectively organising their entrepreneurial activities through the sustainable management of natural resources (KyT, 2009). The present study thus elucidates the role of women, as well as their participation and self-empowerment through social learning, in reducing poverty among themselves and promoting sustainable development.

Contextual Background

The research discussed in the present article forms part of a research programme on education for sustainable development (ESD) and on education quality and relevance initiated and supported by the Southern African Development Community Regional Environmental Education Programme (SADC-REEP). The research programme involved ten universities/higher-education institutions across SADC countries. The aim of the research programme was to investigate the relationship between ESD and education quality and relevance. Its broad research question was: How can SADC education systems respond to contexts of risk and vulnerability, and mobilise opportunities for agency and social change? Underpinning the research programme was Education for All Goal 2 in respect of education quality (UNESCO, 2000) and Millennium Development Goal 7 (UN, 2005) in respect of ecological sustainability. SADC-REEP supported the research programme through seed funds and encouraged institutions to sustain the research initiatives within the constraints of their own financial and budgetary limits. The research programme also addresses the environmental and human-resource goals of the SADC Regional Indicative Strategic Development Plan (SADC, 2003), and aims to inform efforts at mainstreaming environmental and sustainability issues into education systems during the UN Decade of Education for Sustainable Development and beyond. Higher-education institutions were at liberty to choose their focus within the broad aim of the research programme, and the University of Botswana chose to research 'Developing Capability and Agency through a Poverty-reduction Approach to Sustainability in Botswana'.

The context of Botswana

Over 70% of Botswana's population lives in the rural areas. The majority of these people are women who are predominantly subsistence farmers. They derive their livelihood from

subsistence agriculture and other rural activities, but these livelihood sources, as is the case in most parts of the developing world, are never adequate and are threatened by high demand and by climate change and variation. The agricultural sector's reliance on seasonal, rain-fed cultivation makes the sector particularly vulnerable to climate variability and change; hence these rural people are threatened by poverty. Botswana is prone to droughts, which have become more frequent over the last two decades, with devastating impacts on food security, health and environmental degradation. The Second National Communication to the United Nations Framework Convention on Climate Change for Botswana (Republic of Botswana, 2011) recognised the country's high levels of vulnerability to climate change, noting that this was due to the variable nature of the country's rainfall frequency and amount. In many rural areas, such as the Tswapong Region, rural women are poor and depend on agriculture and natural resources for their livelihoods.

National policies

To encourage sustainable utilisation of natural resources, the government of Botswana has initiated the formation of CBOs through the CBNRM of 2007. The Policy encourages local communities to participate in natural resource management. Further, it gives 'communities incentives to engage in conservation activities leading to sustainable development and poverty reduction' (Republic of Botswana, 2007:2). Other policy documents linked to natural resource management and poverty reduction are the National Tourism Policy (Republic of Botswana, 1996), the Ecotourism Strategy (Republic of Botswana, 2002a) and the National Poverty Reduction Strategy (Republic of Botswana, 2003a). These national policies guide and facilitate the coordination of various poverty-related efforts by the various government sectors. They encompass cost-effective interventions and time-bound objectives and targets, which are gender- and health-sensitive, environmentally friendly and sustainable. The National Poverty Reduction Strategy is integrated into district and national development plans. Moreover, to promote literacy, the government has introduced a free Adult Literacy Programme. The majority of the beneficiaries of the Adult Literacy Programme are women in the rural areas.

Poverty continues to be one of the major challenges facing Botswana. 'According to Vision 2016, Botswana will have eradicated absolute poverty by the year 2016, so that no part of the country will have people living with incomes below the national poverty datum line' (Republic of Botswana, 2003b:63). The Botswana government had managed to reduce poverty from 47% of the population in 1993/1994 to about 30% by 2010. However, 22% of the remaining poor people experienced food shortages (Makgabenyana, 2010).

Response to resource-utilisation policies: The case of Kgetsi-ya-Tsie

In response to national policies, a collective of women from 26 villages in the Tswapong Region formed a community-based trust known as *Kgetsi-ya-Tsie* in 1997 in order to sustainably manage natural resources within their area. Its purpose is to assist rural women to empower themselves, both socially and economically, by more effectively organising their entrepreneurial activities through the sustainable management of natural resources (KyT, 2009). *Kgetsi-ya-Tsie* works with over 1 200 women in the region to produce business

products (such as marula oil) from natural resources in their area. The Trust started with small, five-person resource user groups in nine villages, which grew to 26 villages federating their groups into 32 local village centres. Finally, these centres registered as a grassroots community trust in 1999 (KyT, 2009).

Kgetsi-ya-Tsie operates a microloan scheme, the default rate of which is very low owing largely to the strong social structure of the groups, which take collective responsibility for individual loans. The groups have set up a factory in the village of Lerala, the main activity of which is the production of marula oil and soap. These new skincare products have remarkable health and nutritional properties and are produced to very high quality standards. The Trust empowers its membership through training workshops and seminars. In addition, it operates grant and insurance schemes for its members.

Conceptual Framework

This research explored concepts such as human capabilities, human agency, and community of practice, each of which is introduced below.

Human capabilities

As described by Sen (1999) and applied to the context of this research, the concept denotes sufficient, basic human capabilities such as education and good health to be able to escape from poverty. The research deployed Sen's capability approach. According to Walker (2005:103), the concept refers to 'what people are actually able to be and do, rather than to what resources they have access to. It focuses on developing people's capability to choose a life that they have reason to value.' In addition, the research explored 'opportunities to develop capabilities and the process of deciding collectively on valuable capabilities' (Walker, 2005:104) in educational contexts. It focused on lived capabilities at the level of everyday life in the context of natural resource management and climate change in Botswana. For Walker (2005), the capability approach provides analytical tools to examine what individuals are able to do, and why they value what they do, that is, it emphasises reflective and informed choices by individuals as well as the evaluation of people's agency and freedom in doing things they have reason to value. The research investigated *Kgetsi-ya-Tsie*'s capabilities and freedom to achieve poverty reduction through natural resource management projects and entrepreneurial activities. In other words, do those concerned 'have the freedom to achieve these …, to live one kind of life, rather than another, to have real opportunity to accomplish what we value' (Walker, 2005:104).

Human agency

The concept of human agency was explored alongside the human capability approach. As Walker (2005:106) puts it: Notions of agency are central to the capability approach. At the boundary of [functioning] and capabilities is the matter of choice, where a person exercises his or her agency, having the requisite set of capabilities, to make choices from a range of options and alternatives, if such a choice achieves his or her well-being. By human agency, Sen means 'someone who acts and brings about change, and whose achievements are to be judged in terms

of her own values and objectives, whether or not we assess them in terms of some external criteria as well' (1999:19). Agency is one's ability to pursue goals that one values. Agency and well-being are then deeply connected.

Walker (2005:108) continues by positing that 'human agency is [about] having the capacity to make informed and reflexive choices'. The present research explored ways in which quality education could play a role in developing and expanding capabilities, for instance with regard to entrepreneurial skills or/and in expanding the opportunities of women through their acquisition of basic skills, thereby making it possible to develop abilities and achieve success in a range of sustainable business possibilities. '[Human] agency is the individual capacity to act otherwise' (Barnes, 2001:249).

Community of practice

This research project also explored the concept of community of practice (often abbreviated as 'CoP') among women in the rural area of Tswapong Hills in Botswana. The concept refers to the process of social learning that occurs and to shared sociocultural practices that emerge and evolve when people who have common goals interact as they strive towards those goals. The rural women who have formed the CBO, *Kgetsi-ya-Tsie*, in order to utilise natural resource products for both subsistence and commercial purposes, represent such a CoP. They informally acquired skills to identify, harvest or collect and process the natural products. The *Kgetsi-ya-Tsie* members are a community 'of practitioners into which newcomers … enter and attempt to acquire the socio-cultural practices of the community' (Lave & Wenger, 1991:8). Lave and Wenger (1991) go on to explain that 'Community of Practice has become associated with knowledge management as people have begun to see it as a way of developing social capital, nurturing new knowledge, stimulating innovation, or sharing existing tacit knowledge within an organisation' (Lave & Wenger, 1991:8).

Lave and Wenger (1991) describe CoPs in terms of the interplay of four fundamental dualities: participation versus reification, designed versus emergent, identification versus negotiability, and local versus global – although, perhaps because of the possible link to knowledge management, the participation versus reification duality has been the focus of most interest. For Wenger, learning is central to human identity. A primary focus of Wenger's work is on learning as social participation, that is, on the individual as an active participant in the practices of social communities, and in the construction of his or her identity through these communities. From this understanding, the concept of the CoP develops: that is, of 'a group of individuals participating in communal activity, and experiencing/continuously creating their shared identity through engaging in and contributing to the practices of their communities' (Lave & Wenger, 1991). The benefits that CoPs claim as part of a knowledge management programme have led them to become the focus of much attention. Earlier approaches to knowledge management treated knowledge as an object (explicit knowledge). However, the CoP approach offers a way to theorise tacit knowledge which cannot easily be captured, codified and stored. The knowledge that is shared and learnt in a CoP amounts to social capital. People connect at various levels without the constraints of a formal structure. As people connect with one another, they are able to share their expertise and to learn from one another.

The benefits of this interaction include problem solving, developing new capabilities, leveraging best practices, standardising practices, and avoiding mistakes (Lave & Wenger, 1991).

Statement of the Problem, Rationale and Objectives

Rationale for the research

Women in the research sample collect natural products, some of which they process and sell to the *Kgetsi-ya-Tsie* Trust. Those products that they cannot process themselves, they sell to the Trust unprocessed. The Trust processes and sells these natural products, together with those that it buys from members already processed. Some of these products are sold to local markets in Botswana, and others to international markets. This research investigated the benefits that members of *Kgetsi-ya-Tsie* derive from their membership, their coping strategies in the face of economic challenges and climate change, and the knowledge gained from the training provided by the Trust as well as the knowledge acquired from their peers through social learning.

Research objectives

The following objectives guided the research:

1. To examine capabilities, agency and CoP concepts among the membership of the *Kgetsi-ya-Tsie* Trust and their coping strategies in the face of poverty and climate change; and
2. To investigate the methods through which they acquire knowledge and skills with respect to the processing of natural resources and in respect of entrepreneurship.

Methodology

Research design

This was a qualitative study following a broadly interpretative approach in order to explore issues of capability, agency, CoP and social learning. Methods of enquiry used included: a questionnaire, a research schedule, focus-group discussions, interviews, observation, and document analysis.

A semi-structured questionnaire was used to generate data among *Kgetsi-ya-Tsie* members on their capabilities, on their views on knowledge, quality education and different ways of knowing, and on the sustainability of natural resources that are the sources of their livelihood. The questionnaire was distributed to those who were literate, while those who were not literate were assisted by research assistants to answer the questions. A research interview schedule was used to generate data among *Kgetsi-ya-Tsie* leaders, such as the coordinator and the centre champions, that would otherwise not have been generated through a semi-structured questionnaire. The research interview data was used to triangulate data that had been generated through the questionnaires and focus-group discussions. The schedule, with a list of questions, allowed probing so as to gain a deeper understanding of the issues raised.

Focus-group discussions were another data-generating technique employed in this research. The purpose of using focus groups was to generate collective views on the uses of particular

natural resources and on the benefits derived from being members of *Kgetsi-ya-Tsie*. This technique assisted the researchers to triangulate data obtained through individual interviews, semi-structured questionnaires and observation (Cohen, Manion & Morrison, 2011). Focus-group discussions were organised and arranged at *Kgetsi-ya-Tsie* centres and villages for members. The discussions focused on the research questions.

Interviews were conducted with individual and group members and with the *Kgetsi-ya-Tsie* project coordinator. The focus of the interviews was to gain an understanding of the Trust profile, of the different natural resources collected and used, of the challenges, and of the benefits and skills acquired. The interview questions were open-ended to allow respondents to provide information that they had, and to allow probing. In addition, non-participant observations were made at the *Kgetsi-ya-Tsie* factory, during meetings, and in the field where raw materials are collected from the veld. The purpose of the observations was to confirm what was obtained from the interviews and document analysis, as well as to discover any other insights and experiences that might not have emerged through either the interviews or the document analysis.

According to Kumar (1999:105):

> Observation is one way to collect primary data. Observation is a purposeful, systematic and selective way of watching and listening to an interaction or phenomenon as it takes place. … It is also appropriate in situations where full and/or accurate information cannot be elicited by questioning, because respondents either are not co-operative or are unaware of the answers because it is difficult for them to detach themselves from the interaction. In summary, when you are more interested in the behaviour than in the perceptions of individuals, or when subjects are so involved in the interaction that they are unable to provide objective information about it, observation is the best approach to collect the required information.

The final data-generation technique was document analysis. The documents analysed included government policies, the *Kgetsi-ya-Tsie* constitution and promotional material, and project proposals. This was done to gain a thorough understanding of *Kgetsi-ya-Tsie*'s historical background and of how it is progressing in the context of rural women's role in the utilisation of natural resources to reduce poverty. Document analyses also assisted in the investigation of the sources (inventory) of raw materials, where they are found, and to where they are transported and sold.

Ethical issues

Ethical issues were considered in this research in order to deal with the dilemma of striking a balance between the role of a researcher and the rights and values of the research participants or respondents. Gaining access to *Kgetsi-ya-Tsie* and its centres was negotiated with the relevant authorities. All ethical questions were properly addressed and considered before and during data generation and collection 'by seeking [the] subject's agreement to be interviewed and quoted, negotiating release of transcripts, etc.' (Gough, 2003:3). Prior to data collection, participants

were briefed on the purpose of the research and on their rights as participants in the research. This was done to ensure that there was informed consent, a free choice to take part, and to place some form of responsibility on the participants with regard to the answers they would be giving (Cohen, Manion & Morrison, 2000; Bell, 1999). As De Vos, Strydom, Fouche, Poggenpoel, Schurink and Schurink (1998:23) put it, 'the final responsibility for the ethical conduct rests squarely with the researcher concerned'.

The researchers avoided violation of privacy by acting with the necessary sensitivity where privacy of the subjects was relevant and by respecting anonymity and the confidentiality of the information provided on, or by, respondents. Particular attention was paid to this when probing 'sensitive and personal information from subjects' (De Vos *et al.*, 1998:25) in order to avoid exposing respondents to the possibility of emotional harm. In analysing data, care was taken to avoid betrayal or breach of trust. Letters of appreciation were written to all those who provided information by completing the questionnaire and to those who facilitated access to institutions.

Ethical issues were also considered in questionnaire administration. Participants were given an explanation of the purpose of the questionnaire. They were also given the opportunity to remain anonymous if so they wished. This was done to allow them to provide information freely and also to give informed consent. In the final analysis and writing up of this research, the respondents' names were removed from the text for ethical reasons. According to May (2001:60), 'informed consent' refers to:

> … freely given agreement on the part of the researched to become a subject of the research process. However, this is not only based on a complete understanding of the aims and processes of the research itself, but also may assume to encompass any consequences that follow from its publication in the public domain. A researcher might, and in many cases ought to take all possible steps to protect the identity of any person in the anticipation of any information being used for purposes other than those intended.

The respondents were given due recognition in the acknowledgements section of the research report without mentioning their names and without linking them to the data they provided.

Research sites and respondents

The research was conducted in 14 out of a total of 26 villages. The findings were based on data generated from 87 participants from 21 centres. *Kgetsi-ya-Tsie* had a total of 42 centres in 26 villages. It emerged that some of the village centres had collapsed, as some members were no longer active or were engaged in small-scale entrepreneurial activities. Their inactivity was attributed to a number of factors such as securing permanent jobs or migration to other areas such as towns in search of employment. Moreover, some were discouraged by the low prices offered by individual buyers locally and on external markets for the produce they were selling. Some former members preferred to sell independently and therefore left *Kgetsi-ya-Tsie*.

Research Findings

Changes in natural resource harvesting

The respondents agreed that natural resources were no longer as abundant as they used to be owing to climate change and variability. However, some claimed that the resources were still abundant, although they acknowledged that low rainfall and high temperatures affected yields of the natural products. Women blamed occasional droughts and low rainfall for the low yields. Other factors contributing to the threat to the abundance of the resources were: 'no more rain [as] in the past'; 'poor harvesting methods such as uprooting some herbal plants'; 'young women uproot some herbal plants such as *galalatshwene* [resurrection plant]'; and 'overharvesting of the resources by traditional doctors and herbalists'. They also blamed low yields of natural products on high demand by the market and stated: 'Not only *Kgetsi-ya-Tsie* members harvest the natural resources but even individuals are free to harvest and sell.' Women normally gather, collect or harvest natural resources in winter when plants are dry. In summer and autumn, they collect *phane* (caterpillars). *Monepenepe* (*Cassia abbreviata*) and Tswapong sand and clay are collected throughout the year, while marula (*Sclerocarya birrea subsp. Caffra*) is collected in the autumn.

Benefits for *Kgetsi-ya-Tsie* members

In terms of benefits from their Trust, women have acquired some skills that assist them in adapting to harsh economic and climatic conditions. Through training, members of *Kgetsi-ya-Tsie* have acquired various skills, which include making jam from marula fruit and *lerotse* (cultivated melons). Members are also trained in how to manage the small businesses that they own, most of which have been set up with the money they earn from selling natural products and resources to *Kgetsi-ya-Tsie* and from the money they are given as grants and loans by *Kgetsi-ya-Tsie*. To generate an income, the produce made from marula fruit and melons is sold and consumed locally or is exported.

Strategies for coping with the supply of natural resources

To improve their capabilities and agency, members of *Kgetsi-ya-Tsie* Trust have adopted several coping strategies to deal with the dwindling supply of natural resources, strategies which include the following:

1. Women use natural products that require very little rainfall, for example *galalatshwene* (*Myrothamnus flabellifolius*, known as the 'resurrection plant'), *monepenepe* (*Cassia abbreviata*) and *mosata* (a wild vegetable). The marula tree often withstands drought, but, during such times, it produces poor fruit which is often dry. Such fruit produces poor products when processed. The uses to which these products are put have been learnt in an informal setting and have been passed on from one generation to the next. To deal with the declining supply of these products, women have acquired knowledge of processing and preserving the products, for instance by sun-drying *monepenepe* (*Cassia abbreviata*, a herbal product) and wild vegetables. Through knowledge acquired from training workshops, *Kgetsi-ya-Tsie* products are now packaged for sale.

2. They grow and sell vegetables using a government scheme for poverty alleviation which encourages development of backyard gardens. They acquire vegetable-growing skills from workshops and by observing other members who started backyard-gardening earlier. The backyard gardens assist in providing food security and nutrition, thereby contributing to poverty reduction.
3. Women engage in recycling projects such as making plastic mats for sale. The recycling skills are acquired through workshops and social interaction.
4. Some members resort to ploughing their fields as a livelihood alternative, although they obtain low yields owing to poor rains. This helps *Kgetsi-ya-Tsie* members to cope with the impact of climate variability as well as to reduce poverty.
5. They operate tuck shops, selling a variety of products, including fat cakes. By engaging in different economic activities, they diversify their sources of livelihood, thereby reducing their impact on natural resources. Some have actually graduated from being destitute and have ceased to depend on gathering and collecting natural produce for sale, as it has proved to be more rewarding to operate tuck shops and utilise some entrepreneurial skills which are more sustainable.

Women's coping strategies have been acquired both informally through social learning and through non-formal training organised by *Kgetsi-ya-Tsie*.

Agency and social learning

Human agency is emerging through social interaction to make *Kgetsi-ya-Tsie* structures more productive and empowering, thereby promoting adaptation and sustainability practices. *Kgetsi-ya-Tsie* members as a community of practitioners collectively act to sustain the supply of natural resources and, through formal and informal training, empower individuals to act independently to promote sustainability in the face of poverty and climate variability. Through the returns from sales of natural products and through appreciation of their indigenous knowledge and normalised new ideas, people develop capabilities 'to value their new doings and beings that make up the adaptation and/or sustainability practices' (Lotz-Sisitka 2009:87). *Kgetsi-ya-Tsie* members have, individually and collectively, developed the ability to define their own goals and act on them. Kabeer, as cited by Lotz-Sisitka (2009:87), states:

> Agency is about more than observable action; it also encompasses the meanings, motivation and purpose which individuals bring to their activity, their sense of agency, or 'the power within'. While agency tends to be operationalised as 'decision-making' in the social science literature, it can take a number of other forms. It can take [the] form of bargaining and negotiation, deception and manipulation, subversion and resistance, as well as more intangible, cognitive processes of reflection and analysis. It can be exercised by individuals as well as by collectivities.

Through social interaction, communities of practitioners can exercise their power within their own context as a response to policy changes and the impact of poverty and climate variability.

They can resist some of the policy initiatives that are meant to encourage adaptation if, in terms of their understanding, their immediate needs are not addressed. *Kgetsi-ya-Tsie* members have accepted national policies aimed at assisting them to cope with harsh conditions such as poverty and climate change, as these policies have proved to be of direct benefit to them. Change-oriented practices or innovations should be promoted through social interaction such as that practised by *Kgetsi-ya-Tsie*. A systemic approach to innovation could facilitate a process of capability development and motivate people to participate in change-oriented practices in the context of poverty reduction and sustainable development.

It has emerged that there is a CoP (Lave & Wenger, 1991) among women in the Kgetsi-ya-Tsie project; they share views and dynamics of learning within the community. There are also common capabilities and agency amongst practitioners in order to reduce poverty and its challenges. The knowledge that is shared and learnt in the CoPs is their social capital. Women connect at various levels without the constraints of a formal structure so as to acquire skills that enable them to be more resilient to poverty challenges in the face of climate change. They share their expertise and experiences, and, from one another, they learn different ways of solving their problems, in the process developing new capabilities, leveraging best practices, standardising practices, and increasing their talents through social learning.

Social learning (Glasser, 2007) involves gaining knowledge and understanding through experiences/interactions. This is a typical process that occurs in rural African societies. Through less formal ways, communities interact and, in the process, share knowledge about farming, hunting, gathering and/or the uses of natural resources. Learning occurs because the community of practitioners meets regularly, both informally and formally. It is through these regular interactions that knowledge about natural resource use and conservation is gained and that new experiences are shared. Women who are members of *Kgetsi-ya-Tsie* utilise such informal interactions to enhance their understanding of natural resource use and economic diversification in the face of poverty and climate variability. The basis of policy change in order to promote poverty eradication and sustainability should be the knowledge generated through social interaction and the acquisition of knowledge from one another.

It emerged from the research that *Kgetsi-ya-Tsie* members felt that most of them had learnt about natural resources and their uses through socialisation. Some respondents said they had learnt about natural resources from their parents. However, a few of them said that they had learnt about these resources from the training provided by *Kgetsi-ya-Tsie*. Some respondents claimed that they had acquired the knowledge from other women (their peers). It is clear from the responses that women learnt about natural resources and their uses through social learning, either at home or through regular interaction as members of *Kgetsi-ya-Tsie*. Most of the members learnt about the commercial uses of the natural products from *Kgetsi-ya-Tsie*. They acquired new knowledge on recycling of products for sale through *Kgetsi-ya-Tsie*-organised meetings and training. They also learnt about new technologies through regular interactions. New knowledge acquired through social interaction assisted in adding value to the natural products and enabled members to reach distant markets for products.

Members of *Kgetsi-ya-Tsie* acquired various skills through social learning, which included making jam from marula fruit and *lerotse* (melons). Members are also trained on how to manage

the small businesses that they own, most of which are set up with the money they earn from selling natural products to *Kgetsi-ya-Tsie* and from the money they are given as grants by *Kgetsi-ya-Tsie* and donor agencies.

The *Kgetsi-ya-Tsie* women have become a CoP through their informal and formal interactions, as well as by sharing both indigenous knowledge (IK) and new knowledge on the use of natural resources. They learn in different ways through knowledge-sharing and intergenerational knowledge transfer processes. Contextual profiling of *Kgetsi-ya-Tsie* has indicated that the majority of a practitioner's knowledge about different natural products and their uses has been passed down through the generations. One practitioner noted: 'I was taught by my parents. My father was a traditional doctor and taught me [about] some medicinal plants and herbs. I now teach my children about these veld products.' The respondent was not a registered herbalist herself, but would prescribe herbs for those who informally consulted her. Interestingly, women learnt about the resources from their close interaction with their parents. In addition, some learnt about them informally from their peers.

Kgetsi-ya-Tsie admits young women who may have missed the opportunity to learn about the uses of the natural resources from their parents. These young practitioners acquire knowledge about natural resources and their uses in formal workshops. The resource persons are knowledgeable elderly women within the groups. However, in matters pertaining to uses of modern technology, business skills, policy and policy implementation, the resource persons come from outside the groups. Following the formal workshops, women teach one another at their respective centres. They meet at least once a month to share experiences and new ideas and to solve some problems.

Interpretation of the Findings

Kgetsi-ya-Tsie is contributing to resilience-building among its members. The Trust aims to help rural Botswana women reduce poverty among themselves through the use of natural resources. Further, it encourages the development of entrepreneurial skills among members and assists them to start small-scale businesses. Through *Kgetsi-ya-Tsie*'s training programmes and monetary donations, most of its members are benefiting from the sale of natural resources and from seed funding for their businesses. The Trust also encourages members to diversify their economic activities in the face of challenging economic and socio-ecological conditions. Women are encouraged to use forest products sustainably for commercial purposes, particularly during drought seasons. Through the use of government schemes and subsistence agriculture, *Kgetsi-ya-Tsie* encourages its members to process some of the crops for preservation, storage and/or sale. This enables women to reduce poverty and the adverse impacts of climate change and its variability. The Trust is also involved in health and vulnerability issues and in keeping the environment clean, and it encourages healthy eating through backyard-gardening. Members are also encouraged to use the produce to improve their diet and to sell surplus vegetables, jam and marula oil. One of the respondents stated: 'We are encouraged to make gardens in our homesteads so that we eat nutritious food.' In addition, members are encouraged to test for HIV/AIDS and to inform the public about diseases such as hypertension. These are positive initiatives that build resilience to socio-ecological challenges.

The research indicated that *Kgetsi-ya-Tsie* women are using social networks and family ties, particularly social-learning processes, to underpin traditional knowledge systems and so enhance practices that are resilient to climate change. This could be knowledge about edible wild vegetables, medicinal and herbal plants, and/or sustainable ways of collecting and gathering them. Traditional knowledge also includes predicting weather conditions, which informs household planning. These predictions may lead either to the use of seeds for early maturing crops or to storing and preserving the harvest so that it lasts longer. Livelihood strategies include dependence on wild food that survives in poor climatic conditions. Social networks and *Kgetsi-ya-Tsie* enhance the reduction in vulnerability, which, in turn, enhances adaptation capacity.

Women also use the barter system to acquire what they do not have in exchange for what they themselves do have (or produce). In addition, they use alternative schemes, such as backyard-gardening and poultry farming. These enable them to survive the harsh climatic conditions that are not suitable for traditional agricultural practices. Some are making profits and are saving as a result of non-agricultural activities such as the operation of tuck-shop businesses, or the sale of products made from recycled material. Others are also reducing their dependence on natural products, thereby not only becoming more resilient, but also promoting the sustainability of natural resources. Diversifying livelihoods in the face of ecological challenges assists in spreading the risks and reducing poverty-related impacts.

An analysis of data collected from among 87 women of the *Kgetsi-ya-Tsie* indicates that some women have adjusted their livelihood practices to cope with economic and socio-ecological challenges. Some of them alternate economic activities throughout the year as a strategy to avoid the adverse impact of poverty. In farming, they have resorted to drought-tolerant (resistant) local crops such as water melons and millet, avoiding the hybrid seeds that, though maturing within a shorter period with high yields, would completely fail when there is either excessive rain or no rain under the rain-fed system for arable land.

Through interaction with community groups and individuals, and from documents, it was established that *Kgetsi-ya-Tsie* is a community of practitioners reliant on the community-based, natural resource management policy to reduce poverty. This confirms Wenger's (1998) notion that CoPs are organised around what matters to the members of the community. It emerged from the research that what women shared were concerns about their economic status, about access to loans and about markets for their produce. This was also key to their identity, knowledge generation, learning interactions and hopes for a better future as members of a CoP. Through formal and informal interactions, *Kgetsi-ya-Tsie* members as a CoP share new knowledge and innovations which benefits them. The natural resources, which are regarded as communal resources, are the focus for regular interaction, particularly among women.

It also emerged that what the women considered relevant and to be quality education was training and information that would address their concerns about reducing poverty. By means of interaction, women feel empowered to make decisions and to improve their understanding of the use of resources and entrepreneurial skills. Some of the benefits of regular social interaction include the reappropriation of indigenous knowledge and traditional resilience practices. The practices are acquired through social-learning processes within CoPs and by

way of relevant training. The social-learning practices build capacity among local CoPs for the purpose of adaptation and resilience.

Challenges that may impede coping strategies

Women have identified a number of challenges that impede the success of the *Kgetsi-ya-Tsie* in mitigating the impact of poverty and building resilience. The main challenge is that 'rain has become more unreliable and varied'. This affects those who are dependent on subsistence agriculture and forest resources. Prolonged and recurrent droughts affect some of the veld products that women usually gather, collect or harvest.

Kgetsi-ya-Tsie women compete for a limited market to sell natural resources and products. One of the women remarked that 'we do not have [a] market to sell jam. The jam has accumulated. Other customers buy on credit and take time to pay so we do not generate enough money to reduce poverty.' However, edible produce such as jam could be used at home, with the surplus being marketed. Members appreciated the skills acquired to make jam from the marula fruit and from cultivated melons, as this has also improved their diet at the household level. However, a lack of markets has led to some members failing to make a profit and repay the start-up loans from the Trust.

One of the major obstacles mentioned by all *Kgetsi-ya-Tsie* members interviewed was *lack of financial capital*. 'There is *not enough money* to start our own businesses or to sustain our projects in order to expand our businesses and to electrify our office.' Some are not able to repay loans. Other members are even finding that the new knowledge acquired is not benefiting them, as they cannot find markets for their products.

Another challenge is that of *governance* regarding the use of, and access to, forest products/resources. The resources that *Kgetsi-ya-Tsie* women use are common property. Legally, there is equal participation in accessing and using the natural resources of the forests to strengthen people's adaptation capacity, except for those intending to commercialise their harvesting or collection, who are usually required to obtain a trading licence. As a result of the communal use of the resources, some people, including those without skills, overharvest the products, thus threatening their sustainability as well as biodiversity.

Conclusions

This research was aimed at exploring how gender-based natural resources are used to reduce poverty among rural women in the Tswapong area. The area is characterised by an abundance of seasonal natural resources and products. Women exploit these resources for subsistence and commercial purposes. The commercial aspects are coordinated and are implemented by a community trust known as *Kgetsi-ya-Tsie*. The Trust assists in processing and marketing the natural resource products. At national level, policies related to poverty reduction, such as the CBNRMP (Republic of Botswana, 2007) and the National Poverty Reduction Strategy (Republic of Botswana, 2002b), have been introduced to support CBOs, among other projects. Through the implementation of such policies and through informal, traditional knowledge systems, women are trained in the harvesting of natural resource products, and in their

processing and use. By way of training and skills acquisition, women's capabilities and agency are enhanced. It emerged from the research that women's empowerment needs multifaceted approaches by those affected and government institutions. Women in the eastern part of Botswana belonging to *Kgetsi-ya-Tsie* are complementing government's efforts in building adaptive strategies to protect themselves from poverty and to reduce its adverse impacts. The research has revealed that households dependent on agriculture are more vulnerable to poverty and climate change. In view of this, therefore, having other less climate-dependent sources of income can build resilience. It is evident that people having a range of sources of income spread the risks; hence these women are more protected and resilient to socio-ecological challenges. Individuals earning incomes from natural products are in a better position to save. Savings and credits by *Kgetsi-ya-Tsie* have not only promoted a money economy through commercial activities beyond subsistence agriculture, but have also provided members with start-up capital for new livelihood activities, thus protecting them from the adverse impacts of poverty. The study showed clearly that women are empowered by having their own sources of income and by having control over how it is used.

Through social learning, women are strengthening their capability to reduce the adverse impact of poverty. Participation in *Kgetsi-ya-Tsie* projects has proved to be an important strategy in sustainable development and a key to capacity-building, as it entails a component of knowledge transfer among group members. Also, social learning has proved to be the key to knowledge transfer, thereby increasing human agency and the intellectual and practical capacity to deal with poverty in the face of climate change.

As described above, this research explored capabilities, agency and CoPs in promoting social change designed to bring about poverty-reduction strategies among rural women. However, what did not emerge clearly from this ongoing research is how power is distributed among women in relation to poverty-coping strategies and organisational practices.

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A Capability Approach
Its Potential for Transformative Education Research Focusing on Education for Sustainable Development and Gender Issues in Science Teacher Education

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Abstract

In this article, I use the capability approach to explore the role that the science, mathematics and technical subjects (SMTs) teacher education curriculum can play as a 'gender conversion factor'. This comes amidst evidence that a major hindrance to the participation of girls in these disciplines is a lack of gender responsiveness in the pedagogy applied in schools. Seven teacher educators, who were purposively sampled at a Technical Teachers' College in Zimbabwe, were the research participants. I adopted a case study design in which I used in-depth interviews, focus-group discussions and document analysis to generate data. Data was analysed deductively using predetermined themes based on an analytical tool anchored on Sen's two, but quite distinct, aspects of freedom, that is, the opportunity aspect and the process aspect of freedom. The findings reveal that there is a limited awareness of gender issues among teacher educators, and that these issues are not being transformed into curriculum practice. All in all, it is evident that curriculum practices of SMTs teacher educators are riddled with gender blindness and so trainee teachers graduate from college without the necessary agency to deal with personal, social and environmental conversion factors that can play a role in girls converting the curriculum into functionings (beings and doings) and wider freedoms and valued beings and doings (capabilities).

Background and Context

Economic and social development in any country relies heavily on a sound technology base, which can be achieved by placing an emphasis on science, mathematics and technical subjects (SMTs) at all levels of the education system. Ensuring good health, fighting diseases, protecting the environment, farming and developing agriculture, developing new industries and technologies, and even building resilience to climate change are all activities that require knowledge, skills and values offered by these disciplines. It therefore follows that there is a need to harness the intellectual and scientific capacity of both men and women for sustainable social, ecological and economic development of any country. Ironically, SMTs constitute the areas within the educational system where gender disparity in several of the poorest countries of the world is greatest (Sinnes, 2006; Cleggy, 2007; FAWE, 2008; Ministry of Labour & Social Services, 2010). Research has shown a persistently visible gender disparity in these disciplines – which is glaring from secondary school level and beyond – characterised by low female enrolment, poor performance and low retention. For example, Table 1 shows the percentages of men and women in the faculties of science in selected Southern African Development Community (SADC) countries.

Table 1. Percentage of men and women in Faculties of Science

Angola		Botswana		Lesotho		Malawi		Mozambique		Swaziland		Tanzania		Zambia		Madagascar		Zimbabwe	
F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
40	60	28	72	26	74	37	63	23	77	28	72	30	70	35	65	33	67	24	76

Source: SADC Gender Protocol Barometer, 2011, p.96.

Researchers who advocate for gender equality in sciences (e.g. Kalu, 2005; Cleggy, 2007; FAWE, 2008; Chikunda, 2010) argue that one major hindrance to participation of girls in SMTs is the lack of gender responsiveness in the pedagogy applied in schools. This is further confirmed by the fact that, although it is now common knowledge that gender imbalances in SMTs exist, teachers are often unaware or unaccepting of this situation and would not naturally feel the need to address it (FAWE, 2008). Such research evidence seems to suggest that SMTs teachers are not receiving from their teacher education the necessary skills, knowledge, values and attitude to engage with social issues such as gender in their curriculum practice. It is such glaring evidence of gender inequality in education that arouses critics to question the commitment of teacher education, as a human development and training sector, to the global efforts towards gender equality in education as a means of achieving social justice.

Over the years, however, efforts have been under way to redress gender imbalances in education. Notable endeavours in this regard were conceived and nurtured by UN-sanctioned initiatives such as Education for All (EFA), the Millennium Development Goals (MDGs), the Beijing Platform for Action (BPfA), and Education for Sustainable Development (ESD). Milestones along the road towards gender equality in education in general have been achieved owing to these international efforts. For example, the Zimbabwe MDGs Country Report (2010) shows that gender equality in terms of enrolment at primary-school level is balanced; in fact, 2009 saw a pro-female enrolment rate of 50.5%. The SADC Gender Protocol Barometer (2011) shows that, in the region generally, girls perform better than boys at primary and secondary levels. This new finding shatters the long-held cultural myth that girls are less capable. Nonetheless, the same barometer laments the low participation of females in the faculties of science. This is despite gender affirmative action policies which have been implemented for years in various ways, such as allowing women access to university education (especially that in science-related faculties) with lower entry points than their male counterparts.

We may want to ask ourselves: What went wrong or where are we going wrong? Why is it that these efforts towards gender equality did not bring about the desired outcome in SMTs in the past years? It is from the viewpoint of what gender justice or gender equality in education should mean that a lot of capability approach-oriented commentators are less satisfied with the philosophy, and hence the efforts, behind the MDG and EFA programmes. For example, MDG 3 was broadly framed to 'promote gender equality and empower women' (Aikman, Unterhalter & Challender, 2005:44). Within the Goal, the target relating to education was set in terms of

eliminating gender disparity in primary and secondary education, preferably by 2005, and at all levels by 2015. Commentators raised concerns that a broad goal of gender equality in political, economic, social and cultural relations is thus interpreted in a limited form as equal numbers, for example of boys and girls in formal schooling (Aikman, Unterhalter & Challender, 2005; Unterhalter, 2005; Unterhalter & North, 2011). The argument is that gender inequality is deeply embedded in *cultural norms*, as well as in the norms of institutions, their decision-making processes, their forms of exercising power, and their rules, unwritten cultures, and approaches to allocating resources (Unterhalter, 2005) and cannot be washed away by mere parity of enrolment. Other commentators have also pointed out that gender parity is misread to mean gender equality, and equality is conflated with gender equity in education (Aikman, Unterhalter & Challender, 2005; Unterhalter 2005). Similarly, the right to education cannot be reduced to merely completing a particular level (McCowan, 2010). All that these arguments point at is physical access in education, which does not always guarantee epistemological access.

Despite these critiques, and after pronouncements of the need for gender equality in education by international bodies such as the United Nations Educational, Scientific and Cultural Organization (UNESCO), most governments and non-governmental organisations (NGOs) now enrol girls in school as a way of heeding the United Nations' (UN) call for education to be a basic human right. Herz and Sperling (2004) identified four key areas that are said to have 'worked' as a means for governments to get girls into school. These were:

1. Eliminating school fees and offering scholarships to certain populations;
2. Providing safe schools nearby every village;
3. Making school a safer place where girls are encouraged to learn; and
4. Providing quality education by way of educated and trained teachers, up-to-date books and a curriculum oriented to the contemporary world.

Very few of these efforts actually concentrated on the transaction between teachers, learners and ideal content. Commenting on the challenges facing educational improvements and transformation to suit current societal demands, Ball and Forzani (2007:529) lament:

> As more and more diverse people need to learn more and more varied things than ever before... an educated citizenry is needed to tackle societal problems of health care, inequality, hunger, energy, poverty, and environmental sustainability. Yet delivering effective education remains a problem. Formal schooling and educational programs often fail. Students retain misconceptions even after instruction, basic academic skills are often undeveloped, and many youth leave school unprepared to participate competently in a democratic and diverse society. Most troubling is that education is delivered unevenly and inequitably.

This quote is, in my view, calling for transformation in teacher education. It is because of such ills as the persistent gender disparities in some sectors of education such as SMTs that the education transformation question comes to the fore.

Education transformation is embedded within the discourse on education for sustainable development (ESD), with environmental sustainability, gender and peace as some of the tenets. In this article, I work primarily with the aspect of gender within a wider frame of ESD and use a capability lens, assisted by the feminist paradigm, to explore the role of teacher education in achieving social justice through gender equality in SMTs. My point of departure is that gender discrimination in SMTs needs to be addressed in order for sustainable societies to emerge, and this needs to be done by unearthing and addressing the stumbling blocks that hinder girls from doing well in these disciplines. What is also required is that greater attention be given to these issues in teacher education curricula. Addressing SMTs education issues from a gender perspective is crucial to ESD and for longer-term, social–ecological sustainability, as many women, especially in sub-Saharan Africa, are responsible for managing household well-being, for contributing to natural resources management, for engaging with climate change risks as they produce food, and so on. Confronting gender discrimination within SMTs requires an orientation to education that is transformative, and the capability approach offers unique philosophical lenses for such an endeavour.

Theoretical Framing: The Capability Approach and ESD

The way we view education is continuously being challenged by the paradigm shift towards viewing development less and less in economic terms and placing the human being at the centre of concerns. In the same spirit, the United Nations Development Programme presents sustainable and human development in terms of enlarging people's choices (Hoffman, 2005). Sen, in his capability approach, expands the idea, arguing that development consists of the expansion of the capabilities of persons in order to lead the kind of lives they value and have reason to value (Sen, 2009; Elliot, 2007). Drawing on Sen (1992), Robeyns (2005) describes capabilities as being made up of people's potential functionings. Functionings are 'beings and doings' (Robeyns, 2005:65). Examples are being well fed, taking part in community or class activities, being sheltered, relating to other people, working in the labour market, caring for others, and being healthy, and so on (Robeyns, 2005:65). She further clarifies that the difference between a functioning and a capability is similar to the difference between an achievement and the freedom to achieve something, or between an outcome and an opportunity. Capabilities therefore correspond to the overall freedom to lead the life a person has reason to value (Kronlid, 2009; Sen, 2005, 2009; Nussbaum, 2000, 2005; Addobbo & Picchio, 2003). For Sen, from this viewpoint, development is about removing the obstacles to what a person can do in life, obstacles such as illiteracy, ill health, lack of access, or lack of civil and political freedoms (Fakuda-Parr, 2003).

Applying this to the SMTs teacher education curriculum, learning should be a capability to transformatively engage with sociocultural constraints that impede SMTs learning for any socio-demographic group. My reasons for using the capability approach to explore its potential for transformative education research towards gender equality in SMTs teacher education is inspired by Sen (2009), Unterhalter (2007) and Robeyns (2007), who, in exploring the idea of capabilities in support of the intrinsic importance of gender equality in education, came up

with three fundamental motives: firstly, because it helps establish conditions in which a broader capability set is available to girls and boys; secondly, because it alerts us to differential conversion processes linked to gender and other social divisions with regard to how resources are utilised to establish a capability set; and, thirdly, because of the importance of gender equality in basic education in preventing human insecurity and establishing conditions for capabilities and freedoms.

With regard to the second point, Robeyns (2007) argues that the relation between a good and the functionings to achieve certain beings and doings is influenced by three groups of conversion factors: personal, social and environmental. I discuss each in turn below.

Firstly, *personal conversion factors* (e.g. metabolism, physical condition, sex, gender, reading skills, intelligence) influence how a person can convert the characteristics of the commodity or resource into a functioning. She gives, as an example, a person who is disabled, or in a bad physical condition, or has never learned to cycle, for whom the bicycle will be of limited help to enable the functioning of mobility (Robeyns, 2007).

The focus on personal conversion factors is particularly important in a study focusing on gender. Feminist standpoint theorists support the view that men and women have different standpoints in life. Such theorists critique science as being developed primarily from the perspectives of one group, which is male (e.g. Harding, 1991; Keller, 1998; Kelly, 1985; Roychoudhury, Tippins & Nichol, 1995). In view of such arguments, the capability approach can help to evaluate, for example, how girls would convert goods and resources, like laboratory equipment such as batteries, wires, electrical equipment and other instruments that ordinarily are deemed to be for men, into their well-being in physics. In this particular case, a gender-responsive SMTs teacher education curriculum would acknowledge and encourage the differences between the two sexes as they engage with SMTs. Within such an initiative, girls, too, would be encouraged to value and appreciate their own experiences and interests as girls (Sinnes, 2006).

The same reason highlights the ability of the capability lenses to draw attention to gender and other subtle social divisions with regard to how resources are utilised to establish capabilities in a SMTs teaching and learning set-up. If we take a teacher as being a crucial 'resource' in any learning situation, one would expect learners of both sexes to access this resource equally. However, research findings point to the contrary. A substantial body of research suggests that most SMTs teachers enjoy teaching boys more, spend more time with boys, hold higher expectations regarding boys' achievements, use resources more suitable for boys, and urge more male participation (Kalu, 2005; McCullough, 2004; Prasad, 2004; O'Connor, 2000). In turn, boys tend to believe SMTs are their domain. Therefore, they tend to be more assertive and are more forceful in getting the teacher's attention through taunting and harassing girls who tend more towards compliance and conformity (O'Connor, 2000). Kalu attributes such gender-specific classroom behaviour to socialisation and gender-role expectations inherent in most African communities. In the case of a gender-responsive teacher education curriculum, it would be important for trainee teachers to be afforded the opportunity to engage with cultural and classroom underpinnings that may be detrimental to girls, based on such research findings, so as to develop skills and attitudes in them to broaden the scope and range of their capabilities.

In other words, teacher education, as a gender conversion factor, will be expected to equip future teachers with pedagogical knowledge, skills and attitude to assist girls to cross the gender divide that saturates the ontology and epistemology of SMTs.

Secondly, *social conversion factors* (e.g. public policies, social norms, discriminatory practices, gender roles, societal hierarchies, power relations) and, thirdly, *environmental conversion factors* (e.g. climate, geographical location) play a role in the conversions that occur from the characteristics of the good to individual functioning (Sen, 2009). The conversion possibilities within the capabilities approach offer a major critique of welfarist-/instrumentalist-driven approaches to gender equality as found in key policy initiatives such as the MDGs and the EFA documentation, as discussed above. Knowing the goods a person owns or can use is not sufficient in order to know which functionings he or she can achieve; or what capabilities he or she has reason to value. Therefore, we need to know much more about the person and the circumstances in which he or she is living, as well as about his or her agentive capacity (Sen, 2009). The capability approach thus takes account of human diversity in two ways: by its focus on the plurality of functionings and capabilities as the evaluative space; and by the explicit focus on personal and socio-environmental conversion factors that transform resources into functionings, and on the whole social and institutional context that affects the conversion factors and also the capability set directly (Sen, 2009; Unterhalter, 2007 and Robeyns, 2007).

Applying this to the SMTs learning and teaching scenario, establishing conditions in which a broader capability set is available to both girls and boys would mean a curriculum that is free of gender bias and stereotypes and in which the experiences of both females and males are represented. In this sense, one would expect an SMTs teacher education curriculum that engages with gender dynamics in the ontology and epistemology of school science. This would mean alerting trainee teachers to pay attention to, and be aware of, research documenting differences in girls' and boys' engagement and interest in SMTs, and making sure that teachers are able to design learning activities that capture such differences and interests (Sinnes, 2006). Furthermore, one would expect trainee teachers to engage with social conversion factors during their training (e.g. the patriarchal social norms and discriminatory practices, gender roles, societal hierarchies, and other power relations that may impede girls from accessing SMTs at the same level as boys). On the other hand, enabling social conversion factors such as the National Gender Policy would be engaged with to build agency for transformative education among future teachers; and enabling environmental factors such as safe and healthy schools near communities (with good sanitation facilities) may also facilitate transformative education and increased participation of girls in schooling, and potentially therefore also in SMTs.

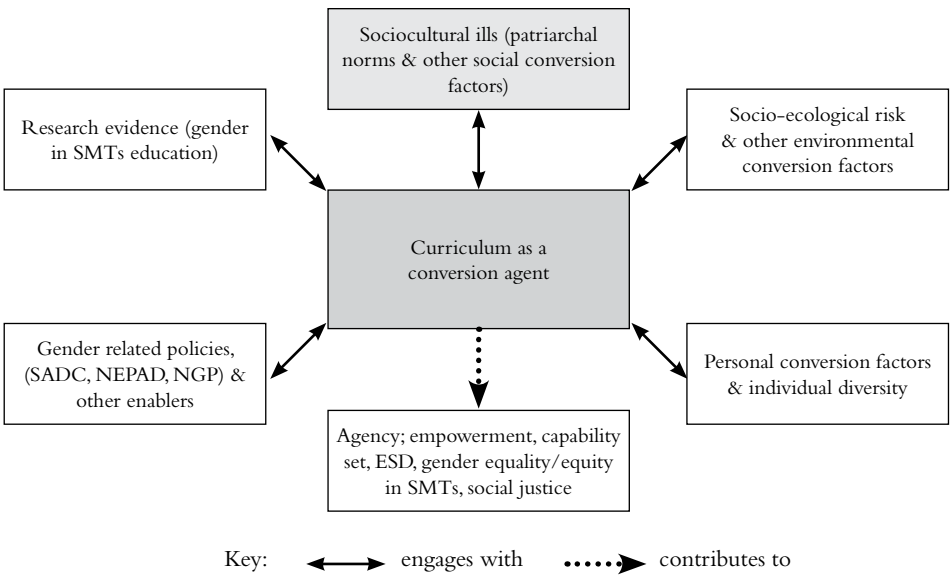
Sen's conception of the role of education, which is to establish conditions that expand people's substantive freedoms to do things that they have reason to value for their sake (Elliot, 2007), dovetails well with the principles of ESD. Education should equip people with knowledge of, and skills and values for, sustainable development, thereby making them more competent and confident to live a healthy, productive life in harmony with nature and with concern for social values, equity – including gender equity – and cultural diversity (UN, 2005), as well as concern for ecological sustainability and other aspects that contribute to the common good. Hoffman (2005) adds that ESD must be an education that aims to help people of all ages

better understand the world in which they live, and better act on this understanding. It needs to address the complexity and interconnectedness of problems such as poverty, consumption, environmental degradation, climate change, health, and population issues, including HIV/AIDS, conflict, inequality and the violation of human rights. ESD has to address these topics by providing not only information, but also the abilities needed to understand and use this information and to establish agency and attitudes supporting behaviour in the context of social practices that lead to sustainable development (UN, 2005; UNESCO, 2005).

To achieve this, the teacher education curriculum needs to be a 'gender conversion agent' itself. Such a curriculum would be a catalyst that would enable future teachers to 'convert' retrogressive gendered practices into capabilities for learners. In such a curriculum, there is a need to pay attention to negative social conversion factors (patriarchal norms and other sociocultural ills) and to engage them in a critical and transformative manner. There is also a need to take advantage of the enabling sociopolitical factors such as gender-related policies, critical and emancipatory pedagogies, and research on gender and ESD and to factor them into the curriculum.

The flow diagram in Figure 1 shows the context of a curriculum that is destined to be a 'gender conversion agent'.

Figure 1. Representation of a Teacher Education SMTs capability set curriculum



Objectives and Research Questions

The main goal of the research was to assess the SMTs teacher education curriculum as a gender conversion factor. The rationale behind this is the assumption that teachers and students alike

come from the same patriarchal background. There is a need, therefore, for teacher education, as an agent of the education and training sector, to play this conversion factor role so as to equip future SMTs teachers with the knowledge, attitudes and skills for gender-responsive pedagogies. To realise the goal of gender equality in SMTs, teacher education is mandated to play the role of a conversion factor by the National Gender Policy (NGP) in Zimbabwe (Ministry of Gender & Community Development, 2003), which stipulates the need to:

- Amend all relevant education and legal instruments in order to promote gender equality and equity;
- Encourage girls to take on science, mathematics and technology at all levels of education; and
- Introduce gender-awareness programmes in pre- and post-training teacher courses.

To realise the research goal, the study sought to respond to the following questions:

1. What capability set (opportunity freedom) is available for girls in the SMTs teacher education curriculum?
2. Which conversion processes are afforded by the SMTs teacher education curriculum so as to establish the capability set in view of gendered sociocultural constraints?

To infer on these broad questions, the study explored the level of gender responsiveness in the SMTs teacher education curriculum by interrogating teacher educators' perceptions of the push-out factors for girls in respect of SMTs, teacher educators' engagement with gender-related policies, and the role that teacher education is playing in bringing about gender equality in SMTs.

Methodology

Data was generated by means of a case study approach focusing on selected SMTs educators in a teacher education college in Zimbabwe, southern Africa. The case study employed document analysis, in-depth interviews and focus-group discussions. This methodological triangulation enhanced the validity of the research (Kelly, 2004; Cohen, Manion & Morrison, 2010), which, in the case of the study reported on here, can only be extrapolated to the specific case. When teacher educators are referred to in the text below, I am referring to those teacher educators involved in the study. Broader, multi-site case studies and/or questionnaire research will be needed for the study to be generalisable to all teacher educators in southern Africa. Seven in-depth interviews were held at the teacher education college: with the head of the division; with three lecturers in charge of each SMTs department (sciences, mathematics, technical subjects); and with one lecturer from each department. Two focus-group discussions were held, one for the technical subjects and one for science and mathematics. Document analysis focused on syllabi, enrolment policy, examination papers, research projects and other assessment tools.

Results and Discussion

To assist me to generate and analyse data, I designed a template (Table 2) based on the capability approach, ESD principles and feminist theory. The template as an analytical tool is anchored on Sen's two, but quite distinct, aspects of freedom, that is, the opportunity aspect and the process aspect of freedom. The opportunity aspect of freedom is concerned with 'our ability to achieve what we value … to pursue our objectives' (Sen, 2009:258). The process aspect attaches importance to the process of choice itself in order 'to make sure that we are not being forced into some state because of constraints imposed by others' (Sen 2009:258). The first two rows of the template were designed to infer the gender capability put in place in the SMTs teacher education curriculum so as to prepare future teachers to avail themselves of these freedoms in their own practice. The last two rows focus on assessing agency in the SMTs teacher education curriculum. Data was gathered and analysed abductively. The following themes were used:

- Knowledge of/perceptions on push-out factors for girls in respect of SMTs;
- Role that teacher education can play in improving the participation of females in SMTs; and
- Level of engagement with gender, ESD and curriculum transformation-related policies.

Knowledge of push-out factors for girls in respect of SMTs

Research tools were designed to use teacher educators' perceptions of push-out factors for girls in respect of SMTs and their views on gender imbalance in SMTs as indicators to infer their level of gender responsiveness in their curriculum practice. Under this theme, research items solicited information on teacher educators' knowledge of the factors that impact on the opportunity freedom or well-being achievement of girls in SMTs. In other words, items probed teacher educators' knowledge and attitudes regarding factors that impact on girls' physical and epistemological access to SMTs.

The findings reveal that all the teacher educators were familiar with gender disparities in SMTs education. Each one of them could tell a story showing gender inequality in terms of enrolment, retention and progression of girls and boys in SMTs from the secondary level of education and beyond. One could say that teacher educators in the sample had some basic levels of gender sensitivity, meaning that they had the mere ability to perceive existing gender inequalities as these apply to gender-disaggregated data only, especially when it came to enrolment and retention. However, this level of gender awareness did not seem to influence the curriculum practices of the teacher educators interviewed. Instead, teacher educators apportioned blame to the girls (blaming the victim) (see Evidence extract 1 below). Judging from such responses during the interviews (both individual and group), teacher educators were far from being classifiable as gender-aware, let alone gender-responsive in their curriculum practice.

Table 2. Capability template to assess gender responsiveness in SMTs teacher education curriculum

Aspects of capabilities (for boys & girls)	Aspect of Education	Expectations on teacher education (what teacher education should prepare trainee teachers for)	Assessment Standard for the SMTs Teacher Education Curriculum
Opportunity freedom. Wellbeing achievement (ability to achieve)	• Accessing, retention and progressing in SMTs • Better carrier prospect (aspects that are constitutive of one's wellbeing)	- Facilitate physical access (parity issues- affirmative action, -Enable cognitive access to SMTs	TE Level of gender awareness: • perception on push out factors for girls • perception of the role that TE can play towards gender equality • ability to use gender lenses in curriculum development • engagement with gender responsive pedagogies.
Process freedom (Wellbeing freedom)	Conditions to do well in SMTs (freedom from gender stereotypes, discrimination or violence (direct or symbolic), socio-cultural constrains etc.).	• Appropriate pedagogies, learning materials and assessment that account for gendered styles of learning. • Engaging with gendered cultural issues • Learning environment that values and appreciative of gendered experiences in SMTs • Critical of the gendered ontology/epistemology of SMTs- catering for gendered conversion processes	Open up alternative combinations of functionings for girls and boys in SMTs trainees: • engagement with gender responsive pedagogies. • engagement with gender/ESD related policies • develop capacity in trainee teachers to engage with gender socio-cultural constraints • develop capacity to create gender inclusive environment in schools.
Agency achievement	Success in(valuing and have reason to value) SMTs	Building agency in trainees focusing on gender differences and cultural constraints on girls. Critical look on rights in education, e.g. Rights and participation: Who (which groups) are defining what is to be taught and how it is to be delivered? (To what extent are women a part of this?) Rights and conceptions of the person: What are girls being taught about who they are in their education? Rights and institutions: Do the processes in which education is institutionalised and delivered allow girls' effective participation? Are girls'/women's existing situations enhanced or diminished through the education they receive?	• Critical/democratic pedagogies • ESD pedagogical strategies
Agency freedom	Having conditions to exercise agency (access to information, chance for discussion and evaluation of learning, freedom to make up one's mind without violence or shame)		

(adapted from Unterhalter, 2003 p.118)

Evidence extract 1

Researcher:

> Now let us talk about the possible push-out factors for girls from science. Why do you think girls become less and less interested in sciences as they continue with their education?

Participants (several interviewees):

- They [the girls] believe that science is for boys/is difficult.
- They put less and less effort [into] science as they proceed [with] high-school education.
- Girls are socialised to do easier stuff.
- Some look up to men to look after them in life.
- They are capable/able, but they put [in] less effort.
- At F3 (G10), they have acquired a gender identity and they want to be recognised as such by male counterparts – [the] implication... [it] is unfeminine to be good in physics, for example. Some even start [romantic] relationships.

Focus-group interviews:

- Girls perceive them [science and maths] as a male domain.
- They are normally weak in maths.
- I don't know why more boys than girls opt for physics; probably it's a perception that girls have that physics is a male domain.
- This perception, I think, is propagated by teachers themselves.
- Lack of motivation by teachers.
- Teachers propagate stereotypes.
- Society looks down upon females.
- Information technology is lifelong learning; it depends on the character of the person – females [are] not willing to continue learning.
- Males are more creative, more forthcoming, and [are] adventurous.
- Females not, probably due to socialisation … not that they are dull.

Supplementary items in the category of knowledge of push-out factors for girls in respect of SMTs looked at teacher educators' perceptions of patriarchy as both an ideology and culture and its impact on designing and learning of school SMTs. The idea was to further probe teacher educators' level of gender awareness and extrapolate this to curriculum practice in order to check whether there is provision for a gender capability set in the teacher education curriculum. Six of the seven in-depth interviewees were found wanting. They could not link cultural gender inequality inherent in patriarchy to SMTs learning and teaching. In the interviews and focus-group discussions, teacher educators acknowledged having witnessed, especially during their high-school teaching, attributes such as: boys being inclined to be more assertive and more forceful in getting teachers' attention, with girls tending more toward compliance and conformity; and boys taunting and harassing girls so as to cow them away

from active participation in sciences, especially practical activities that they (the boys) deemed male-oriented. Surprisingly, as shown in Evidence extract 2 below, teacher educators could not attribute such gendered pedagogical behaviours to patriarchal power socialisation and sex-role expectations inherent in most African communities, even though there is an abundance of such reports in the literature (e.g. O'Connor, 2000; Prasad, 2004; Kalu, 2005; FAWE, 2008; Rwodzi, 2006; Cleggy, 2007). Moreover, because of the 'blame-the-victim' response, teacher educators did not see it as core business to incorporate gender issues into their teaching.

Evidence extract 2

Researcher:

> Traditionally, in our African homes (Christian values as well), girls/females are expected to be obedient, submissive, passive… personality attributes that may not be in accordance with active participation as required in SMTs learning. How do you see this affecting learning and what can possibly be done to equip a trainee teacher to handle such cultural issues?

Interviewee 1:

> Learners should be able to draw the line between culture and academic aspects – when we are in class it's about learning, [and] nothing to do with behaviour at home. Opportunities [for] education for all are there; the fault is theirs [the girls], not the system.

Interviewee 3:

> Teacher education institutions should bring this issue [the impact of patriarchal socialisation] to the trainee teachers, [and] make them aware of gender stereotypes… This should be in our methods syllabus, [but] for now we don't talk about cultural issues in science education.

Using the capability lenses to interpret this evidence extract shows that lack of knowledge and/or improper attitudes to gender concerns result in lack of agency in the case of teacher educators. Such agency is required to transform curriculum practice and to adopt appropriate pedagogies that would engage trainee teachers in encounters with the skills, knowledge and attitudes to deal with gendered cultural issues that could improve the well-being freedom of girls in and through SMTs. Teacher education, in this case, is not doing as Sen (2009) suggests, that is, establishing conditions that expand people's substantive freedoms to do things they have reason to value for their own sake.

The ontology and epistemology of school science was also put under the spotlight in this research in order to assess the level of gender responsiveness of SMTs teacher educators. The idea was to assess whether SMTs teacher educators prepare their trainee teachers to be aware of, and equip them to respond to, the experiences, learning interests and styles of both girls

and boys in SMTs. Put, in simpler terms, interview questions were designed to check whether teacher educators were aware of the gendered nature of SMTs as taught in school; and hence of the need to alert trainee teachers to this and equip them with the relevant knowledge and capabilities. Evidence gathered shows that all of the teacher educators had some experience of the different ways in which boys and girls would prefer to learn. However, the teacher educators were not translating this into their own curriculum practice, as none of them was able to come up with clear-cut curriculum practices to ensure that trainee teachers get exposure in this regard. Evidence extract 3 highlights some of the opinions.

Evidence extract 3

Researcher:

> Do you think girls and boys may have different preferred learning styles?

Interviewee 1:

> Yes … there are girls who prefer to work with boys, these are clever girls –they have confidence… and may want to show the boys that they know just like them.
>
> There are girls who prefer to work in a group of girls only – the average and the weak ones.
>
> On the other hand, boys, whether weak, average or gifted can work with anyone; they don't care much. When they make mistakes they are not very worried … life goes on – it's an attitude thing.

Interviewee 5:

> Well, probably yes… . What I have seen is that the examples talk more about males and appeal more to boys than to girls… . Obviously, I know that examples [of women's] experiences will appeal more to girls. Unfortunately, most examples in textbooks make reference to males and their socially ascribed gender roles.
>
> We hope to improve as we work towards a new syllabus on equipping our trainee teachers to be able to pick out and engage with such issues in textbooks.

These responses make one wonder how the teacher education curriculum caters for the freedom of girls, both as regards the opportunity aspect and the process aspect of it in SMTs. The evidence shows that, despite their knowledge of preferred, different learning styles between girls and boys, teacher educators are not providing future teachers with the necessary capabilities, that is, the ability to achieve curriculum practice in a gender-responsive manner.

As a result, teacher education lacks the necessary agency to allow girls to flourish increasingly in SMTs. There is deprivation of capabilities on the part of the teacher education curriculum, capabilities that would allow future SMTs teachers to exercise their agency freedom so as to afford both girls and boys real opportunities to achieve well-being freedom in SMTs. Instead, SMTs teacher trainees are likely to graduate from college without the required 'agency freedom', that is, access to information related to gender and science learning. For example, the curriculum does not allow them to look critically at: who (Which groups?) are defining what is to be taught, and how it is to be delivered (To what extent are women a part of this?); what girls are being taught about who they are in their education; whether the processes in which education is institutionalised and delivered allow girls' effective participation; and if girls'/women's existing situations are enhanced or diminished through the education they receive.

The role that teacher education can play in improving the participation of females in SMTs

Sen (2009) argues that our evaluations and policies should focus on what people are able to do and be, on the quality of their life, and on removing obstacles in their lives so that they have more freedom to live the kind of life that, upon reflection, they have reason to value. In the same vein, I argue that the aim of curriculum development, which is the core function of teacher education, should be to remove obstacles to learning so that youngsters can flourish in school. In view of the gender disparity reported on above, one would expect a SMTs teacher education curriculum to be so designed as to remove obstacles that may hinder girls from flourishing in SMTs. Gender-responsive curriculum practice would entail responding to gender issues in an endeavour to find ways of eradicating the bias and discrimination, thereby ensuring equality and equity. Further, one would expect that teacher education (as a tertiary institution) should contribute to social justice by working towards the eradication of gender inequality, and by equipping future teachers with the necessary values, knowledge, skills and attitudes. This would be a way of responding to the National Gender Policy. At a global and regional level, this will be a synergic way of teacher education contributing to achieving some of the MDGs, the EFA agenda, and other subregional policy interests such as those framed in the SADC Regional Indicative Strategic Development Plan. It could also contribute to curriculum reorientation as encouraged by ESD. At individual professional level, this entails inculcating in both teacher educators and trainees qualities of reflexivity and agency.

With this in mind, I wanted to find out whether SMTs teacher educators are aware of the role that they can play (within teacher education) so as to improve the participation of females in the sciences. All this was done in order to assess the level at which SMTs teacher education operates as a gender conversion factor.

As noted above, SMTs teacher educators had some sense of gender disparities. However, they did not articulate any substantive gender-responsive strategies beyond suggesting greater involvement of girls in SMTs, and making links to the national policy. Their responses did not reflect, for example, making use of gender-responsive pedagogies and how these could be brought into the curriculum, or the efforts to deconstruct the SMTs curriculum and its

assumptions. The responses, as is apparent in Evidence extract 4 below, indicate that teacher educators gave a set of somewhat disjointed responses regarding the role that they play, or could play, as teacher education institution in equipping future teachers accordingly. Furthermore, the framed solutions seemed to rely on the girl child to respond to the complexities of the SMTs curriculum context. In general, there was some level of what can be described as 'gender blindness', the failure to realise that policies, programmes and activities can have different effects on men and women, and that this often leads to rigidity and unchanging attitudes to the more complex aspects of gender and SMTs, and to the wider constraints facing girls in SMTs, such as the masculine nature of the knowledge that is accepted as scientific.

Evidence extract 4

Researcher:

> What curriculum efforts are there/are you putting into your practice to impart gender-responsive skills, knowledge, and attitudes to future SMTs teachers?

Interviewee 1:

> The education [is failing to stress] to the girl child that we are all the same. There is nothing like subjects for boys and some for girls. … Teachers don't convey such messages to girls. … I sensitise my own trainee teachers [to] this. … Last week I spoke about it, giving a lived example [where] … 8 out of 10 who did well in a test were females.

Interviewee 3:

> We always try to make a reference to the low involvement of females in maths. … TEs [teacher educators] should try by all means in their practice to motivate girls to [study] maths/the sciences. … We always point it out that they [the trainee teachers] should try as much as possible to motivate our girl child out there to [engage with] maths/science.

Focus group:

- [There is] no college policy [on] gender-responsive pedagogy.
- There should be some national policy [on finding] mechanisms to promote girls' access to [the] sciences.
- A way [should be found] to incentivise girls to participate in the sciences, e.g. bursaries for tertiary education. However, they should enter tertiary [education] with the same score [as] boys … lower entry points tend to attract prejudicial attitudes.

This evidence led me to conclude that teacher educators in the context of this case lacked the tools/artefacts and institutional culture to equip future teachers with knowledge, attitudes

and skills regarding gender. Document analysis of syllabi, past examination papers and research projects did not show any institutional commitment to building a gendered capability set in curriculum practice. There was, however, a noted commitment in some minutes of meetings to factor in gender when enrolling students at the college. This means that the college is committed to ensuring physical access of females to SMTs, but, beyond this, there is no guarantee that future teachers will acquire skills and knowledge through training to ensure cognitive access to SMTs. Such an assumption and narrow conception of gender equality in education (Unterhalter, 2007) overlooks the existing gendered social relations in school bureaucracies and in the societies of which they are part. All in all, it is evident that curriculum practices of SMTs teacher educators in the context of the case are affected by gender blindness. Consequently, trainee teachers graduate from college without the necessary agency to deal with girls' conversion factors (personal, social, environmental) that can play a role in them converting the good (curriculum) into functionings (beings and doings).

Level of engagement with gender- and ESD-related policies

Gender-responsive policies are a social conversion factor that can facilitate the transformation of a good into individual functioning. In this case, the Zimbabwe National Gender Policy (Ministry of Gender & Community Development, 2003) clearly stipulates: encourage girls to become engaged in science, mathematics and technology at all levels of education; and introduce gender-awareness programmes for pre- and post-training teacher courses. It follows that the SMTs teacher education curriculum will benefit more from such pronouncements in the process of being a gender conversion factor curriculum. In contrast, as Evidence extract 5 shows, there was minimal or no evidence of engagement with such a policy in the teacher education institution, and little awareness of other global initiatives designed to achieve gender equality in education. This means that the social and institutional context provided by policy was not well engaged, even though it has the potential to influence the gender conversion factors that can establish the capability set for girls in sciences.

Evidence extract 5

Researcher:

> Do you in any way engage with gender-related policies, such as the National Gender Policy, in your relations with the teacher education curriculum, and, if so, how?

Several interviewees:

- Haven't heard of such a document.
- Haven't seen it; hence [there is] no college policy [on] gender-responsive pedagogy.
- Not sure … When we teach science, we just teach science.

Researcher:

> What do you put in place to ensure education for all in SMTs, as prescribed by Education for All frameworks for example?

Interviewee 2 & 4:

- There is equal opportunity to study SMTs for all the children [both sexes].
- We don't actually see any tangible barrier to deny girls equal access to SMTs.

Conclusion

Use of the capability lens to explore gender responsiveness in curriculum practices in this article has shown up some of the gaps that exist between policy and practice, and which need to be attended to for gender equality to be achieved in SMTs in teacher education in particular and in education in general. The agency aspect in the capability approach looks at what human beings can do to bring about improvements, particularly through policy and political changes. Sen (2009) regards such agency itself as a valued functioning. In other words, the agency aspect looks at the achievement of states of well-being. In this regard, it has become clear that, by and large, the teacher education curriculum is failing in two ways. Firstly, the policy practice gap implies that teacher education as an institution lacks the agency to put policy into practice in moving towards social justice and human rights as related to concerns associated with gender equality in SMTs. Secondly, and related to this; the curriculum is not building that agential capacity for future SMTs teachers to be agents of change.

Notes on the Contributor

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Mainstreaming ESD into Science Teacher Education Courses: A Case for ESD Pedagogical Content Knowledge and Learning as Connection

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Abstract

In this case study, researchers evaluated national education policies in Zambia, analysed a localised science (Chemistry 5070) syllabus, assessed a university teaching methods course, and evaluated 54 mathematics and science education students' perceptions on mainstreaming education for sustainable development (ESD) into their courses. ESD was a salient matter in education policies and in the preamble to Chemistry 5070, but not in the university teaching methods course. The chemistry syllabus included ESD issues in the 'notes' section, but was lacking in guidance on teaching and learning approaches to integrate the issues. The university Teaching Methods course did not include content and methods to assist teachers to effectively teach Chemistry 5070 and to integrate ESD issues into it. Students surveyed had some awareness of ESD issues and most were inclined to suggest that ESD issues must be mainstreamed into their courses, especially in educational theory courses; few students suggested natural sciences as carrier subjects for ESD. The findings pointed to a discrepancy among educational policies, school Chemistry 5070 and the university teaching methods courses. A paradigm shift is recommended in order that the quality and relevance of science education be viewed via the metaphor of 'learning as connection' and that Shulman's (1986) pedagogical content knowledge model be adapted so that content and pedagogy of science courses are inclusive of social and humanistic issues such as those advocated in ESD discourse.

Introduction

Science educators have struggled for decades with the question of how to design and evaluate curricula so that scientific knowledge does not end up in isolated, artificial settings such as tests, but leaves sustainable traces in students' daily lives (Van Eijck & Roth, 2007). This observation foregrounds the important concern for quality and relevance in science education, especially the need to connect its teaching and learning to issues in the real lives of learners. With reference to this, the Ahmadabad Declaration proposed that education must build capacity in order to engage critically with contemporary (unsustainable) discourses and practices (ICEE, 2007). It suggested that transformation in pedagogy is also needed in science education where, by historical precedent, the focus has been on the technical side of learning that lacks personal and/or societal relevance (Yager, 2002). In this article, we examine the question of the quality and relevance of science education by mainstreaming ESD. We evaluate the policy context, the curriculum context, and the perceptions of pre-service teachers mainstreaming ESD in the context of mathematics and science teacher education. This is a local response to an international call. For example, we note three actions at the level of practice in the Bonn

Declaration (UNESCO, 2009) of relevance to this research:

1. Support the incorporation of sustainable-development issues through the development of effective pedagogical approaches, teacher education, teaching practice, curricula, learning materials, etc.;
2. Reorient curriculum and teacher education programmes in order to integrate ESD; and
3. Promote evidence-informed policy dialogue on ESD, drawing upon relevant research, monitoring and evaluation strategies, and the sharing and recognition of good practices.

The findings of this study are interpreted in the light of the metaphor 'learning as connection' (Lotz-Sisitka, 2010) and by reflecting on Shulman's (1986) pedagogical content knowledge (PCK) model. Learning as connection implies learning that has meaning in people's lives (Lotz-Sisitka, 2010; Stephens, 2003), while PCK interweaves pedagogy and subject matter knowledge for good teaching of the subject. This is a viable way of describing the knowledge possessed by expert teachers (Veal & MaKinster, 1999). The notion of learning as connection conflates with concepts of inclusivity (Lotz-Sisitka, 2010) and with 'bigger issues of society' such as democracy, freedom, equality and human rights, or, conversely, exploitation, oppression and inequality (Stephens, 2003). For Lotz-Sisitka, learning as connection implies 'to be inclusive of culture, local context and issues and practices that have meaning for local societies such as environment and sustainability practices, health education practices, life skills and citizenship practices' (Lotz-Sisitka, 2010:26). These issues are the ones often excluded from science education, and, yet, they can provide a context for relevance and personalisation of meaning.

To connect the learning of sciences to these and other sustainable-development issues requires a reconsideration of what constitutes the PCK of science teachers. We therefore suggest that the traditional models of school science may exclude attention to ESD and the context of learning the science. The Johnstone (1991 & 2006) model was developed in the context of the learning of the technical assets of the discipline, that is, its macroscopic, sub-microscopic and symbolic representation. In the case of chemistry, explanation of the behaviour of substances is in terms of the abstract world of atomic theory and representing that behaviour in terms of chemical equations, mathematical equations, graphs, reaction mechanisms, analogies, et cetera. The PCK of the teacher developed around this model of learning a science, we conjecture, leads to abstraction and to fixation on the technical and symbolic representation of science concepts, theories and models (Bucat, 2004; Bond-Robinson, 2005; Hofstein, 2005) at the expense of personal and societal relevance. As such, it fails to connect, for the majority of learners, the chemistry of substance to students' life-world of environmental pollution and impact (atmospheric, soil, water and public health) or sustainable-development issues of human rights.

We contend that the PCK (Shulman, 1986) modelled around the Johnstone (1991) model of learning science would focus mainly on the knowledge about the teaching and learning of particular subject matter. It accounts for the particular learning demands inherent in the subject matter (Bucat, 2004) and thus excludes matters of societal relevance, for example responsible citizenship and sustainable development. This is the sense in which we interpret Geddis (1993) (in Bucat, 2004) who states that '*many of the pedagogical skills of the outstanding teacher are content-*

specific' (emphasis added). We suggest that the competencies of the teacher must include a clear understanding of the connection of this specific science content to societal issues and a clear appreciation of the pedagogy in order to communicate this connection to societal issues such as those defined in ESD. Mainstreaming ESD thus requires us to reflect critically on these two models (Shulman, 1986; Johnstone, 1991 & 2006) through which science education is practised in terms of the context and pedagogy for learning. The Ahmadabad Declaration (ICEE, 2007), for example, reminds and urges us to change our thinking about education and learning and to employ approaches suited to integrating environmental education (EE)/ESD principles and for transformative learning in all areas of the curriculum, that is, science education included.

Purpose and Significance of the Research

This vision of the Ahmadabad Declaration (ICEE, 2007) predicates learning science in context, which entails addressing personal needs, addressing societal issues, and orienting learners for science–technology-related careers (Yager, 2002). Yager (2002) makes the point that '*context* – rather than *content and process skills* – is essential for learning science' (emphasis added). 'Science in context' implies 'learning as connection', thus making it feasible for students to connect their learning to real life. In real life, reality is defined by the impact of science and technology on society, for example global warming, climate change, et cetera. Real understanding of science, therefore, is a real-world context for seeing, learning and using the ideas and skills which develop when emphasis is given to questions, problems, concerns and societal issues (Yager, 2002:3) and when there are opportunities for reciprocation of learning between school and community (Shumba, Kasembe, Mukundu & Muzenda, 2008). Yager cites studies that showed that, in the United States of America (USA), 85 to 90% of university science and engineering majors failed to demonstrate real understanding of the concepts and processes they had mastered in courses, when doing their independent research. The students could not use the information and skills to solve problems and were unable to connect the ideas and skills to anything else.

> They were merely conscientious students who committed important concepts and skills (often mathematical equations) to memory. In fact, the minds of most of the science and engineering students in the study were not engaged (Yager, 2002:3).

Contextualisation, for example by integrating ESD, enables learners to make a connection of the abstract symbolic and technical aspects of science to existing experiences based on the real-world life in the community and in society. It is on the score of contextualisation that the localisation of science curricula in southern Africa is relatively ineffectual. Lotz-Sisitka (2010:24) made this observation with respect to southern Africa, in which she criticised the education systems for 'outdated syllabi and forms of pedagogy offered in foreign languages, or content that is decontexualised and disembedded from local history, experience, culture and aspiration'. In Zambia, for example, the National Assessment Project (1999) pointed to 'a nation at risk', as 'very little learning of the *type expected by society* is occurring in Zambia's schools' (emphasis added) (Examinations Council of Zambia, 2000:6). Localisation of the

school science curricula has not led to the desired status with respect to quality and relevance, that is, if one considers the critique of the high-school curriculum in *Educating the nation* (Republic of Zambia, 2005). The authors of *Educating the nation* observed that the 'high school curriculum has no relevance to either the world of work or to the socio-economic realities in the country' and that the pedagogy was examination-driven and characterised by 'parroting and memorisation'. They suggested curriculum reconceptualisation to start with, reflecting on the question 'learning for what?' vis-à-vis real-life situations. In the research reported here, one of our students, in reflecting on participation in this action research, stated:

> AM: One thing I have noted is that, when it comes to learning in Zambia, mostly when we learn, we cram facts mostly up to grade 12. That is always the case. What I am able to see is a situation where we are introducing something [i.e. integrating ESD] which is going to bring a real life situation to … certain lessons, not only just to cram the stated facts and to reproduce the facts but to understand the concepts fully so that they can be of use, even of use to society (Focus Group Discussion, 26 August 2011).

The purpose of this study was:

1. To evaluate how mainstreaming ESD into university mathematics and science education courses improves their quality and relevance; and
2. To explore how mainstreaming may be achieved for the university science teacher education course to have impact and relevance in respect of high-school science education.

Before this could be done, we carried out a policy and curriculum analysis and assessed perceptions of pre-service mathematics and science teachers, guided by two research questions:

1. How are ESD issues featured, or not featured, in national education policies, in a localised science (Chemistry 5070) syllabus, and in a university teaching methods course?
2. What are mathematics and science education students' perceptions on mainstreaming ESD into their university courses?

Methodology

The case study was conducted at the Copperbelt University in Zambia where 54 students in the third year of the Bachelor of Science (Mathematics and Science Education) degree were participants. The degree prepares teachers for high-school subjects in mathematics and the natural sciences through: (a) 10 mathematics and science courses; (b) 6 education theory and practice courses; and (c) 2 research courses – educational research methods and a research project. The students were in the third year of their studies and were taking Teaching Methods (TM310) to prepare them to teach high-school Chemistry 5070. A questionnaire survey and focus-group interviews were conducted to determine the students' perspectives on mainstreaming ESD into their courses.

Results

Analysis of educational policy context: ESD a salient issue?

A review of the educational policy context was conducted with a view to assessing how ESD and quality and relevance issues were featured. We established that the educational framework, *Educating our future* (Republic of Zambia, 1996), permeates all subsequent educational planning policies, including: *Educating the nation* (Republic of Zambia, 2005), the *Fifth national development plan (2006–2010)* (Republic of Zambia, 2006), and the *Sixth national development plan (2011–2015)* (Republic of Zambia, 2010). *Educating our future* informed the localisation of the high-school science curricula, focusing on relevance and diversification (CDC, 2000). Appreciation of the relation between scientific thought, action and technology and the sustenance of quality of life, tolerance and valuing other people's liberties, rights and views, and participating in preserving ecosystems in one's immediate and distant environments is its stated goal. Increasing equitable access to quality education and skills training to enhance human capacity for sustainable national development continues to be the national vision (Republic of Zambia, 2010).

The inclination of *Educating our future* towards ESD is reflected in the themes of the basic education curriculum, for example education for democracy, for peace and for international understanding, education for an occupation, health and personal well-being, and sexuality and personal relationships. The high-school curriculum is expected to prepare learners for 'the conclusion of life in school and for the commencement of adult life' (Republic of Zambia, 1996:60) and for appreciating the:

> … nature of democracy in Zambia, participation in civil life, respect for the personal and sexual integrity of others, maintaining human and personal well-being, managing personal interests and interpersonal relationships, crucial demographic and population control issues, respect for the environment, understanding of the pervasiveness, causes, and human dimensions of poverty, and the positive use of leisure (Republic of Zambia, 1996:56).

All in all, ESD issues are a salient feature of the educational policy scene in Zambia, with the aim being to improve quality, contextualisation, and the relevance of education to national sustainable development. In *Educating the nation* (Republic of Zambia, 2005), it is stressed: 'In order to produce the kind of learner as espoused in the Policy, one would have to *place curriculum relevance in the centre of any learning, teaching or training activity*' (emphasis added). The orientation to localisation and relevance of science and technology subjects is found in the following quote from *Educating our future*: 'The criterion should be the relevance of the material to the environment and to the possible later sphere of employment of the people' (Republic of Zambia, 1996:35).

Analysis of high-school Chemistry 5070

Chemistry 5070 is a localised science syllabus *that we analysed to check how it reflects or does not reflect educational policy pronouncements and an ESD orientation in its content and methodology*. Its

rationale is based on the educational policy, *Educating our future* (Republic of Zambia, 1996), in which its EE/ESD intentions are explicit:

> The syllabus also addresses issues of national concern such as Environmental Education, Gender and Equity, Health Education and HIV/AIDS, Family Life Education, Human Rights, Democracy, Reproductive Health, Population Education, Entrepreneurship and Vocational Skills, Life and Values Education (CDC, 2000:v).

Its aims are specific to:

1. Experimental, investigative and practical aspects of chemistry and to interest, enjoyment, and attitudes relevant to chemistry; and
2. An EE/ESD focus, for example making learners confident citizens who have an interest in, and who care for, the local and global environment.

Learners are expected to appreciate the benefits and disadvantages of chemistry to the individual, the community and the environment.

However, assessment objectives do not balance the learning of chemistry content with learning about EE/ESD issues. For example, out of five objectives relating to knowledge with understanding, only one relates to 'scientific and technological applications with social, economic and environmental relevance' (CDC, 2000:8). The other four relate to chemistry phenomena, theory, and symbolic representation. All seven 7 objectives relating to (a) handling information and solving problems, and (b) experimental skills are silent on the context of learning, that is, no reference is made to social, environmental or economic spheres.

The contents of Chemistry 5070 are organised into thirteen units presented on a three-column spread-sheet specifying content (Column 1), objectives (Column 2) and notes (Column 3). Of these 13 units, only Unit 13: Chemistry, society and the environment is the most directly oriented to an EE/ESD context. Contextualisation to EE/ESD in the other 11 units is indirect, with the teacher being guided to specified issues to 'refer to' or to 'include' in the notes section. For example, in the notes for Unit 9: Metals and Unit 12: Non-metals, teachers are asked to refer to: processing of minerals in Zambia; toxic gases and effluents from factories; the disposal of scrap metal; land degradation due to mining and dumping; common pollutants such as carbon monoxide, carbon dioxide, sulphur dioxide, nitrogen and lead oxides; the dangers of ozone-layer depletion, climate change, the greenhouse effect and skin cancers; effluent in rivers from industries and farms; et cetera. While these notes direct teachers to examples of chemistry in the context of Zambian society and industry, the danger of placing such issues there is that most teachers may not read the notes. Besides, the notes do not clarify the depth of treatment of the reference issues and do not specify the teaching and learning methodology.

The practical syllabus component of 5070 specifies experimental work limited to laboratory qualitative analysis and identification tests for anions, cations and gases. It does not contextualise practical work by suggesting analytic tests to be applied to, for example, domestic chemical products, local foods, and resources such as plants, air, soil and water in the local environment.

Overall, the syllabus is silent on pedagogy that would enable teachers to connect the chemistry content to the EE/ESD 'issues of national concern' indicated in national education policies and in the preface and the notes section of the syllabus.

Reflections on Teaching Methods 310

Teaching Methods (TM 310) is the course that introduces students to the teaching and learning of high-school science subjects, for example Chemistry 5070. It was assessed in relation to pedagogical chemistry knowledge in general, to pedagogy for mainstreaming of ESD into it, and in relation to its relevance for supporting mainstreaming of ESD into teaching of Chemistry 5070. From the 2006/2007 academic year to 2011, the Teaching Methods course underwent four changes. In the 2008/2009 academic year, some ESD issues were incorporated, including students projects and presentations, simulations, debate and value clarification, and action research as some of the teaching methods introduced. In the 2010 academic year, the ESD- and action-oriented approaches introduced in 2009 were no longer featured. From one year to the next, changes introduced were not guided by a systematic focus on issues such as mainstreaming a particular pedagogical orientation or learning style or a focus on PCK. TM 310 tends to focus on general PCK, that is, general strategies for teaching mathematics and science subjects (Veal & MaKinster, 1999). It is silent on domain- or topic-specific PCK (Veal & MaKinster, 1999) and on pedagogy that would enable teachers to connect the chemistry content to the 'issues of national concern' identified in the preface to Chemistry 5070. In our view, TM 310 is currently inadequate in order to provide sound PCK for Chemistry 5070 and to enable teachers of this high-school course to integrate ESD into their teaching of it.

Results of student surveys

A survey, interviews and focus-group discussions were conducted with 54 students (46 males and 8 females) in the third year of the four-year BSc (Mathematics and Science Education). The results presented here are those from the sections of the questionnaire that asked students to assess statements on a Likert-type scale concerning: (a) whether or not there should be integration of sustainable-development (SD) issues into courses; (b) the importance of development knowledge, skills and attitudes for sustainable development, based on the Learning and Skills Council (2010) statements; (c) the importance of teaching and learning approaches proposed in *The ESD lens* (UNESCO, 2010). In addition to indicating their level of agreement on the Likert scale, they were asked to indicate their choice of carrier subject for particular learning outcomes. Ten-member, focus-group interviews were used to complement the data collected through the questionnaire and to follow up and clarify trends in the questionnaire responses.

Excluding the five students who did not indicate their ages and/or teaching subject specialisation, the students were between 19 and 36 years of age (42 students were 25 years of age or younger) and were distributed according to their main teaching subjects as follows: Biology (n = 14; 25.9%), Chemistry (n = 17; 31.5%), Mathematics (n = 12; 22.2%) and Physics (n = 6; 11.1%). Table 1 summarises the responses of the students to the question whether or not sustainable-development issues must be included in their degree courses. More than 75% agreed to the inclusion of sustainable development in the education courses: Teaching Methods, Principles of Education

and Research Methods. Their level of agreement decreased to below 69% for the inclusion of sustainable development in science courses, with the least level of agreement for Physics at 48.1%.

Table 1. Students' responses as to whether or not sustainable-development issues must be included in their degree courses

Course	Frequency as a percentage (N = 54)			
	Agreeing	Disagreeing	Others	Missing cases
Teaching Methods	88.9	1.9	1.9	7.4
Principles of Education	83.3	3.8	5.6	7.4
Research Methods	77.8	3.7	11.1	7.4
Biology	68.5	3.8	9.4	18.5
Chemistry	68.5	3.8	7.5	20.4
Physics	48.1	1.9	20.5	25.9
Mathematics	63.0	1.9	16.7	18.5

Note that 'Others' in the table is a combination of those who did not have an opinion and who did not indicate any response, that is, missing cases.

Table 2 correlates their levels of agreement to inclusion in each subject. Significantly positive correlations among levels of agreement for inclusion of sustainable development in Teaching Methods, Research Methods and Principles of Education were obtained, with the degree of association ranging between 16% and 36%. Their rating of agreement for inclusion of sustainable development in Teaching Methods and Research Methods appeared to have no significant relationship to the rating of inclusion in three sciences (except that the Biology rating correlated significantly with research methods). Ratings of inclusion showed a strong positive association accounting for nearly up to 50% among the sciences.

Table 2. Correlations of perceptions relating to inclusion of sustainable-development issues in courses (N = 54)

	COTM	COPE	CORM	COBI	COCH	COPH	COMA
COTM	1						
COPE	.433**	1					
CORM	.475**	.611**	1				
COBI	.082	.390**	.303*	1			
COCH	.192	.356**	.139	.491**	1		
COPH	.263	.368**	.205	.600**	.741**	1	
COMA	.348**	.282*	.001	.349**	.565**	.730**	1

Key: * Correlation is significant at the 0.05 level (two-tailed).

** Correlation is significant at the 0.01 level (two-tailed).

COTM – Teaching Methods; COPE – Principles of Education; CORM – Research Methods; COBI – Biology; COCH – Chemistry; COPH – Physics; COMA – Mathematics

When students were asked to suggest examples of sustainable-development issues to be included in each course, the percentage of those giving a realistic example was as follows: Teaching Methods (59%), Principles of Education (54%), Biology (52%), and Research Methods (50%). Fewer and fewer students suggested examples of sustainable development to be included in Chemistry (44%), Physics (30%) and Mathematics (19%). The most commonly identified issues were: pollution, waste management, global warming and climate change, conservation, gender and intergenerational equity, human rights, and health and population education.

Tables 3 to 5 show the results of the students' perceptions regarding statements to assess level of agreement with respect to inclusion of specific knowledge, skills and attitudinal outcomes in education for sustainable development taken from the Learning and Skills Council (2010) and the UNESCO ESD Lens (2010), with minor modifications. The results are shown in Table 3 (knowledge outcomes), Table 4 (skills) and Table 5 (attitudes), where the two aspects to be read off are the ratings and ranking in importance of each outcome and the proportion of students suggesting a specific subject as a carrier for the outcome. In reading the data on proportion of students suggesting a specific subject as a carrier for the outcome, we allowed a 40% threshold as the level that would reflect a subject as a carrier for the outcome.

Table 3. Pre-service teacher perceptions of the importance of knowledge outcomes in ESD and potential carrier courses

Knowledge of education for sustainable development	Frequency (%) of those rating (N = 54)							
	Importance & rank	Carrier subject						
		TM	PE	RM	CH	PH	BI	MA
K1. Interdependence of society and life on planet	90.7 (1)	27.8	40.7	24.1	24.1	27.8	68.5	18.5
K2. Limited carrying capacity of planet	64.8 (10)	11.1	14.8	16.7	14.8	42.6	29.6	11.1
K3. Value of biological, social and cultural diversity	88.9 (3)	29.6	31.5	25.9	18.5	16.7	74.1	11.1
K4. Role of rights and responsibilities	85.2 (6)	40.7	59.3	40.7	18.5	14.8	13.0	16.7
K5. Role of equity and justice	87.0 (5)	27.2	72.2	35.2	26.7	13.0	11.1	14.8
K6. Observing precautionary principle	81.5 (8)	20.4	37.0	38.9	25.9	37.0	33.3	25.9
K7. Rights of future generations	90.7 (1)	25.9	61.1	29.6	20.4	22.2	27.8	18.5
K8. Democracy and civic participation	85.2 (6)	27.8	50.0	38.9	11.1	9.3	11.1	14.8
K9. Equitable distribution of wealth and resources	70.4 (9)	22.2	46.3	31.5	14.8	13.0	14.8	24.1
K10. Participation in initiatives to eradicate hunger and poverty	88.9 (3)	31.5	46.3	31.5	25.9	18.5	27.8	20.4

Key: TM – Teaching Methods; PE – Principles of Education; RM – Research Methods; CH – Chemistry; PH – Physics; BI – Biology; MA – Mathematics

Table 3 shows that 8 out of 10 knowledge outcomes were rated as important in 80% of the responses. Based on the 40% researcher-determined threshold, 7 of the knowledge outcomes were expected to be carried in Principles of Education. The question of rights and responsibilities was seen as a matter largely for the three education courses. Table 4 shows that 6 skills or competencies were perceived as important by more than 75% of the students. Table 5 shows that 70–85% of students rated all 7 attitudinal outcomes as important. Overall, the survey shows that students were favourably disposed to the inclusion of specific knowledge, skills and attitudinal outcomes in ESD, mainly through education courses as the carriers. Among the natural sciences, only Biology featured as a projected carrier subject, with items relating to interdependence and to diversity being rated by 68% or more.

When asked to rate the teaching and learning approaches proposed for sustainable development (UNESCO, 2010), the results in Table 6 were obtained. Eight approaches were rated important for university courses by at least 75%; the highest ranking was 'teacher-led and student-led educational storytelling, drama, poetry, music or dance to raise relevant sustainable-development issues' (85.2%). The Research Methods course was expected to utilise 9 (or 60%) of the approaches. Using the 40% threshold, only 3 approaches were considered by the students as pertinent for Chemistry or Biology. These pertained to fieldwork and research projects in the community. The lowest-rated approaches were critical media analysis (ranked 15) and the use of multimedia technologies (ranked 14).

Table 4. Pre-service teacher perceptions of the importance of skills in ESD and potential carrier courses

Skills in education for sustainable development	Frequency (%) of those rating (N = 54)							
	Importance & rank	Carrier subject						
		TM	PE	RM	CH	PH	BI	MA
S1. Connecting different issues affecting society	85.2 (1)	46.3	59.3	38.9	24.1	18.5	27.8	24.1
S2. Recognising and solving issues	83.3 (2)	29.6	51.9	48.1	24.1	22.2	27.8	22.2
S3. Cooperation and consensus in decision-making	79.6 (3)	29.6	51.9	50.0	18.5	14.8	16.7	20.4
S4. Cooperation in decision-making in respect of power diversity	75.9 (6)	27.8	59.3	42.6	20.4	18.5	20.4	20.4
S5. Thinking critically beyond making systems and products less unsustainable	77.8 (4)	24.1	51.9	40.7	33.3	24.1	27.8	33.3
S6. Thinking to create sustainable systems and products	77.8 (4)	29.6	50.0	38.9	33.3	25.9	35.2	31.5

Key: TM – Teaching Methods; PE – Principles of Education; RM – Research Methods; CH – Chemistry; PH – Physics; BI – Biology; MA – Mathematics

Table 5. Pre-service teacher perceptions of the importance of attitudinal outcomes in ESD and potential carrier courses

Attitudes in respect of education for sustainable development	Frequency (%) of those rating (N = 54)							
	Importance & rank	Carrier subject						
		TM	PE	RM	CH	PH	BI	MA
A1. Confidence to take positive action	83.3 (2)	48.1	53.7	51.9	24.1	20.4	25.9	24.1
A2. Balancing individual behaviours and responsibilities	85.2 (1)	37.0	59.3	38.9	25.9	22.2	31.5	22.2
A3. Respect for, and being in harmony with, the natural world	79.6 (3)	24.1	63.0	29.6	22.2	24.1	35.2	20.4
A4. Respect for biological, social and cultural diversity	70.4 (6)	40.7	40.7	37.0	16.7	18.5	51.9	18.5
A5. Caring for self, other people, all life and the planet	75.9 (4)	35.2	40.7	35.2	29.6	37.0	46.3	24.1
A6. Cultivating peace and mutual understanding	72.2 (5)	35.2	55.6	25.9	18.5	18.5	18.5	16.7
A7. Promoting equality and empowerment for the less privileged	70.4 (6)	40.7	57.4	35.2	20.4	20.4	20.4	20.4

Key: TM – Teaching Methods; PE – Principles of Education; RM – Research Methods; CH – Chemistry; PH – Physics; BI – Biology; MA – Mathematics

Table 6. Pre-service teacher perceptions of the importance of instructional approaches in ESD and potential carrier courses

Instructional approaches for sustainable development	Frequency (%) of those rating (N = 54)							
	Importance & rank	Carrier subject						
		TM	PE	RM	CH	PH	BI	MA
Classroom exposition on students' research	79.6 (3)	50.0	37.0	59.3	22.2	20.4	22.2	18.5
Use of educational entertainment	85.2 (1)	61.1	48.1	37.0	35.2	29.6	29.6	37.0
Presentation by guest speakers	81.5 (2)	37.0	46.3	38.9	35.2	31.5	35.2	27.8
Student (STS) debates	79.6 (3)	27.8	38.9	46.3	37.0	29.6	31.5	25.9
Experiential learning in local community/environment	79.6 (3)	33.3	25.9	44.4	35.2	33.3	35.2	29.6
Analysis of practical data sources, e.g. photographs, videos, graphs, maps, etc.	75.9 (8)	37.0	25.9	35.2	37.0	38.9	35.2	29.6
Student-inquiry projects	79.6 (3)	40.7	31.5	55.6	37.0	33.3	33.3	31.5
Values clarification on STS issues	72.2 (10)	33.3	38.9	37.0	27.8	29.6	29.6	33.3
Simulation and role play	68.5 (12)	40.7	46.3	22.2	24.1	22.2	22.2	22.2
Future problem and lifestyle analysis and projection	68.5 (12)	25.9	31.5	42.6	42.6	35.2	33.3	33.3
Fieldwork in community/environment	74.1 (9)	31.5	27.8	38.9	44.4	37.0	44.4	25.9
Community-service projects	72.2 (10)	25.9	37.0	50.0	27.8	22.2	31.5	20.4
Critical media analysis	57.4 (15)	22.2	33.3	50.0	16.7	18.5	16.7	16.7
Research projects in local community/environment	77.8 (7)	18.5	29.6	48.1	40.7	18.5	25.9	14.8
Use of multimedia information communication technologies (ICTs), videos, social media, etc.	66.7 (14)	31.5	29.6	42.6	35.2	33.3	29.6	27.8

Key: TM – Teaching Methods; PE – Principles of Education; RM – Research Methods; CH – Chemistry; PH – Physics; BI – Biology; MA – Mathematics

Synthesis and Discussion

This study demonstrates that EE/ESD issues are salient in education policies in Zambia. However, the high-school Chemistry 5070 and the university Teaching Methods (TM 310) syllabi do not carry ESD content and change-oriented teaching and learning approaches. They are unlikely to model integration of ESD issues such as those stated in policies, for example human rights, values education, entrepreneurship, et cetera. One of our students put forward the following analysis (our reflections are italicised):

> HM: In here (*referring to a Mathematics syllabus*), if we were to compare the expectations written by the Permanent Secretary [PS] (*in the preamble to the syllabi*) and the content, the way the syllabus really is laid out, in the syllabus, we are just seeing the content itself, specifying the objectives... (*inaudible*). They (*the syllabi*) do not talk about the expectations of the PS (*for mainstreaming EE/ESD issues*) in the content of the syllabi. We just see dry mathematics, pure mathematics. Even if it's Chemistry (*syllabus*), it's just pure chemistry, inside these syllabi. … We can directly say, there is no 'Zambianness' (*possibly meaning no local relevance and contextualisation*) inside the content because the mathematics that is here (*referring to a Mathematics syllabus*) is … the mathematics which everyone else out there does. … We do not see anything that we can say, yes, OK, this is for us (Focus Group Discussion, 26 August 2011).

Pre-service teachers surveyed expected ESD to be mainstreamed in their courses. Their perception was that ESD knowledge, skills and attitudes were better dealt with in educational theory courses than in mathematics and natural science courses. With respect to mathematics and natural science courses, they expected pedagogical changes to address real-world applications and societal issues. One student teacher observed:

> Student 47: The process of teaching [that is] prominent in universities, where lecturers only present the abstract concepts, makes it difficult for the student to get the context of the concept in real life. This never makes it … sustainable, even when the student can master, through memorisation, the concepts from the abstract point of view. Hence the concepts do not add any value to the students' personal lives (Open-response text).

Overall, the results of policy and curriculum analysis and of the student surveys point to a discrepancy among policies, school science syllabi and the university teaching methods course. Policies stipulate mainstreaming of ESD, but the syllabi do not systematically point out the content and the teaching and learning methods for integrating ESD. Students' experiences and perceptions suggest a disconnect between what they learnt in the past or what they are currently learning and ESD outcomes; they anticipate that integration of ESD would enhance the relevance of their courses. A paradigm shift might occur by adopting the metaphor of 'learning as connection', a notion that connects science to social and humanistic issues such as those advocated in ESD discourse.

However, learning as connection cannot be superficially adopted. It requires a deeper reflection on the competencies expected of science educators and teachers. For example, it is ordinarily accepted that teachers who understand the science subject matter, and who are knowledgeable on the specifics of teaching and learning of specific topics making up the subject matter, possess PCK, that is, pedagogical chemistry knowledge (Bucat, 2004; Bond-Robinson, 2005). Looked at from the perspective of Shulman's (1986) PCK model, this subject matter pedagogical knowledge is often interpreted with respect to the technical aspects and content of the subject. A good example is the presentation of subject matter exclusively on the basis of Johnstone's (1991) model of how scientists view the nature of their discipline, that is, examining macroscopic aspects, explaining these macroscopic aspects using subatomic theory, and representing macroscopic aspects in symbols and equations. These models fall short in connecting science to humanistic, social and personal aspects and to societal issues. Consequently, teachers lack the experiences and competencies to integrate ESD and to use transformative teaching and learning approaches (see, for example, UNESCO, 2009; Rosenberg, O'Donoghue & Olvitt, 2008). Bearing in mind that students' experiences and their thinking exist at the macroscopic level (Bond-Robinson, 2005), transformative learning occurs when there are connections to real-life issues and examples. We therefore suggest that, in addition to describing PCK in terms of subject matter knowledge and pedagogical knowledge, PCK must include ESD knowledge and competencies. Teachers need knowledge of specific sustainable-development issues and the pedagogical approaches to integrate ESD into their teaching; they need ESD issue-specific PCK (ESD PCK). ESD PCK would suggest expertise on the part of the teacher of science to connect its subject matter and concepts to personal and societal issues as defined in ESD discourse.

In the context of Zambia, there are numerous local ESD issues and a favourable educational policy context that could serve to contextualise local high-school science education and science teacher education courses. Deliberate and systematic teaching and learning of such issues may serve not only as the constituents and identifiers of the localised syllabus, but also as the 'connectors' to the real issues of concern to Zambian communities. Contextualisation enables learning as connection to achieve what educational theorists such as David Ausubel and John Dewey called 'meaningful learning'. However, as noted in our analysis, the ESD issues tend to be relegated to the preamble to syllabus 5070 and not explicitly articulated in the content section. There is a need for explicit guidance as to how to integrate and to bring into science education ESD- and change-oriented teaching and learning methods (see, for example, UNESCO, 2009; Rosenberg *et al.*, 2008) in order to connect school learning experiences to life and issues in communities. This creates relevance by creating a fit between the experiences in the local community and school learning (Shumba *et al.*, 2008). We think that science education must focus in a balanced way on science discipline, educational theories and societal issues. We take a cue from De Jong (2005), who suggested that an education in science should develop capabilities to form opinions and make political decisions on science–technology–society issues. We see science education as a knowledge area and a process that is beneficial to society at large, and, as such, it must take its full share of responsibility for educating for sustainability thinking and action. For this to happen, social and humanistic issues in the sustainable-development

discourse must not remain on the periphery of science learning. We propose that, for 'learning as connection' to occur, ESD issues and suitable pedagogical approaches must become part of the science PCK.

Conclusion

All in all, the issue of contextualisation and our analytical tool of 'learning as connection' point us towards the need to rethink the way we prepare mathematics and science teachers for school-level teaching. We think that Shulman's (1986) PCK model and Johnstone's (1991 & 2006) model of learning science, for example chemistry, do not focus science educators on integration of societal issues as a necessary component of contextualised learning. Our metaphor of 'learning as connection' gives rise to the need to consider the notion 'ESD pedagogical content knowledge (ESD PCK)' a notion that modestly extends Shulman's (1986). This foregrounds the importance of science teachers understanding sustainable-development issues and ESD concepts, principles and values (i.e. ESD content knowledge) and of the appropriate teaching and learning approaches to interrogate and act on them (i.e. the ESD pedagogy). ESD PCK relates to teacher expertise to connect their subject content and concepts to issues of concern to society's development. While the technical content and concepts of science are universal, what defines a local science syllabus is the extent to which it connects these universal concepts and values to experiences and examples from the local environment and culture. A focus on ESD PCK enables this connection and would enable the teaching and learning of a science subject so that it contributes to developing a sustainability-minded citizen consistent with emerging notions of scientific literacy (Shwartz, Ben-Zvi & Hofstein, 2006). Shwartz *et al.* (2006) contend that chemical literacy, for example, could be described in terms of chemistry in context, entailing using understandings of chemistry in daily life, as consumers of new products and technologies, in decision-making, and in participating in a social debate regarding chemistry-related issues and topics, especially in non-formal frameworks. It is imperative in thinking about ESD PCK and learning as connection to reflect on how learning of science subjects must instigate and catalyse a sense of responsibility and agency for sustainable development. Natural-science subjects must aim to contribute their share to moulding a new generation of citizens who value sustainable development. In the 'action' phase of this research, and as a suggestion for further research by others, these challenges and questions must be explored.

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Contextualising the Curriculum through Local Floodplain Artefacts at Lealui Basic School of Western Zambia

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Abstract

The purpose of this article is to report on a study conducted in Western Zambia which set out to explore how Lealui Basic School could be assisted to provide contextualised environmental and sustainability education through the display of local floodplain artefacts at a school open day. A collection of floodplain artefacts was prepared in readiness for display, and this article reports on how such artefacts can be used in localised curriculum work for teaching and learning purposes. The study used a participatory action approach in which school personnel participated in the collection of artefacts.

It was found that connection, quality and relevance could be brought about by developing the capabilities of learners, teachers and community members through the use of floodplain artefacts. School managers could also draw relevance from the artefacts by innovatively working through such artefacts to improve the management of their school institutions. Teachers could work through 'learning as connection' in order to help their learners to make connections between a cross section of situations which are currently disconnected one from the other, such as the knowledge base of children, adults and elderly persons. Such findings can benefit school practitioners, educational administrators or university teacher educators interested in mainstreaming education for sustainable development (ESD) into education.

Introduction

In the preface to *Guidelines for the Development of the Localised Curriculum in Zambia* (Ministry of Education, 2005), the then Permanent Secretary of the Zambian Ministry of Education stated that the purpose of the Educating Our Future (1996) reforms was 'to use the Ministry's and *local* resources more efficiently in order to improve access to basic education and fulfill the Ministry's vision to provide *quality* and *relevant* basic education to all Zambian children' (Ministry of Education, 2005:(ii); emphasis added). Since the issuing of this statement, few studies have been conducted in Zambia to determine exactly the way in which local resources existing in a community may be used to contextualise and localise a curriculum. In this regard, this article describes a research study whose curriculum argument was that local artefacts which exist in a community are significant for contextualising the curriculum in a manner that brings about quality and relevance. This curriculum argument for contextualisation is rooted in historical dimensions which, together, influenced the research. These dimensions include the following:

1. The non-use of local resources in the vicinity of Basic Schools, in Zambian education;
2. The relatively low professional status of primary education in Zambia as compared with secondary education; and
3. The non-use of cultural, social and linguistic histories of people in southern Africa for educational purposes.

Such a curriculum thrust would be of interest to educational planners, teacher educators, university academics trying to work with schools and many others interested in environmental and sustainability education issues. The study was constituted as a small qualitative study informed by an emerging theory of 'learning as connection' (see Lotz-Sisitka, this volume).

The research, conducted from November 2009 to February 2011, was part of the Southern African Development Community Regional Environmental Education Programme's (SADC-REEP) research programme consisting of ten participating universities and a college of education in southern Africa. The main focus at a general level among these ten universities was the exploration of quality and relevance in environmental and sustainability education. In particular, the research team's argument was that education for sustainable development (ESD) involves a kind of learning that is meaningful in people's lives. Such a form of learning supports capabilities, actions and agency. As such, it improves the quality and relevance of education and introduces innovation into the education systems of southern Africa. This key argument is evident in the case study reported on in this article.

Statement of the Problem and General Orientation of the Study

Schools such as Lealui Basic School are expected to design localised curricula to implement Zambian government policies on environmental education (EE) and education for sustainable development (ESD). The Zambian National Policy on the Environment, in particular, extols schools such as Lealui Basic School in helping Zambia to realise the policy objective of 'increasing public and political awareness and understanding of the need for environmental protection, sustainable natural resource utilisation, conservation and management as essential partners in development' (Ministry of Tourism, Environment & Natural Resources, 2007:23). To attain this objective, Lealui Basic School is expected, in terms of policy, to produce a learner who is capable of 'participating in the preservation of the ecosystems in one's immediate and distant environments' (Ministry of Education, 1996:5).

A situation where Basic Schools lack knowledge on how to draw up localised curricula using local resources in order to implement such government policies in their local environments, despite well-meant promulgations aimed at 'localizing the curriculum' (Ministry of Education, 2005; 2007), constitutes a problem. This is despite the fact that such schools may have a locally designed, school-based strategic and implementation plan (SIP), such as the one which Lealui Basic School had by virtue of its professional linkage to the Sefula Provincial Environmental Education Centre (SEPEEC). Lack of knowledge on how to design localised curricula could be a problem, because sustainability issues embedded within the local resources of such schools need to be identified, unwound and addressed at a contextual level. This article describes a study

which addressed such a knowledge gap within Lealui Basic School as part of the pilot project.

The aim of the study was to explore how Lealui Basic School could be assisted in offering environmental and sustainability education through the display, at a school open day, of local floodplain artefacts occurring naturally or made by learners, teachers and community members.

The specific objective of the study, as reported on in this article was:

- To explore the type of environmental and sustainability content associated with floodplain artefacts that could be used to build a localised curriculum for teaching and learning purposes.

At the time of writing this article in October 2013, a school open day had also been held in 2011, but the authors of this article did not participate in the event. This article reports on the above objective only; not on the extended programme of learning at the school. Well-conceived school open days can be very effective occasions for contextualising a curriculum, because local communities, in collaboration with schools, can innovatively articulate issues in their surroundings for members of the public. Exactly how this can be done for the purpose of contextualising a curriculum will not be examined here, as this is to be the subject of another article that may potentially expand on this article.

The research was justified for a number of reasons. The Zambian Ministry of Education acknowledges the need to raise the relatively low status of primary education in the country to a level that is comparable with secondary education. In the context of this study, one way of doing this is by finding creative ways of incorporating the rich indigenous knowledge occurring locally into learning and the curriculum in line with the Zambian education directive on localised curricula (Ministry of Education, 2005). The Lozi people of the Barotse floodplain have rich cultural, social, linguistic and historical knowledge which could be incorporated in a localised curriculum. One creative means of incorporating such knowledge is through an open-day initiative and other subsequent activities where artefacts used by local people linked with the floodplain are showcased and used for curriculum purposes.

Additionally, one of the core values of the University of Zambia, where the two researchers come from, is to engage with public institutions (as suggested by Barnett, Clark & Rees, 2001). There is, therefore, a need for active engagement between primary (basic) schools and the University (as suggested by Barth, 1990) in order to work through the central role of teacher education relating to environmental and sustainability education.

This study was framed by four main ideas that are related to one another. Firstly, the study arose from an orientation that perceives context to be a friendly phenomenon full of opportunities. In this regard, Lealui Basic School may likely discover various organisations that might be interested in collaborating with the School in order to promote indigenous knowledge, in the school curriculum, related to floodplain artefacts. Secondly, this research was theoretically guided by the idea of the strengths model described in a United Nations Educational, Scientific and Cultural Organization (UNESCO) document (UNESCO, 2005), implying that each school has areas of potential strength in need of working through. Thirdly, Namafe (1992; 1998) suggested the idea of service knowledge, by means of which university

researchers would create something new to be of direct use and benefit to both respondents (such as the community) and researchers at one and the same time. The 'new' thing here is a collection of floodplain artefacts to be exploited for their educational messages using the agency of a school open day and other potential activities. Fourthly, in relation to behavioural- and cognitive-learning theories, this study is located within the theory of situated learning which argues that learning is an enculturation process that affords people the opportunity to thoughtfully make meaning of their environments, to practise in situ the behaviour of members of a culture, and, gradually, to act in accordance with the norms of that culture (Brown, Collins & Duguid, 1989). Critical aspects of the situated-learning model as applied to this particular study are articulation of learning skills, reflection, coaching, and a learner observing members and practitioners of the Lozi culture in their everyday work with floodplain artefacts – in short, a learner observing the 'community of practice' consisting of Lozi cultural members. The main focus of this particular article, however, has been to provide articulation that enables tacit knowledge embedded in Lozi cultural objects to be made explicit for teachers. Tables 1, 2 and 3 in this article, as well as Figure 1, all aim to achieve such articulation.

As already noted, this research is serially poised in due course to use the agency of a school open day and other activities to educate people about environmental and sustainability issues. However, it concentrates on the first part of the process, as the embedded and encultured knowledge in artefacts is often missed or taken for granted (O'Donoghue & Neluvhalani, 2002), yet artefacts are critically important for the success of further learning in contextualised curriculum development. O'Donoghue and Neluvhalani (2002:124) report that 'historical evidence illustrates how insightful knowledge was often overlooked and marginalised in the past', and they report on the pedagogical potential of artefacts in their research by stating: 'As knowledge-laden indigenous artefacts were sourced and used and compared with the way we do things today, further action-centred materials and methods developed.' (O'Donoghue and Neluvhalani, 2002:133).

Research Methodology

The research methodology was influenced by the following considerations:

- To generate data from local resources on how a Basic School may construct a localised curriculum in order to offer environmental and sustainability education to the public using its area of strength – in this case, floodplain artefacts; and
- To strengthen school–community relationships.

The overall design of the study was qualitative in nature and participatory action approaches were employed. The study involved a case study of only one Basic School's approach to mobilising local artefact knowledge in, and for, environmental and sustainability education. Apart from the involvement of university researchers, the study actively involved school authorities and teachers in locating and acquiring floodplain artefacts. It can, in this regard, be appreciated that the research entailed both a data-collection and data-dissemination process, undertaken at one and the same time.

The population which was studied included learners, teachers and community members of Lealui Basic School in Western Zambia. The following steps were followed in the collection of data:

1. A letter of intent was written to the Provincial Education Officer (Western Zambia) and the District Education Board Secretary (Mongu District) seeking permission to undertake research at Lealui Basic School under the aegis of the SEPEEC. This step addressed ethical procedures to some extent.
2. A personal introductory letter for the two researchers was also secured from the Head of Department of Language and Social Sciences Education (LSSE) at the University of Zambia.
3. School managers at Lealui Basic School (i.e. the head teacher and deputy head teacher) were provided with a small amount of seed money in November 2009 to enable the school to purchase local floodplain artefacts from learners, teachers and community members.
4. An advertisement was placed with a local community radio station to broadcast a message to learners, teachers and community members in the vicinity of Lealui Basic School to submit their floodplain artefacts to the school (surrounding schools also participated in this exercise and the collection of items was therefore not restricted only to Lealui Basic School learners, teachers or community members). The focus was on collecting samples of all the available local Barotse floodplain artefacts as far as was possible.

Results

As stated, the study aimed at assisting Lealui Basic School to offer environmental and sustainability education through the display, at a school open day, of floodplain artefacts occurring locally or made by people, as well as by way of other expanded curriculum activities. Lealui Basic School managed to make a collection of floodplain artefacts (presented in Table 1), despite the fact that some teachers were reported by the school head teacher to have been somewhat reluctant to collect the artefacts for reasons this research did not delve into. Table 1 provides a summarised classification of all of the collected floodplain artefacts by using:

- Categories of basic raw material from which the artefact is made;
- The floodplain artefact itself;
- The genre (major family grouping of the artefact); and
- The vernacular language associated with the artefact.

The collected items in Table 1 form a basis for extracting information to be used in drawing up a skeletal, localised curriculum. Some of the names of items in Table 1 have been presented directly in the indigenous Lozi language as they were received from respondents in the field, because they do not have a direct linguistic or translation equivalent in English. All the artefacts reported here are from the floodplain environment of Western Zambia.

Table 1. Local floodplain artefacts collected for educational purposes at Lealui Basic School, Western Zambia

Basic raw material	Floodplain artefact	Genre	Associated language
Papyrus (*kuma*)	*Museme, Lishasha*	*Liluka, Sikololo*	*Mitila, Kulitela, Sibikeleli*
Reeds (*mataka*)	*Libinda/mainda/liinda* *Mashasha/lishasha* *Makuko, Lizuma*	*Lin'gele*	Weaving *Kupunya, Lutabo, Mihala*
Limbinda	*Lizuma, Miseme*		*Kuluka, Mashandi*
Matutu	*Miseme, Mututo*		*Kuluka, Kupunya, Mihala*
Palm family (*mukulwani*)	*Lizuma* (baskets) *Likuwani* (hats), *Maselo* *Lipaupau* (handbags), *Tutumbwa* (*katumbwa*, a small woven basket with a lid), Table mats		*Mutumba, Mababa, Kuluka, Mitila*
Clay (*lizupa*)	*Lindondo, Lipizana* (*Ntozi*), *Tumbwengele, Tung'angwa, Tubana*		*Kubupa, Kuluba, Kunambanisa*
Grass (*bucwani*)	*Lukuko, Lufiyelo, Situwa sandu*	*Nangenya, Katondo, Lufiyelo, Mwange, Matengenya, Makelele, Silenge*	*Kuluka, Kuyaha, Kubasa, Mihala, Mashandi*
Water Subdivided into: Flood water (*muunda*); Well water (*lisima*); Canal water (*liabwa*); River water (*nuka*); and Lake water (*lisa*). Also classified into: *Manelele* (small waves); *Mandinda* (big waves); *Mapaipai*; and *Silembe*.	Animals	Hippo, Crocodile, Water monitor *Ng'ibi, Mbao, Lingongole*	
	Fish	Bubble fish, Red bream, *Seo, Mu, Njinji, Nembwe, Mbaala, Liulungu, Linyonga, Mbuna, Nembele, Njenga* *Mulumesi, Ngweshi, Mushuna, Ndikusi, Mutokoya, Mbanda*	*Kuyamba, Kuwaya, Kushuta, Kushuwa, Kuyalela, Kulaleka, Kupazula, Kupunya, Silwapa*
	Amphibians	*Simbotwe* (frog), *Kanyukuta*	
	Birds (*linyunywani*)	*Macikwi Linongolo, Kang'umbi, Sinolo Sifuli, Ng'ambwamukule, Linjekele, Maiwiye, Imuyulu, Ling'ungu, Liya, Nalwange, Nalukapwa, Mulombwe, Ng'ubang'uba, Simukata*	
Food (*lico*)	*Mbonyi, Mabele, Mashela, Makwangala, Maoma, Linjefu, Ndongo, Lituu, Manawa, Ngulu, Siboyani*		
Trees	*Sibumbu, Mukoma, Sitaka*		
Insects	*Sului, Mabombolwa*		

Interpretation of results

In the first instance, the floodplain artefacts in Table 1 are all water-related and provide the Lozi people living in the locality of such artefacts with certain capabilities in terms of enabling them to choose what type of people they want to be, which, in this case, is to be water people as a matter of cultural identity. Over the centuries, water people have existed in many lands and have been recognised as such by scholars. Choosing to be water people is a capability attribute related to identity creation. Capabilities, as defined by Sen (1999), are 'valued beings and doings' or those things or ways of being that people have reason to value. A capabilities lens was found in this study to be a useful construct for conceptualising a contextualised curriculum. Unfortunately, since the 16th and 17th centuries, many water cultures across the world have become extinct as a result of drainage projects designed to create dry agricultural land (Swift, 1983). The Lozi culture is, therefore, fortunate to still be able to maintain water-based lifestyles and artefacts and, by so doing, challenging educationists to plan curricula to sustain such water lifestyles.

The other capability facilitated by the artefacts is the opportunity for Lozi individuals to choose a specific floodplain lifestyle they wish to lead, that is, whether or not they wish to weave reed objects, to fish or to mould clay objects. These dimensions of capability are a springboard for innovation and modernisation among the Lozi community, in that they enable Lozis to engage in trade, with a cross section of the international community, around the artefacts.

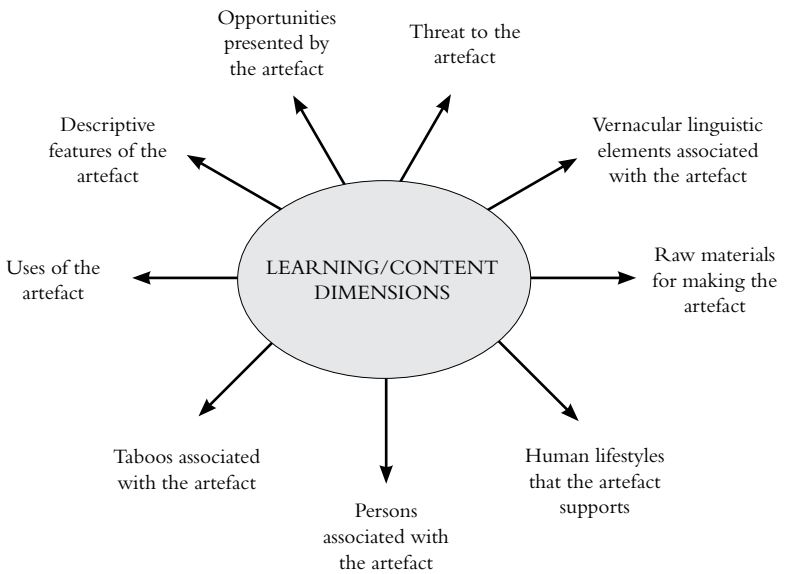
The second reason why the artefacts in Table 1 are of significance relates to their relevance in pedagogy and in curriculum design, that is, to the richness of environmental messages which each artefact radiates for possible classroom use by teachers or learners in an educational setting. For instance, an item such as the *katumbwa*1 may be educationally studied from the following vantage points:

1. *The vernacular linguistic elements* associated with the process of making it. Some of these elements are faced with extinction owing to various factors and, therefore, there is a need to sustain them educationally.
2. *The raw materials* required as prerequisites or co-requisites when making it. The environmental sources of such raw materials may be threatened in various ways, such as by agriculture, construction or drainage.
3. *The specific human lifestyles* supported or threatened by such an artefact (e.g. the *katumbwa* is normally kept by elderly persons for specific purposes). For such elderly persons, this relates to their capability in respect of privacy (e.g. to live a lifestyle away from the knowledge of young ones).
4. *The specific persons* associated with it, for instance elderly people (when using it), young people (when collecting raw materials to make it), young adults (when making it) or the specific gender roles associated with it.
5. *The taboos* associated with the process of making the artefact. Some of these taboos could be rationally explained, could be scientifically justifiable or could simply be ethical in their nature.
6. *The uses* of the artefact, that is, what the object can be used for (this relates to the capability to do certain things with the objects which may not be done successfully with other objects).

7. *The descriptive features* of the artefact in terms of its shape, colour, size, smoothness, durability, strength, fragility, and so on.

The above features are indicated in Figure 1 for further clarity regarding the parameters which can be the bases for generating content from the artefacts.

Figure 1. Teaching–learning/content dimensions of local artefacts



The third aspect of Table 1 challenges us to answer the question: how can the artefacts be handled in a formal school system so that such artefacts assist teachers to make 'connections'? Learning as connection has teaching implications and such implications can be generated with the aid of a matrix that addresses issues of sustainability. Such a matrix consists of guiding themes of knowledge, issues, skills, values, challenges, opportunities and action points, as shown in Table 2. By employing the illustrative sustainability matrix in Table 2, teachers can make connections using a questioning technique and so help learners to make connections between school knowledge and everyday knowledge, between past, present and future worlds or between different sectors of society (e.g. the needs of the hospitality industry and those of local artefact producers).

Similar challenging questions related to 'learning as connection' can be posed with respect to assessment. How can teachers assess the kind of learning taking place with regard to the floodplain artefacts in Table 1? Would this kind of learning improve learner performance in 'mainstream subjects' like Civic Education, Home Economics, Biology, and so on? However, as regards the floodplain artefacts and Lozi indigenous ways of making artefacts, there are a lot of Western ways of knowing to be found in mainstream subjects (paraphrased from Lotz-Sisitka, 2011).

Table 2. Teaching/learning dimensions on *katumbwa*

Outcomes	Natural	Economic	Social	Political
Knowledge	Identification and collection of all varieties of *katumbwa* with a view to describing the natural materials used in making them.	Of what economic use can the *katumbwa* be for various clients?	What stylistic preferences can be identified and sustained by the *katumbwa* among the people?	Why are the local traditional leaders not encouraging the use of the *katumbwa*?
Issues	How can the natural environments support various types of *katumbwa* so that they are conserved?	Of what potential value is the *katumbwa* to hotels and lodges?	How can the local community and individuals be empowered to produce *katumbwa*?	Who has the power within the office of the Provincial Education Officer (PEO) to create projects to conserve the *katumbwa*?
Skills	How will we revive the lost skills of making *katumbwa* in the environment?	What trading skills should teachers and learners acquire in order to sell the *katumbwa*?	What family skills should be introduced to learners so as to sustain the *katumbwa*?	What skills are needed when using *katumbwa* in order to avoid conflicts in the home?
Values	How will we revive indigenous traditional objects like *katumbwa* and value them?	If improved, how can *katumbwa* become a source of entrepreneurship in its local areas of production and a means of poverty reduction?	What family values can be used in the functional processing of *katumbwa*?	What solutions would the availability of *katumbwa* provide?
Challenges	Why are local people disregarding *katumbwa* in preference for exotic handbags?	How would local people know how to innovate *katumbwa* to suit the dictates of time and the needs of society?	How would the local people know how to use *katumbwa* in traditional activities?	Why could the choice of *katumbwa* over exotic handbags by one married partner cause conflicts in the home?
Opportunities	What research projects can be generated to investigate the pool of natural objects that may be exploited in order to improve *katumbwa*?	What teaching and learning materials can be produced and sold based on *katumbwa*?	How can skill, knowledge and values regarding *katumbwa* be taught in all school-learning areas? How can a localised curriculum on preserving, marketing and selling *katumbwa* be created?	How could the area Member of Parliament (MP) be enlisted to support the cause of reviving and sustaining the *katumbwa*?
Action points	How can we investigate different natural environments which support the growth of *katumbwa* and conserve them?	How can we create a comprehensive data bank of all types of *katumbwa*? Can we invite hotel and lodge managers to an open day to market the *katumbwa* so as to sell it for its cultural value and to make a profit?	How can we contact relevant individuals and organisations within and beyond Zambia that are interested in *katumbwa* (e.g. the SADC Cultural Centre)?	How can we lobby relevant decision-makers to revive the value of the *katumbwa*? Can we write to the area MP or the *Post* newspaper?

Table 3. Managing a school for innovation by means of local floodplain artefacts

Educational aspects	Organisational aspects
• As a group (learners, teachers and community members), the school should complete the sustainability matrix in Table 2, focusing on floodplain artefacts in line with their context. • The school should determine how individual learning areas of the curriculum could be addressed by means of various dimensions of the matrix. • How could learners, teachers and community members be organised so that they research the identified elements of the matrix? • What teaching–learning materials can be created from the matrix elements? • What types of collaborative ventures among learners, teachers and community members could be initiated based on the matrix? • What about collaborative projects (ventures) undertaken together with other schools or offices? • What kind of expertise is needed to tackle aspects of the matrix? • How can elements of the matrix facilitate different types of professional development among environmental-education teachers (i.e. cater for practitioner development, professional development, professional training and professional support)? • How could one use elements of the matrix to address the various needs of the stages of a teaching career (i.e. the needs of a novice teacher, advanced beginner teacher, competent teacher, proficient teacher and expert teacher)? • How could the matrix elements be applied to meet the requirements of the different periods in the career of Basic School teachers (i.e. initial professional development, early professional development and continuing professional development)?	• The school needs to nominate one person (a learner, teacher or community member) to spearhead and coordinate the perfection of the identified strength. • The school needs to market and publicise the strength beyond the school. • The school needs to strategise how to increase the identified strength so that it becomes even stronger than before. • The school should seek out appropriate partners, alliances or networks based on the identified strength. • The school must have special days on which to celebrate the identified strength in the form of a school ceremony or open day. • The school should clarify how to involve learners, teachers and community members as active participants in the identified strength. • The school should maintain an active communication channel between itself and the zonal, district and provincial education offices regarding progress, challenges and problems in respect of operating within the identified strength. • The school needs to arrange visits to and from the school based on the identified strength. Contact with the Barotse royal establishment and other key stakeholders in the community could be made.

The fourth point to be made is that education for sustainable development (ESD) as embedded in the artefacts of Table 1 involves a kind of learning that is meaningful in people's lives. As such, it improves the quality and relevance of education and introduces innovation into the education systems of southern Africa. This can be illustrated by the work of school managers. From a panoramic perspective of managing a school for the purpose of innovation, school managers could employ the artefacts in Table 1 to implement educational and organisational activities as illustrated in Table 3. The essence of Table 3 is, as we saw in Table 2, to use the agency of the 'strengths model' and apply themes of 'educational aspects' and 'organisational aspects' to it in such a manner that we generate relevant ideas in line with such aspects.

Conclusion

This article has reported on an ongoing study conducted in Western Zambia which set out to explore how Lealui Basic School could be assisted in conducting contextualised environmental and sustainability education by means of a school open day and other curriculum activities. The specific objectives of the part of the study reported on here were, firstly, to explore the type of environmental and sustainability issues associated with floodplain artefacts that could be used for creating a localised curriculum for teaching and learning.

Secondly, the study sought to explore specific activities which the said school could engage in to enable its learners, teachers and community members to educate successfully by way of a school open day and related activities associated with the artefacts. The intention of the research was to explore the potential of the objectives noted above for contextualising and localising the curriculum in a manner that reveals the possibilities whereby 'learning as connection' is achieved, capabilities are recognised, and quality and relevance in education are potentially enhanced. Although the school open day and other activities that took place during course of the study have not been included in the report in this article, the article has shown that the artefacts have considerable potential for mobilising and supporting learning as connection. Through this, issues of quality and relevance are likely to result by developing the capabilities of learners, teachers and community members as explained in this article in relation to the floodplain artefacts in Table 1. Monitoring of this could be the focus of another research paper. School managers could also draw relevance from the artefacts by innovatively working with such artefacts to improve the management of their institutions. As for teachers, they could work through 'learning as connection' in the context of the questioning method in order to help their learners to make connections between a cross section of situations which are currently disconnected one from the other, such as the knowledge base of children, adults and elderly persons.

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Endnotes

1. A *katumbwa* is a small basket with a lid. The basket is kept by elders to hide some important personal items for them, items which should not be seen by youngsters. It is woven by both men and women.

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Learners' Experiences of Peer Tutoring in the Context of Outdoor Learning
The Case of a Primary School

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Abstract

The article explores peer tutoring in the context of outdoor learning at a primary school in Lesotho. The peer-tutoring approach was trialled to explore its effectiveness in promoting learning in large class sizes which characterise primary and secondary schools in Lesotho. An urban primary school was purposively selected for the study. The study involved 104 Class 6 learners as tutors, 86 Class 2 learners as tutees, and 8 teachers as facilitators. To determine the learners' perceptions on the peer tutoring and outdoor activities, focus-group discussions were employed. It is concluded that both the tutors and tutees responded positively to the outdoor learning activities and peer tutoring, but that the approaches need to be investigated further to establish tutor and tutee processes of interaction.

Introduction

From 1997 to 2010, the National University of Lesotho, the Lesotho College of Education and Durham University in the United Kingdom partnered in the Development Partnership in Higher Education (DelPHE) Project. This was a project sponsored by the British government that set out to explore effective and relevant teacher education in Lesotho in relation to numeracy, English literacy and education for sustainable development (ESD). This article is based on the ESD strand. Our particular interest in ESD was to build on the work done by the Lesotho Environmental Education Support Project (LEESP) from 2001 to 2003. The research team believed that, while the LEESP had introduced some significant environmental education concepts in the school curricula (Mokuku, Jobo, Raselimo, Mathafeng & Stark, 2005), it fell short of activities that engaged learners in outdoor learning.

Furthermore, the DelPHE team was concerned about the difficult circumstances in which many teachers in Lesotho schools had to work, in particular about the large size of many classes. As part of the government of Lesotho's initiative to improve access to education, free primary education was introduced in 2000, resulting in huge numbers of learners attending schools (World Bank, 2005). Against this background, peer tutoring was investigated as a teaching strategy that could optimise learning in large classes. Outdoor learning activities were considered complementary to peer tutoring, but also as significant in enhancing ESD in the curriculum.

Theoretical Underpinnings and Literature Review

Although innovative in the context of this study, peer tutoring is not a new idea. It involves drawing on the services of other learners in the same class, or in another class in the same school, to provide one-to-one or small-group support for learners (Fitzgibbon, 1992). The purpose is not to replace the teacher, but to find a way of supporting the teacher in developing pupil learning potential. Research indicates a number of benefits that peer tutoring can provide: It is an efficient and cost-effective way of supporting children's learning and can strongly reinforce the work of the teacher (Fitzgibbon, 1992). The strategy can also motivate both the tutors and the tutees, partly through the provision of individual attention for learners, and the act of tutoring itself provides an important learning opportunity for the tutors (Fitzgibbon, 1992; Tariq, 2005).

Cross-age/grade tutoring in particular has been found to develop social skills and discipline, especially among senior students, and to contribute to child-friendly schools (Greenwood, Carta & Hall, 1988). Communication, self-esteem, social interaction and a clearer sense of the learning environments are also improved (Topping, 1988). For tutorials to be effective, they should provide a non-threatening, supportive learning environment for the students, as this allows them to explore their own thinking (Schleyer, Langdon & James, 2005), and learners' motivation tends to increase when used together with 'group reward contingencies' (Johnson, Maruyama, Nelson & Skon, 1981; Slavin, 1985; Wentzel, 1999). Ryan and Deci (2000) have shown that peer tutoring works well for lower grades (1–3), and Rohrbeck, Ginsburg-Block, Fantuzzo and Mille (2003) have made similar positive observations about peer tutoring in challenging socio-economic situations.

In a context of large class sizes and poor resources, it was anticipated that an amalgam of peer tutoring and outdoor learning would create diverse learning possibilities in science subjects and ESD within a nexus of tutor, tutee and local environmental interaction.

'Outdoor learning' is learning that occurs outside the school building. It is significant in terms of 'bringing curricula alive, [and] it helps students understand our environment and related issues of sustainable development' (Beames, Higgins & Nicol, 2012:1). 'Sustainable development' involves development of an understanding among learners of the global implications of their actions with respect to resources such as energy and of the importance of taking responsibility for their actions (Beames, Higgins & Nicol, 2012).

Nielson (2009:140) argues that classrooms can be oppressive and that their 'walls are strong in keeping students comfortable with the idea that nature is outdoors and humans are separate from [the] environment'. Children also prefer learning outdoors than indoors (Waite, 2011). However, there is evidence that 'the indoors and outdoors may access different aspects of [a] child's personality and therefore may both be needed to provide holistic education for that individual' (Waite, 2011:76). The significance of lessons outdoors is to engage the class by way of numerous factors that shape their environment and wider society, and this 'allows the teacher/student dichotomy to be broken' (Nielson, 2009:145), as the teacher now explores new knowledge together with the learners. Teaching outdoors can, however, be difficult, particularly for novice teachers who might feel nervous and inadequate working with science and other

content in an outdoor context. Nevertheless, outdoor experiences often create enthusiasm and excitement among learners that can positively enhance the teachers' confidence (Carreir, 2009).

There is evidence that both well-organised, outdoor, subject-based lessons (Fančovičová & Prokop, 2011), as well as informal outdoor experiences (Rea, 2008; Waite, 2011) can benefit learners. Fančovičová and Prokop (2011) indicate that learners' attitudes to developing a knowledge of plants improved significantly following an outdoor-based biology lesson. Rea (2008) illustrates how more informal outdoor learning, in which learners construct their own meaning by exploring the environment and engaging in activities such as free writing and diarising of their experiences, can result in important benefits such as behavioural and attitudinal change, as well as increased confidence and assertiveness, among learners.

Outdoor learning and peer tutoring represent a shift from teacher-centred learning and whole-class activities to a more socio-constructivist approach to learning in this context. Outdoor learning is informed by context and values and represents a shift from technicist approaches to teaching and learning (Waite, 2011). From a socio-constructivist perspective (O'Loughlin, 1992; McRobbie, 1997; Waite, 2011), learning is not a simple transmission of knowledge from the teacher to the learner, but a complex construction of knowledge through dynamic class discussions, collaborative work, and activities that relate to learners' prior knowledge and experience (Vygotsky, 1978; Waite, 2011). With appropriate guidance from a more knowledgeable person, which post-Vygotskyian researchers describe as 'scaffolding' (Waite 2011), meaningful learning occurs. In peer tutoring, scaffolding may occur as learners discuss a topic and assist one another to construct meaning. Learning outdoors enhances knowledge retention, as learners make meaning in an enjoyable and positive emotional context and engage their varied senses in learning (Waite, 2011).

Methodology

The aim of this study was twofold: to explore the effectiveness of peer tutoring in large classes; and to investigate the impact of outdoor learning in a primary-school context. The study was guided by the following two research questions:

1. What are the learners' experiences of peer tutoring in the context of their participation in outdoor learning activities?
2. To what extent is peer tutoring appropriate for teaching and learning in a primary-school setting in Lesotho?

Selection of the case study school

This case study is located within an interpretive paradigm (Cohen, Manion & Morrison, 2007). It involved a peer-tutoring trial for two months in a primary school located in Maseru that had a population of about 800 learners (Classes 1 to 7).

The school was purposely selected owing to its proximity to the college where two of the researchers were based, thus enabling them to make regular visits in order to monitor developments. The head teacher of the school, the teachers and the Chairperson of the School

Board were approached about the study and were all keen to have peer tutoring trialled in their school. Eighty-six Year 2 learners were identified as tutees, and 104 Year 6 learners as tutors. These latter learners were chosen as tutors because they were older and therefore better positioned to help the younger Year 2 learners.

Data-collection method and analysis

After a two-month trial of the outdoor peer-tutoring activities, focus-group discussions were held with both the tutors and the tutees to evaluate the impact of these activities. The discussions were conducted in groups with a total of 20 tutors and 20 tutees, with each group having 5 members. The interviews were undertaken in the first language, Sesotho, to enable free communication with the learners. Two research-team members interviewed the tutors and the teachers interviewed the tutees, based on the teachers' advice that the learners might be uncomfortable if they had to communicate with the researchers. The learners' responses were written down as accurately as possible by the interviewers during the discussions.

The focus-group discussion questions for the tutors numbered 12 in all and sought to establish the following:

- The learners' views about their role as tutors;
- Their preferred and not-so-preferred activities;
- The extent of participation by the tutees and the lessons learnt;
- The benefits of peer tutoring; and
- Their views on how peer tutoring could be improved.

There were, on the other hand, only three simple discussion questions for the tutees. These sought to establish their preferred and not-so-preferred activities, as well as their preferred and not-so-preferred qualities of the tutors.

To analyse the data, the researchers typed out the handwritten learner responses, translated them into English and then organised them into the themes. The themes were interpreted in line with the reviewed literature and the research questions.

A description of the outdoor-learning and peer-tutoring activities that the learners were engaged in are described below in order to provide a background to the activities that were being evaluated.

Outdoor and peer-tutoring activities

The project team, comprising the whole DelPHE project team, introduced peer tutoring at the school for two weeks. This initial phase involved the planning of lessons based on Class 2 syllabus topics, as well as the engagement of an initial team of 20 learners as tutors. Following this phase, peer tutoring was conducted for two months: for the first two weeks, peer-tutoring activities were held once a week and, later, once every two weeks. Lesson duration was 40 minutes during the introductory phase and increased to one hour during the two-month period.

In the beginning, one tutor was allocated a group of four to six tutees, and, later, when the

remaining Class 6 members were incorporated, the number was increased to two or three tutors per group. The reason for increasing the number of tutors was to engage all the learners and optimise support for the tutees, and for the tutors to help and learn from one another.

Before each activity could be carried out, the tutors were briefed on the activity and on their expected role. During the activities, the teachers were also readily available to guide the tutors. At the end of each session, a reflective meeting was held with tutors to share their experiences and challenges, and to plan for the next activity. The actual peer-tutoring activities undertaken included the 'story stick', colour identification and camouflage, and simple-toy activities described below.

Story sticks

Story sticks are based on a Native American tradition (Lesson Pathways) and serve as diaries that record events for future recall or storytelling. They were used in the study to develop competencies in observation and oral communication skills. In this activity, tutees were asked to find a stick, to wander in the school grounds and to identify anything (e.g. animal hair, a seed, a piece of plastic) that they found interesting or which triggered certain memories. They then had to collect these items and tie them to the stick. As the tutors and the tutees walked around, they slowly wound some wool around the sticks to tie down the objects found, starting at the base of the stick. In this way, each stick was used to gather unique items recording learners' different 'journeys'.

Back in class, the tutees, guided by questions posed by their tutors, had to explain why they had selected certain items and what these items reminded them of. This encouraged the tutees to tell their individual 'story behind the stick' with reference to each of the items tied to it. At the end of the activity, different story sticks were displayed around the classroom as a reminder of the individuals' journeys.

Identifying colour and camouflage

This activity was based on tutees' awareness of colour in the environment and on the concept of camouflage. About 100 pieces of different-coloured wool were scattered among the vegetation in the school grounds. Some pieces were deliberately located against contrasting coloured backgrounds, others against similarly coloured backgrounds, and yet others against different backgrounds (e.g. on bare ground, in the trees or in the grass).

In this activity, tutees were expected to collect as many pieces of wool as possible and to tie each piece of wool through numbered holes in a card. This helped record the order in which the different pieces of wool were collected. Back in class, tutors led discussions about which colours were easily seen, the order in which the items were collected, and why this was the case. The discussions revealed the importance of colour in the environment, as well as of camouflage in relation to the survival of plants and animals.

Constructing simple toys and other items

In this activity, the tutors worked with the tutees to collect different materials, for example plastics, tins, and clay soil from the school environment. With the help of their tutors, tutees

used the materials collected to make different types of simple objects and toys, for instance ashtrays, balls, skipping ropes and clay models. Papier mâché was also made from collected paper in order to mould a variety of items. Some of the intended outcomes of the activity were that learners would appreciate how the reuse and recycling of materials found in the environment can address the problem of littering on schools grounds.

Findings

This section outlines the responses of the learners following the peer-tutoring activities. The responses are organised into six themes as indicated below.

Theme 1: Views about their new role
The tutors had varying views about their new role, and their feelings were mainly a mix of delight, nervousness and calmness about their new role. Responses included the following:

- I felt happy and relaxed.
- I was nervous at first, [but] then I felt relaxed.
- I did not know what to say, but, after we were told what to say, I felt relaxed.
- Initially, I [was frightened], but I was eager to learn.
- I didn't know what to expect.
- I was happy to be elected as a tutor.
- I was happy [that the] Sesotho language [was used] during the peer-tutoring sessions.
- [I was] frightened, because it was the first time [that] I was engaged in helping the young ones to learn.

Theme 2: Tutor/tutee relations
Many responses indicated that tutors appreciated their tutees' positive responses and their willingness to learn during the sessions. Their responses included the following:

- I liked [it] when they responded to [our] questions.
- Some understood activities easily.
- They were not playful, but were eager to learn.
- They were attentive.
- Not all of them were participating, but others responded well.
- Tutees were supportive of [one another].
- I liked guiding them, as they were eager to learn.

There were also views suggesting that the tutors learnt from the tutees and that some tutees did not cooperate:

- I liked [it] when they explained to us things we did not know. [For example], we did not know what other hats were made of, and they told us that they were made of plastics.

- They looked down [on] me because most of them are my playmates; so [they] did not take me seriously during the sessions.

In their descriptions of what they liked about the tutors, the tutees mentioned attributes that mattered to them, such as the tutors' patience, and their commitment to assist them and answer their questions.

- The tutors were very patient with us and they managed to control us when we lost concentration.
- The tutors had time to respond to our questions and we felt free to ask questions.
- They did their best to help us understand the activities we were dealing with.

The tutees also welcomed the freedom the tutors gave them to do the activities: 'They let us do the activities on our own [and] only [assisted] where we needed their help.' Tutees also had views on what did not make for a good tutor, and this concerned how tutors related to them:

- If we happened to lose concentration while doing the activities, the tutors did not deal with that; rather, they continued to do the work with those that were concentrating.
- Our tutor pinched [our] ears if we started to play.
- Some of the tutors ignored us if we did not understand the activity [that] we were supposed to do and tended to work with those who understood quickly.

Theme 3: Preferred activities

The tutors' responses suggest that they mostly enjoyed two of the three activities described above, namely the story stick and simple-toy activities:

- I liked the story stick, because I didn't know that one can use things to [tell] a story.
- [I liked] using litter to make useful materials, e.g. toys.
- [The] modelling activity was an eye-opener [for] me, as I was not aware that waste material could be used to make useful materials.

Of the three activities, one tutor mentioned the story stick as an activity that they did not enjoy, because the group they worked with 'struggled to understand it'. The same activity was not on the list of tutees' preferred activities. Instead, they mentioned only activities such as the following:

- Collecting wool and sorting it according to different colours.
- Recycling, because, after collecting all the paper and tins which were scattered [about], we made useful items like decorating materials, balls as well as ashtrays.

Theme 4: Perceived knowledge gains

Varied responses were elicited, suggesting some knowledge gains in science – although not all the knowledge gains were science-specific; most were related to more general aspects of learners' awareness and the use of litter, and how to work with the tutees. The third response below was specific to science knowledge. Responses included the following:

- I learnt that we should not throw away paper and plastic.
- We can collect rubbish [using] a story stick.
- I have learnt that plastics are useful if we do not burn them. We should collect them and use them, because, when we burn them, we pollute the atmosphere.
- Mashed paper can be used for [making] ornaments.

The tutors also thought the activities were a new and different way of learning science:

- Normally, science lessons are based on book knowledge, but, through peer-tutoring sessions, we [were] introduced [to a] hands-on approach to learning science.
- Activities were hands-on and we were introduced to finding information on our own.

Further knowledge gains mentioned by the tutors relate to their approach of caring for the little ones:

- I learnt to look after the little ones.
- [Our] approach to young ones has improved.

Theme 5: Perceived benefits of the outdoor activities in learning other subjects

Most learners found it challenging to identify subjects that they thought could be enhanced by the activities. This was evident from their silence in this regard. A few responses elicited suggest a potential benefit of the outdoor activities to Sesotho and health education:

- [Sesotho:] I have learnt some new names of plants in Sesotho.
- [Health education:] [I have learnt about] colours to be worn to promote road safety.

Theme 6: Personal development and performance

Regarding their personal improvement and performance, tutors mentioned their increased willingness not to pollute and their increased recognition of the possibilities for the reuse of waste, as well as both improved confidence in class and improved performance in other subjects.

- I can now tell other people not to pollute the environment.
- What has changed in me [is that,] if I cannot afford to pay my school fees, I can make things [using litter] that I can sell.
- They [the activities] have contributed [to] improving my performance in other subjects.
- They [the activities] have boosted my confidence.

- [I have] improved in sounds and spelling.
- [I] know most of the young ones better than before.
- [The activities have given] me confidence to talk in class.

Concerning performance, specifically in science, the tutors believed that they had benefitted in terms of remembering things they did, their improved participation and performance in science lessons, and in developing courage to answer questions:

- If we are asked a question in class, we will remember certain things that we have made.
- My performance has improved because I now score better marks.
- They [the activities] [have] helped me to participate in class.
- [I am less afraid] to answer questions in class.

Discussion

Outdoor learning and ESD-related knowledge

The learners indicated that, as a result of the activities, there had been some gains with regard to their scientific and environmental knowledge. The tutors' knowledge that burning litter causes air pollution and that litter should be reused instead is significant, given that litter is generally burned in schools. Some learners thought the activities made them better people and capable of advising others not to pollute. Tutees mentioned the collection of litter, leaving their school grounds clean, and becoming aware that they should not litter, as gains. The learners began to appreciate the implications of their actions and to be aware of their responsibility to keep the school grounds clean (Beames, Higgins & Nicol, 2012). Recognition of the impact of littering on school grounds is an important ingredient of ownership of the learning environment. Ownership involves believing that one's views matter and that taking part in decision-making in the school can lead to improved classroom performance by learners (Waite, 2011).

Apart from raising awareness of littering, the other intended outcomes of the story stick were the development of the learners' observation and oral communication skills. That the learners did not mention these benefits resonates with Waite's observation that 'play, especially with younger children, is an essential mode of learning, but children and staff may not always recognise alternative modes as "learning" unless they share characteristics of the formal' (Waite, 2011:67). The tutees did not include the story stick among their favourite activities, but the tutors liked the physicality aspect of the activity.

The colour-identification activity did not register as interesting to tutors, but was on the list of tutees' preferred activities, perhaps because of its play-like simplicity. Its value was mentioned in relation to wearing appropriate colours for road safety. The scientific aspect of the significance of colour in adaptation was somehow lost in the play-type activities.

Alternative pedagogy

The question whether tutors thought that the peer tutoring had introduced them to different ways of learning science was a higher-order question and was not easy for most tutors to answer.

However, some tutors stated that the activities allowed them to do things using their own hands, instead of learning science from the textbook. A shift from a textbook to experience at an early age is significant in developing appreciation of, and a caring attitude to, the environment (Palmer, 1998; Beames, Higgins & Nicol, 2012). The physical outdoor activities led by learners, such as the collection of litter to make toys, can support creativity among learners (Waite, 2011). Such creativity is quite rare and is limited in conventional whole-class teaching contexts.

Scaffolding and knowledge construction

While many tutors looked forward to their new tutorship role, some expressed feelings of nervousness or fright about being tutors. Carrier (2009) makes a similar observation with regard to pre-service teachers with limited outdoor teaching experience. Their confidence, states Carrier, was developed by engagement in outdoor teaching and by their recognition of learners' positive responses to their lessons. The knowledge gains that the tutors and the tutees made suggest that the peer-tutoring activities created opportunities for their engagement in an active process of co-construction of knowledge (Waite, 2011). Knowledge was not necessarily transferred from the tutors to the tutees, but was created by a nexus of interactions among the tutors, the tutees and the activities. The tutees assisted one another, as the tutors stated, and the tutors learnt from the tutees, thus affirming that the act of tutoring can provide an important learning opportunity for tutors (Fitzgibbon, 1992; Tariq 2005). In a sense, the outdoor learning activities broke down the initially envisaged tutor–tutee dichotomy as a result of the numerous factors that were brought into play (Nielson, 2009). There can, however, be challenges in levelling the power relations between 'teachers' and the 'taught' in this way. Tutors who might perceive their role as needing to teach as they themselves are taught in conventional teacher-led settings may be daunted by feelings of inadequacy and that they will not be respected by their playmate tutees – as some felt in this study. This emulation of what they mistakenly perceived as the teacher role is evidenced by tutors physically punishing the tutees by pinching their ears when they did not understand or lost concentration, behaviour which negates the creation of a non-threatening, supportive learning environment (Schleyer, Langdon & James, 2005).

The social relations among the tutors were on the whole positive, as evidenced by the expression of their views about one another. The tutees appreciated the tutors' assistance, as well as the fact that they were patient with them and answered their questions. This individual attention, which is rare in normal whole-class lessons, is an important motivation for learning (Fitzgibbon, 1992). Tutees were also allowed to do activities on their own, which created an opportunity for 'freedom and fun' (Waite, 2011), an outdoor learning value associated with less tightly structured activities that provides rich learning opportunities. This new learning space provided learners with the freedom to communicate in their mother tongue, a liberty from a usually inhibiting use of English as the language of instruction and one which the tutors found pleasing. Paradoxically, some tutees were concerned that the tutors did not keep them concentrating on the task, thus reflecting their (the tutees') conditioned dependence on the 'teacher' instead of taking responsibility for their own learning. By seeking to be controlled, they ironically 'negated' the potential new freedoms provided by an alternative learning environment. As shown by the specific scientific knowledge gains versus the other gains of

socialisation, confidence-building, and so on, it would seem that the pedagogical strategy developed here was stronger on the latter than on the former, which is to be expected, as learners (peers) may not have access to the wider body of scientific knowledge that needs to be mediated within a wider science education curriculum. The benefits of the lessons seem therefore to be more in the alternative pedagogical practices and experiences than in the substantive acquisition of scientific knowledge as a whole.

Development of social skills

The learners developed varied social skills through the peer-tutoring activities. Some tutors mentioned learning how to approach and take care of the little ones. Others stated that peer tutoring had boosted their confidence, had given them confidence to talk in class or had helped them to participate in class. Yet others believed that they knew most of the young ones better than before. Similar observations of learners developing self-confidence and improving their self-esteem have been made about peer tutoring (Topping, 1988) and are characteristic of cross-age/grade tutoring among tutors (Greenwood, Carta & Hall, 1988). These are essential personal aptitudes for learning that are not easily attainable through the traditional, whole-class, teacher-centred methods.

Conclusion and Recommendations

The learners' experiences of peer tutoring in the context of their participation in outdoor learning activities affirm some of the benefits of peer tutoring. The strategy has the potential to support meaningful learning as well as improve learners' self-esteem, communication skills, and many other social skills. The application of this strategy in Lesotho primary schools, which are characterised by large class sizes and very limited teacher–learner interaction, could be highly beneficial in terms of the facilitation of tutees' meaningful learning and the development of tutors' academic and social competencies. While it is recognised that such strategies cannot take the place of qualified science teachers, it is to be noted that they can help with complementary teaching and learning experiences that extend what science teachers can offer learners.

It is recommended that further research on peer tutoring be undertaken. The studies could be multiple case studies that investigate in depth the processes of interaction of tutors and tutees and the extent to which meaningful learning of the subject matter is achieved.

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The Effect on Attitudes of Particular Teaching Methods Used in an Environmental Education Programme

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Abstract

Environmental education programmes should be designed to inspire learners and have enough impact to change learners' attitudes to environmental issues. These programmes can use a variety of teaching methods – some take the form of lectures, while others allow for group participation. The question arises whether the particular teaching method that is used could have an effect, or can influence, learners' attitudes. Attitudes are complex and appear to be a consequence of life experiences. Through active involvement, an attempt can be made to intensify those experiences and create a lasting impression that may alter attitudes. This investigation compared the contribution of the lecture method and collaborative learning used in an environmental education programme with the development of positive attitudes on the part of learners who participated in the programme. The findings suggest that, though both methods are effective in changing attitudes, the lecture style did allow for a greater change in attitude over the three-month period. Possible reasons for this unexpected finding are proposed.

Introduction

The goal of any environmental education programme should be to inspire and provoke thought and to spark the interest of learners in the hope of encouraging positive attitudes to the environment (Kuhar, Bettinger, Lehnhardt, Townsend & Cox, 2007:161). An attitude can be described as an enduring positive or negative feeling about some person, object or issue (Newhouse, 1990:26). The essential feature of an attitude is the readiness for response (Cushman & McPhee, 1980:2). However attitudes are complex. Cunningham, Packer, Kesek and Van Bavel (2012:486) point out that the earliest definitions of attitudes were thought to invoke readiness for behavioural action, and, as such, had physiological consequences supported by emotional states. Because activation of an attitude leads to an emotional reaction, one could understand a person's evaluative state by monitoring bodily responses. However, 'attitude' encompasses all pre-existing evaluative information a person has owing to prior learning, whether directly experienced or socially communicated. Although evaluations are constructed from multiple representations and contexts, this does not imply that attitude representations are constructed (Cunningham et al., 2012:488). This makes determining an attitude a difficult task, especially if respondents 'fake' their replies and give socially desirable responses (McLeod, 2009), which then affect validity. This needs to be kept in mind when trying to determine an attitude to something.

In an effort to do this, Newhouse (1990:28) relates attitudes to four entities: a target, an action, a temporal reference and a situational reference. Because an attitude is a positive or

negative feeling, it needs to relate to a target, and, when an attitude is the readiness for response, there will be an action that requires a reference. Attitudes generally seem to be a consequence of life experiences rather than being related to any set programme, but repeated exposure to a particular stimulus enhances an attitude to an object (Newhouse, 1990:29). Consequently, a learner's attitude to the environment will depend on experiences of a particular environmental stimulus. The media creates awareness of global issues through news broadcasts and magazine articles, but these seldom relate to local environmental issues, and, as a consequence, young people may be more concerned about issues at a global level than about those of a local nature (Yeung, 2004:101). This is a cause for concern, as it is generally at local level where individuals can make an impact. If learners can relate to, and are exposed to, local environmental issues, this could influence their attitude to those particular issues and lead to action to address these issues.

Vermunt and Vermetten (2004:361) describe how active involvement during the learning process affects emotions that may arise during the learning experience and result in a change in attitude or behaviour. A direct experience results in greater attitude–behaviour consistency than an indirect experience, thus making more information available, and, in so doing, allowing for a more positive environmental attitude. Direct experiences may cause an individual to focus on a particular behaviour and may therefore promote a positive attitude. Through the repetition of the more positive behaviour, the associated attitude may be more easily or accurately remembered. Newhouse (1990:130) describes how, at the schooling level of Grades 5 to 8, there is an increase in cognitive and factual understanding regarding attitudes to animals. Therefore, if one introduces the handling and observation of animals in an environmental education programme to illustrate the importance of conservation and biodiversity, one would expect a positive response in the learners' attitude to animals, and, therefore, a positive response to the conservation of those animals and their habitat. If this is applied in practice, learners who, for example, have the opportunity to interact with live marine animals or dried specimens may have a long-lasting memory of the experience that could affect their attitude in future situations. Keeping the preceding in mind, the question arises whether particular teaching methods could contribute to the development of a positive environmental attitude. Is one teaching method better than another for the realisation of a positive environmental attitude?

Lectures versus Collaborative Learning

The lecture method appears to be the least appropriate when learning objectives relate to developing a change in feelings, emotions or attitudes, because it provides little opportunity for learners to interact with one another or with the teacher (Westwood, 2008:19). Often, lectures outlast the attention span of learners and are frequently considered boring, as learners are expected to passively receive information delivered to them in a particular way (Eggen & Kauchak, 1996:215). Additionally, learners tend to lack the necessary confidence to ask questions when in a large group (Westwood, 2008:21). There are further limitations to this method, such as the possibility that individual learners differ with regard to prior knowledge, experience and motivation, and it is not always possible to determine whether every learner has understood the content of the lecture (Westwood, 2008:21).

Alternatively, cooperative learning allows for intense personal involvement when learners participate in tasks, also encouraging open communication (Lord, 2001:32). This method promotes face-to-face interaction and group processing, and focuses the learners' attention on the content. Learners actively process content and their learning often incorporates a varied use of materials and resources such as visual media, experiments or the use of live or real material where possible. It thus allows learners to learn from their own active processing of information using a range of authentic resources (Westwood, 2008:35). As one of the objectives of environmental education programmes should be to try to foster awareness of, and compassion for, animals and their natural environments, the interactive style of cooperative learning may be considered ideal. Yet, according to Langen and Welsh (2006:600), there is limited quantitative data to support the experiential and active learning process in terms of improving change in attitudes to the environment. Consequently, there is a need for more research on closing the gap between environmental teaching methodology and attitude change. The following questions therefore guided this investigation:

1. How do lectures and collaborative learning compare with regard to their influence on attitude change?
2. What is the influence of these two methods on attitude change before and after an environmental education programme is presented?
3. What would the long-term effect (after three months) of lectures and collaborative learning be on attitude?

Method

Data was collected using a questionnaire with statements that were rated on a five-point Likert scale. The initial questionnaire was piloted with a group of 54 Grade 7 learners from a school with learners of a similar socio-economic background to those of the sample population, but who were not involved in the actual study. The pilot questionnaire initially had 30 attitude statements. This allowed for the possibility of removing unsuitable statements. A correlation was run between the response score of each learner on each item, and the scores of each across the whole scale. Increased correlation indicated a stronger relationship, so only questions with a score of 0.5 were used. The results of the correlation allowed for the removal of, or changes to, questions that might have been poorly worded or where there might have been ambiguity. The statements with the lowest correlations were removed, and two were reworded, resulting in a questionnaire with ten statements. All questions were phrased in such a way that 'strongly agree' showed a favourable response and 'strongly disagree' suggested a negative response. This scale was used to measure the learners' attitudes to environmental issues that were covered by the lesson. These included water usage, food resources and the food web, biodiversity, human impact, litter and pollution, and how people can make a difference. A second pilot test was not conducted, but the questions were reviewed by an outreach coordinator who had an understanding of the learners' language capabilities.

The sample selection focused on the target population from the eThekwini municipal area in KwaZulu-Natal, and a two-stage sampling technique was used to select schools involved in an outreach programme sponsored by Natal Portland Cement (NPC) and offered by the uShaka Sea World Education Centre. First, stratified sampling was done by dividing the area into five regions: a central area, a northern area, a southern area, an inland area and a coastal area. This was followed by simple random sampling of the strata. One school was chosen from each area, with a total of 504 Grade 7 learners, who ranged from 10 to 15 years in age, participating in this study. These learners were from similar socio-economic backgrounds.

Data was collected over five days, with each school being brought in on a different day. The selected sample of learners from each school was randomly divided into two groups, Group A and Group B. Each group completed a pre-session questionnaire, which covered specific environmental topics relating to the lesson that followed. This data was used to obtain an indication of learners' prior attitudes to environmental issues. The questionnaire was completed in the presence of a uShaka Sea World Education Centre educator. Each learner responded individually, although the questions were read aloud to guide learners and to eliminate the possible influence of poor reading abilities.

Each group then attended a lesson on how people rely on the environment to survive, on the role of the marine environment and on why sustainability is important. The topic for the lesson was linked with the Natural Science Curriculum Core Knowledge Concepts of 'Life and Living'. Group A was exposed to a teacher-centred strategy using the lecture method (Method 1). A PowerPoint® presentation was given during the lecture on resources used by humans. The presentation portrayed the idea that people need these resources in order to survive, and that the choices people make impact on these resources and on the environment. The presentation also looked at steps individuals can take to help solve related problems.

Group B was exposed to a learner-centred strategy resulting in cooperative learning (Method 2). This group was subdivided into six groups of approximately ten learners per group. The learner-centred lesson was based on the same topic as that of the lecture, but the presentation of material was different. This lesson used picture cards to determine what resources are essential for people to survive. A game was played to illustrate the impact of humans on the environment, and another game highlighted positive environmental choices.

After the learners had completed their respective lessons and had been taken on a guided tour through the aquarium, they were given a post-test questionnaire containing the same questions. Three months after their visit to the uShaka Sea World Education Centre, the learners were visited at their schools and given a second post-test questionnaire. The design of the three questionnaires was intended to provide an indication of both the short- and longer-term effects of the lesson in terms of attitude change.

Data Analysis

The ten statements rated on the five-point Likert scale covered the full scope of the lesson. Learners would obtain a single attitude score on the basis of the ratings they selected, with a minimum score of 10 and a maximum score of 50; 10 is viewed as being more environmentally

positive and 50 as being more environmentally negative. Microsoft Excel and Statistica were used to perform parametric statistical analysis on the data collected. The pre-test and post-test questions were entered on an Excel worksheet, were then transformed into a Statistica worksheet, and the variables were named.

The pre-test and post-test design has the potential to control threats to internal validity and increases statistical power precisely because of the inclusion of pre-test data. However, it is acknowledged that the issue of how data from pre-test and post-test groups should or should not be analysed has been questioned and discussed over a lengthy period (Dugard & Todman, 1995:181). During this research, analysis included the measurement of the raw data to determine the average, distribution and spread of the data sets. A normality test was done to determine if the frequency distribution of values from the different ranges of the variables was symmetrical, therefore indicating a normal distribution of data. A Levene's test was then done to determine the absolute deviations of values from the respective group means, therefore indicating that the variances in the different groups were equal. If this is the case in both instances, the assumption can be made that the data is normally distributed and parametric tests can be applied.

A t-test was performed to compare the differences in the means (Tuckman, 1999:300) between the pre- and post-test scores of learners, as well as the pre-test and delayed post-test scores of the learners for both groups. The tests were done collectively for all data and then individually for each participating school.

Results

Preliminary inspection of the data using a normality test showed that the sample test scores followed a normal distribution, and the Levene's test indicated that the variances in the groups were equal (Table 1).

Table 1. The p-values and skewness scores for the pre-test, post-test and delayed post-test scores for normal distribution

Data group	p-value	Skewness
Pre-score	0.31321	-0.039399
Post-score	0.04174	0.175996
Delayed score	0.00000	0.867102

This implies that the learners in the two groups may be considered as being equal to one another before any tests were conducted, therefore eliminating any prior biases.

When looking at the two methods (Method 1 – Group A and Method 2 – Group B) individually, the results shown in Tables 1 and 2 were obtained.

When comparing the two methods, the data shows that there is a significant difference for the delayed post-tests, as reflected in Figure 1.

Table 2. Learners' attitude scores from the sample t-test for pre-test, post-test and delayed post-test scores for Group A (Method 1)

	Pre-test	Post-test		Pre-test	Delayed-test	
Group A	**Mean**	**Mean**	**p**	**Mean**	**Mean**	**p**
Total	23.78	21.43	0.00000**	23.78	22.29	0.00815*
School 1	24.50	24.94	0.622	24.50	23.25	0.365
School 2	23.58	21.50	0.062	23.58	22.04	0.204
School 3	26.33	22.85	0.000204**	26.33	21.23	0.000009**
School 4	16.62	15.51	0.2135	16.62	20.06	0.024705*
School 5	27.83	23.41	0.000001**	27.83	24.90	0.001437*

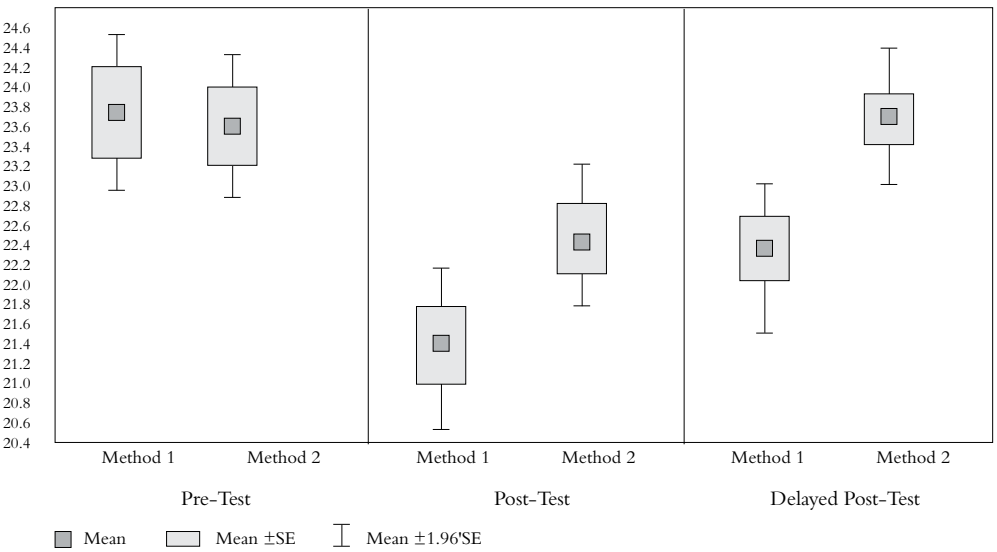
Mean: Possible attitude score range from 10–50 *p<0.05 **p<0.001

Table 3. Learners' attitude scores from the sample t-test for pre-test, post-test and delayed post-test scores for Group B (Method 2)

	Pre-test	Post-test		Pre-test	Delayed-test	
Group B	**Mean**	**Mean**	**p**	**Mean**	**Mean**	**p**
Total	23.71	22.51	0.00729*	23.71	23.77	0.884
School 1	25.57	25.30	0.717	25.57	25.47	0.893
School 2	24.43	22.38	0.0206*	24.43	22.64	0.0597
School 3	25.31	24.20	0.374	25.31	24.00	0.192
School 4	17.40	15.44	0.0525	17.40	22.15	0.000155**
School 5	25.31	24.75	0.5699	25.31	24.65	0.518

Mean: Possible attitude score range from 10–50 *p<0.05 **p<0.001

Figure 1. Box-and-whisker plots comparing attitude scores for Method 1 (lecture) with Method 2 for pre-test, post-test and delayed post-tests



Discussion of Results

The results for Method 1, the lecture method, as reflected in Table 2, show that there is a significant difference ($p = 0.00000$) between the pre-test and post-test score for the total Group A. This suggests that the average mean of the attitude score decreased significantly, showing that there was a positive change in attitude between the pre- and post-test for Group A. The inference made is that the lecture method (used with Group A) had a positive influence on the learners and that their attitudes were more environmentally positive after the lesson. A similar trend was noticed with Schools 3 and 5, while Schools 1 and 2 showed no significant difference between pre- and post-testing. School 1 is very much a rural school that may not be significantly affected by environmental impacts. These learners' attitudes to the environment may already be positive, as they have limited resources and are possibly more conscious of those resources that they do have. School 2 is a peri-urban school and learners in this school may also be more conscious of their environmental resources. Both of these schools have fewer learners compared with Schools 3, 4 and 5. School 4 showed no significant difference for the pre- and post-test, which may suggest a lack of empathy for the environment, as these learners live in the heart of the city.

When comparing the means of the pre-test and delayed-test scores for Method 1 (Table 2), there was an overall significant difference ($p = 0.00815$) between the pre-test and delayed post-test scores, suggesting that there was still a significant change in attitude three months after the learners attended the environmental education programme, as there was a drop in the mean attitude score. As the attitude score was measured on a Likert scale, with 1 measuring a positive and 5 a negative environmental attitude, a low score or a decrease in the mean attitude score could imply that a more positive attitude score was obtained. When considering individual schools, Schools 3 and 5 showed a significant difference for the pre-test and delayed post-test scores, while Schools 1 and 2 showed no significant differences between the pre-test and delayed post-test scores. This may again be due to the fact that these two schools may not be heavily impacted upon by environmental issues such as litter and water pollution, and many of these learners live in communities that grow their own food. It is possible that these learners are more conscious of where their food comes from, resulting in a stronger environmental awareness. As an increase in the mean attitude value from the pre-test to the delayed post-test shows a significant decrease in positive environmental attitude, the attitude of the learners from School 4 was actually poorer three months after the use of Method 1.

Method 2 also showed an overall positive attitude change between the pre- and post-test, suggesting that this method may also be effective in changing attitude in the short term. However, there was no significant difference in attitude change between the pre-test and delayed post-test, suggesting that Method 2 had little effect on attitude change after three months and is therefore less effective for long-term attitude change. Table 3 shows that, when comparing the means of the pre- and post-test scores for Method 2, it was found that, overall, the total group showed a significant difference ($p = 0.00729$) between the two scores, with a lower than average mean. This suggests a positive change in environmental attitudes. One may therefore deduce that, over a short-term period, participating in an interactive lesson can

increase learners' environmental awareness enough to change their environmental attitudes in a more positive way. This trend was apparent in School 2, but there was no significant difference between scores for Schools 1, 3, 4 and 5.

When looking at the long-term effects of Method 2, it appears as though this method has little impact on the long-term effects of learners' attitudes to environmental issues. In Table 3, the means for the pre-test and delayed post-test scores showed no significant difference ($p = 0.884$) for the total group, and similarly for Schools 1, 2, 3 and 5 individually. School 4 did, however, show a significant difference between the pre-test and delayed post-test scores with $p = 0.000155$, but the average mean for School 4 was higher in the delayed-test score compared with the pre-test score, which implies that environmental attitudes had become weaker compared with the pre-test evaluation. The implication is that, before the learners participated in the cooperative lesson, they had a more positive attitude to the environment compared with the situation after they had participated in the lesson.

The results are illustrated in Figure 1 by means of box-and-whisker plots for Method 1 and Method 2 for the pre-test, post-test and delayed post-test scores. The pre-test values show no significant differences, which is to be expected, as this indicates that all learners were of the same attitude base when they started the programme. The post-test scores showed no significant difference ($p = 0.051$) for the total group, which may indicate that neither method was more effective than the other in creating attitude change in the short-term period. It could be that it does not matter which method is used, as it appears as though neither is more effective in order to change attitudes in the short term. However, the results indicate that Method 1 does promote a positive change in environmental attitudes in the long term (after a three-month period), as the delayed-test scores showed a significant difference between the two methods for the total group, favouring Method 1 over Method 2 in creating more positive environmental attitudes. Figure 1 reiterates that, for the total group of learners, there is a positive change in environmental attitudes when using Method 1 from the time of taking the pre-test to completing the post-test and the delayed post-test. Method 2, by comparison, only shows a positive change in environmental attitudes from the time of taking the pre-test to completing the post-test. There is no significant difference in attitude change when comparing the pre-test and delayed post-test results for Method 2, suggesting poor long-term effects on attitude change of learners. Consequently, it can be deduced that either method could be used to influence environmental attitudes in the short-term period, but, to create a long-lasting effect on attitudes to the environment, Method 1 may be the more successful for these particular learners.

Conclusions and Recommendations

The results of this study suggest that lectures could be more effective in the long term when considering the development of positive environmental attitudes. This finding is unexpected, but raises the importance of the attitudes and emotions of the learners, as well as their background and life context that have to be considered for the programme to be a success. Learning is a process of relating new information to previously learnt information (Ormrod, 1990:151), and learners understand better when concepts relate to other concepts that they

know (Taylor, 2002:154). It is therefore important that the learners are familiar with the materials used in the programme, as learners need to find personal relevance to what they learn to be able to connect with the concepts presented to them. Athman and Monroe (2001:39) describe how content is more effective if conveyed when embedded in a local context, giving learners a chance to explore what is around them. The most powerful experiences in our lives are not those designed to educate, but rather life experiences (Newhouse, 1990:27), and attitude is linked to 'situational reference from life experience' (Newhouse, 1990:28). If this is true, then it is very important to consider the learners in their daily life context. The resources that are used should be related to the setting and understanding of learners.

It is also necessary to focus on the ability to reflect on an experience that may influence the bridging between the experience and the theoretical concept being taught (Gibbs, 1988:9). In this particular study, a lack of understanding of certain marine concepts may inhibit reflection and therefore be lost or forgotten. It is therefore recommended that the visiting school be provided with some base or background information that the teacher can cover with the learners before their visit so as to enhance their experience.

It is also recommended that, prior to the learners participating in the environmental education programme, further information be obtained about the teaching methods used predominantly at a particular school to ensure that the most effective teaching method is selected for that particular group. This could enhance their experience and therefore make it more effective in creating a positive change in attitudes to the environment in the long term.

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Exploring Opportunities for Mainstreaming HIV/AIDS in the Secondary-school Curriculum as an ESD Strategy

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Abstract

Education for sustainable development (ESD) embraces a variety of social- and environmental-health concerns, including the impact and implications of HIV/AIDS in respect of schooling and the quality of life of children and their communities. In this study, the researchers adopted a qualitative case study approach in which a school (Parirewa High School and its community in Domboshava) within a growth-point community in Zimbabwe was purposively selected because of its uniqueness as an information-rich source for HIV/AIDS and ESD interactions.

The objective was to work with teachers in order to develop their capabilities and agency, thereby animating them to effectively integrate HIV/AIDS education in the formal school curriculum in a bid to reduce the negative impacts of HIV/AIDS on the quality of education and quality of life of vulnerable youths. Data was collected from 50 teachers by way of interactive workshops, focus-group discussions, document analysis, face-to-face interviews, observations and open-ended questionnaires.

The findings suggest that, although teachers may be willing to embrace vulnerable learners in their teaching and change the way they teach and relate to their learners, there are a number of constraints. These include stigmatisation of those who teach the subject, a lack of knowledge and skills on how to deal with the sensitivity and the special needs created by HIV/AIDS, attitudes of society to the infected and the affected, and lack of support structures within the school. However, after participating in capacity-building activities, teachers realised that the issue of HIV/AIDS can be integrated into any subject if teachers are taught how to mainstream, are prepared to change the way they perceive their roles, their subjects and their learners, and are committed to making a difference in the lives of the learners they teach.

Teacher education thus needs reorientation in order to embrace skills necessary for teaching in contexts of risk, vulnerability and uncertainty. Further, it needs to embrace life skills education and ESD techniques for creating child-friendly schools and for bringing about healthy environments for both physical and psychosocial support within the school system. The study recommends that school administrators embrace HIV/AIDS and life skills education in the way schools are run and managed. In addition, relevant authorities should design legislation on mainstreaming HIV/AIDS so that the teaching of HIV/AIDS takes a whole-school approach. The conception of quality education and teacher competency need not be narrowly defined by learner pass rates alone, but may incorporate creativity and innovativeness and contribute to the creation of a better world.

Contextual Background

This article is an extract from a study that sought to enhance teachers' capacities to effectively integrate HIV/AIDS education, within a wider ESD framework, into the school curriculum in a bid to reduce the negative impacts of HIV/AIDS on the quality of education and hence the quality of life of vulnerable youths. In the wake of increased environmental, social and economic (i.e. sustainability) challenges, education institutions have been challenged to take a leading role in providing quality and relevant education that is responsive to learners' needs and which animates people for positive social transformation (Kasembe & Moonga, 2009; Government of Zimbabwe, 1999). Such education has been referred to as education for sustainable development (ESD). ESD aims to empower citizens to act with a view to bringing about positive environmental and social change (UNESCO, 2005), adds to the quality and relevance of education, and improves innovation in the education systems (Lotz-Sisitka, 2011).

Zimbabwe, like many other countries in southern Africa, faces a number of environmental, socio-economic and sustainability issues, including that of HIV/AIDS. With the HIV/AIDS prevalence rate at 14.3%, Zimbabwe is rated among the worst-affected nations in southern Africa and the world (UNDP, 2009; UNICEF, 2011). HIV/AIDS has caused immense human suffering, including, but not limited to, the loss of loved ones and the breaking up of families. Although Zimbabwe boasts a rich cultural fabric, social bonds have lately been threatened by the challenges posed by HIV/AIDS. Chief among the social effects of HIV/AIDS is the increasing number of children infected with, and orphaned by, the disease and who have to take up the responsibility of caring for sick parents/relatives (ZPRF, 2003). These vulnerable and orphaned children may be stigmatised and can suffer great trauma. Such children eventually end up in school, where the teachers are not formally trained to deal with the challenges posed by the socio-economic, socio-ecological and/or psychosocial aspects of HIV/AIDS in the classroom. What is more, teachers themselves may be infected or affected in one way or another, and this makes the whole issue even more complex to address. By their nature, sustainability issues are extremely complex and are highly contextual and contested; hence they have considerable implications for education – and the issue of HIV/AIDS is no exception.

In response to the HIV/AIDS pandemic, the Zimbabwean government initiated a number of projects and programmes to curb the pandemic. One such programme is the Schools AIDS Programme, launched in 1994, which was meant to integrate HIV/AIDS into the national education system. The Zimbabwean Ministry of Education, Sport, Arts and Culture (MoESAC) developed policy guidelines for schools that made it mandatory to devote one class period per week to the teaching of HIV/AIDS as an integral part of Guidance and Counselling. Textbooks and syllabi were developed covering a range of topics, including making friends, increasing self-esteem, and coping with unplanned pregnancy and sexual pressure. What is noteworthy is that this programme was mainly meant to spread messages of HIV/AIDS prevention and care. However, young people need more than just facts about HIV/AIDS and sexuality. They need skills to deal with conflicts, to stand up to the influences of peer pressure, and to deal with other socio-ecological aspects of HIV/AIDS, such as food security. More importantly, they need to know how to deal with the challenges posed by HIV/AIDS. They need to learn to build

resilience, to adapt, and to counter the negative impacts of HIV/AIDS on the quality of their education in particular and their life in general. Teaching should therefore develop effective communication skills, responsible decision-making, and assertiveness; and it should encourage respect for self and others, as well as help each person to understand their responsibilities to others and to learn new practices.

An important pedagogical dimension, particularly in the context of HIV/AIDS, is to reconsider the notion of 'teaching a subject' as opposed to 'teaching a learner'. There is a need for teachers to be more sensitive to the needs of their learners, to be more tolerant, and to take on extra caregiving and support roles. This therefore calls for a shift from the traditional modes of delivery, which are mainly 'chalk and talk', to using participatory methodologies that encourage reflexivity which leads to transformative learning. Learners need to be exposed to experiential learning in practical settings and to gain new skills, abilities and insights that contribute to an enhanced linking of theory and practice. Participatory and collaborative learning also helps teachers to move away from reliance on linear models of learning and knowledge transmission to facilitation of processes that allow learners to construct their own theories and bodies of knowledge in a more relevant and demanding context than that which can be achieved in the classroom. The argument is that critical reflection by all individuals influences the participatory process as well as the ethics and process of participation. Thus participants become more effective agents of social change. Consequently, the research project was tailored to reorient methods of delivery to embrace skills for teaching in contexts of risk, vulnerability and uncertainty, to embrace life skills education and the techniques for creating child-friendly schools, and to create healthy environments for both physical and psychosocial support within the school system.

In as much as there are policy recommendations to teach HIV/AIDS at all levels of the school curriculum, no provision was made to formally train teachers in the teaching of this new area of the school curriculum. The study thus sought to devise ways of helping teachers to effectively integrate HIV/AIDS education in the formal school curriculum in a bid to reduce its negative impacts on the quality of education of vulnerable youths. Educational quality and relevance have recently emerged as topical issues for education debate, but, suffice it to say, there is no clear conception among academics as to what quality in education is; hence several notions of the term have emerged.

UNESCO (2005) identifies learners' cognitive development as the major explicit objective of all education systems. This view defines quality as efficiency and regards learning as mastery/successful performance (Lotz-Sisitka, 2011; Harvey & Green, 1993, in Kissack & Meyer, 1995). In another dimension, quality emphasises education's role in promoting values and attitudes of responsible citizenship and in nurturing creative and emotional development. Improving quality also means successfully overcoming and addressing various challenges posed in the different educational settings. This results in the dimension of quality as inclusivity, a dimension that views learning as a democratic process. The thrust of the project was to improve the quality and relevance of education in respect of disadvantaged learners; hence the concept of inclusivity as a dimension of quality became imperative. The intention was to engage educators in a process of dialogic inquiry to question the curriculum and determine the extent to which it

catered for the needs of orphans and vulnerable children (OVC); to identify the competencies required by the teachers and build capabilities for agency; and to develop action competence directed towards mitigating the needs of learners living in contexts of risk and vulnerability related to HIV/AIDS. In this context, 'capabilities' are understood to mean those things people value being and doing (Sen, 1990). 'Action competence' is defined as people's competence to take action (Jensen & Schnack, 1997). 'Agency' is regarded as what people actually do (Sen, 1990). Ultimately, the goal was to improve the quality and relevance of education in respect of disadvantaged learners in order to empower them and to build resilience and adaptation so that they could live more sustainable lives. Based on the premise that ESD enables capabilities (what people value doing), action competence (their ability to learn how to act and do new, valuable things) and agency (taking action) (Lotz-Sisitka, 2011), it became imperative to question what, in an educational setting, constraint people's abilities to turn their existing resources into capabilities and actions. Another important aspect was to question why, sometimes, there is no agency, even if the teachers are not constrained. The study specifically sought to:

1. Identify challenges, risks and vulnerabilities related to HIV/AIDS that learners in the Parirewa High School face and devise curriculum interventions to mitigate such challenges;
2. Explore teachers' knowledge gaps and attitudes with regard to HIV/AIDS;
3. Build on existing knowledge and support structures within the school so as to improve on HIV/AIDS learning in the school; and
4. Identify training needs of teachers in order to enhance capacity for effective teaching/learning in respect of HIV/AIDS.

Research Context

The study was conducted at Parirewa High School and its community in Domboshava, Zimbabwe. The school is located within a growth point just outside Harare, Zimbabwe's capital city. The post-independence government, to provide employment and improved social services for rural communities, mooted the growth-point concept. These growth points serve as social centres where people meet as they shop and share drinks. Since there has been little industrial development, these areas are characterised by high levels of unemployment, extreme poverty and high levels of informal employment, with many women turning to sex for money, thus exacerbating the spread of sexually transmitted infections, including HIV/AIDS. A growth-point community was chosen because of its convenience as an information-rich site for HIV/AIDS-related vulnerabilities and risks.

We chose a secondary school because this is the age group at the greatest risk of contracting HIV/AIDS. However, with a capacity to reach large numbers of young people with information, school education can have such a powerful preventive effect that it has been described as a 'social vaccine' (Pembrey, 2009). Schools also have potential to build capacity for adaptation and resilience to the special needs created by HIV/AIDS.

Research Design and Methodology

The researchers adopted a qualitative case study approach in which a local growth-point community was purposively and conveniently selected to provide an information-rich site. The research involved an action research process which took a phased approach, with one process following up on another upon reflection on previous activities. Action research has been used in many areas where an understanding of complex social situations has been sought in order to improve the quality of life (Riding, Fowell & Levy, 1995). The methodology offers a systematic approach to introducing innovations in teaching and learning by putting the teacher in the dual role of producer of educational theory, and user of that theory to enhance qualitative learning. For this particular research, the goal was capacity-building for positive social transformation; hence, the team worked with the teachers in ways that allowed them (the teachers) to identify what they valued to do (Allen, Kilvington & Horn 2002). Teachers were then supported with training in the areas they identified so that they could do what they valued to do. The strategies were guided by Amartya Sen's (1990) approach of 'capabilities' and 'functionings', which stipulates that people have opportunities to realise different 'functionings' they may have reason to value (their capabilities). However, someone could be deprived of capabilities in many ways owing to social, economic, physical, political or intellectual constraints that affect their functionings and their ability to convert the resources that they do have into valued functionings and capabilities. The team thus worked with teachers to identify what was constraining them from effectively integrating HIV/AIDS in the subjects they taught and why there was sometimes no agency even if there were no constraints.

The action research process is summarised in Table 1.

The principal participants were teachers, the librarian, and one education officer in charge of the Better Schools Programme. They provided most of the data. Since the study topic is extremely sensitive, precautions were taken to ensure the confidentiality of information provided by the participants. No reference was made to individual names and informed consent was formally sought from teachers before they took part in the study. Participation in the study was voluntary and participants were allowed to withdraw at any stage.

Results and Discussion

Since we adopted an action research design, it was important to analyse the data as we collected it in order to inform the next cycle. However, a detailed analysis of the data was undertaken based on the idea that ESD improves quality of education and introduces innovation to education in southern Africa (Lotz-Sisitka, 2011). In this article, 'quality of education' is defined as education that is relevant and inclusive. We were also guided by Sen's capabilities and functionings approach as noted above, which stipulates that people have opportunities to realise different 'functionings' they may have reason to value, but could be deprived of such capabilities due to typical constraints.

Table 1. The action research process

Cycle	Plan	Act
The baseline	• Negotiating entry • Mapping out sustainability issues related to HIV/AIDS • Testing feasibility of study	• Meeting with the school head and three teachers in charge of the Child Protection Committee and discussing sustainability issues and risks related to HIV/AIDS and how the study could be introduced in the school • Meeting with district education officers and negotiating ministry's approval to conduct the study in the school
The inception/ needs analysis workshop	• Preparing materials to facilitate discussions so as to enable teachers to examine their knowledge of, and attitudes to, HIV/AIDS and its impacts • An appreciation of the existence of OVC/disadvantaged and the different burdens they carry, and the interactions in the classroom • Preparing a questionnaire to determine existing support structures to advance HIV/AIDS education within the school	• Holding an interactive workshop through focus groups, plenary and scenario sessions to explore: • Basic information on HIV/AIDS; attitudes to HIV/AIDS and its impacts on individuals, families, learners and education; skills to identify and resolve problems faced by young adults; reality of the OVC at Parirewa High; current instructional methodologies and content related to HIV/AIDS • Conducting a questionnaire audit to determine support structures to advance HIV/AIDS education within the school
The intervention	• Preparing materials to facilitate training of teachers in life skills education and how to teach for the development of life skills • Mainstreaming HIV/AIDS in different subjects • Developing a school HIV/AIDS policy • Developing an appreciation of their roles in mitigating the impacts of HIV/AIDS in the classroom	• Holding an interactive workshop meant to enhance capacity of teachers to: • Deal with OVC • Teach for the development of life skills • Mainstream HIV/AIDS in different subjects • Develop a school policy • Empower teachers to deal with impacts of HIV/AIDS in the classroom
Monitoring	• Preparing assessment tools to check on progress made by teachers in mainstreaming HIV/AIDS in their subjects and how they related and interacted with their learners	• Face-to-face and follow-up telephone interviews with selected participants and linking persons within the school to determine the extent to which skills learnt in the workshops were being implemented to alleviate the plight of the OVC

Vulnerabilities, risks and issues related to HIV/AIDS in the Parirewa High School context

The teachers at Parirewa High School work in a context where HIV/AIDS has led to a situation where some of their learners are sick, some are on antiretroviral therapy, some are giving care to sick parents/siblings, and some do not have adequate resources to pay for school fees and buy uniforms and other school supplies, and are also suffering from food insecurity. Absenteeism is high and some children are dropping out of school. All these issues are negatively impacting both the quality of education and the quality of life of the affected children. Teachers cited the influence of the growth point, brothels, commercial sex, poverty and peer pressure as some of the drivers of HIV/AIDS in the community. In as much as these challenges exist and need to be addressed, the majority of teachers were not formally trained to deal with these challenges. They therefore required training to build action competence in order to respond to these and other risks and vulnerabilities among themselves and their learners.

Curriculum interventions to mitigate the impacts of HIV/AIDS in the school

An audit of the support structures for enabling HIV/AIDS education within the school showed that the school has an HIV/AIDS Policy, but that it is not clearly defined and that this tends to negatively impact on its implementation. Its alignment to the national policy is also weak. Learner participation in HIV/AIDS education is satisfactory and the school has access to quality information on HIV/AIDS. The school incorporates calendar events such as National AIDS Day in the teaching of HIV/AIDS. However, the school is not aware of its HIV/AIDS prevalence rate and efforts at reducing HIV incidence are generally poor and not coordinated. There is a peer education club at the school, which was not functioning so well at the time that the research started, and the general feeling among the teachers was that HIV/AIDS was not a priority in the school timetable. Although very few teachers are trained to teach HIV/AIDS, a sizeable number of teachers have basic counselling skills, and a fair number of teachers have training in life skills education. The school also had a properly structured guidance and counselling forum. The school could capitalise on these and other support structures to enhance the quality of HIV/AIDS education.

This was the situation at the start of the action research process. Reported below are the findings of the study after the action research process, which shows changes in teachers' practices and in the ways in which the school was responding to the HIV/AIDs concerns.

Capabilities and agency for mainstreaming HIV/AIDS in the curriculum

The teachers indicated that they valued, among other things, being more tolerant to their learners' needs and being able to make a difference in the lives of their learners. Through engagement with the action research process, they were able to make deliberate efforts to identify disadvantaged learners and support them materially. Some indicated that they were now paying more attention to learners who were having problems at home. The teachers demonstrated agency for improving HIV/AIDS education, as reflected in the following responses.

> I have used skills gained in the workshops to identify students in need… . I am now paying more attention to students who are having problems at home… . I became more concerned with pupils' other needs outside their academic needs; …I was empowered by the workshop to create healthy relationships with students so that they can openly share their problems.

One particular teacher said:

> I have learnt to be more open and accessible to my students… . [S]tudents now feel free to come to me for counselling… . I was enlightened [by] the fact that when dealing with students, especially OVCs, they feel so abandoned and dejected and feel like they have no one to run to and have no shoulder to cry on… . I realised the need to be approachable, to change myself, and my attitude… .

The teachers highlighted the fact that the inception workshop had created a 'new culture' where pupils who fail to pay their fees on time are treated with the sensitivity each case deserves. Teachers coined the phrase, *'ndozviya zvakarambidzwa',* which, literally translated, means *'this is what we have been discouraged from doing'*, which they have successfully used to discourage one another from actions that would aggravate the plight of the OVC. The teachers were connecting what they had learnt during the workshops to their day-to-day work and used this knowledge to change the way they behaved. If quality of education is defined from an inclusivity dimension, it may be argued that the interventions by the teachers improved the quality of education of vulnerable children.

Action competency for positive social transformation

Teachers demonstrated willingness to change the way they interacted with learners. Asked to describe what they had learnt and what they were willing to change (action competence), one teacher said: 'I need to help students to open up and share their experiences… . In fact I take it as a challenge since I have not been doing it; I will change my teaching approach… .' Teachers reportedly became more observant, approachable, receptive and sensitive with respect to the needs of learners in difficult circumstances. Asked to comment on how they were mainstreaming HIV/AIDS, the history teacher said:

> I have infused HIV/AIDS in the teaching of my subject (History). I also talk about life skills. Topics such as '[u]rbanisation and the development of towns and cities' touch on movement of people from rural areas to towns and cities. We discuss the consequences of such developments …what happened when husbands left for the cities … what did the women left in the villages do while their husbands worked in the cities? We talk about the effects of such splits and the exposure to Sexually Transmitted Infections. Even though AIDS was not prominent then we draw students' imaginations to what is happening now then make connections with what happened in the past.

Teachers also appreciated the fact that each of them had a role to play in the fight against HIV/AIDS and its impacts in the school; hence the need to mainstream in all subject areas. The actions thus improved the quality of education if we define quality of education from a relevance perspective.

Constraining factors

Amartya Sen's approach of 'capabilities' and 'functionings' stipulates that people could be deprived of capabilities due to typical constraints. The teachers demonstrated eagerness to mitigate the negative impacts of HIV/AIDS on education and on their learners, but highlighted the following constraints. Very few teachers in the school have formal training in counselling and none have been formally trained to teach HIV/AIDS. Teachers also reiterated that they were equally burdened by the challenges posed by HIV/AIDS. Excerpts from teachers' responses highlighted that 'teachers are not competent enough to deal with some of the burdens… '. Some teachers hinted that there was a stigma attached to the teaching of HIV/AIDS 'by virtue of being allocated to teach HIV/AIDS, we have been labelled the "AIDS ones" as if we are suffering from the disease'. Teachers lose the zeal to teach the subject for fear of being labelled.

Asked to comment on what the teachers are doing to help students in need, one teacher's response was as follows:

> We want to help the students but we don't know how, we need guidance and direction and technical expertise to be able to effectively deal with the challenges posed by HIV/AIDS.

The teachers' freedoms to be what they value are constrained due to lack of expertise, and this has negative implications on the quality of education.

Another constraint relates to the influence that parents and the community have on what teachers could teach in terms of HIV/AIDS. Sexuality and sex education are complex and sensitive topics for Zimbabwe and there is no consensus on how they should be handled. Lately, there has been heated debate on whether condoms should be made available in schools as part of the Zero New HIV/AIDS Infection Campaign. Encouraging condom usage has been castigated as immoral and as encouraging learners to engage in premarital sex. Quality of education is thus compromised, since teachers are not at liberty to deal with sensitive matters that might be relevant to learners' needs.

Government policy constitutes another constraint with regard to the teaching/learning of HIV/AIDS. The Zimbabwean curriculum is examinations-driven, but HIV/AIDS is integrated into Guidance and Counselling, which is a non-examinable, non-core subject. Generally, schools and learners alike do not attach importance to non-examinable subjects and the quality of delivery of such subjects suffers as a result. In this particular school, HIV/AIDS was not appearing on the timetable, even though the teachers claimed it was being taught.

Lessons drawn from the study

Teachers confessed that the action research engagement was an eye-opener; it made them see their learners differently and made them change the way they perceived their roles in the wake of HIV/AIDS. The key lesson from the project is the idea that HIV/AIDS can be integrated in any subject as long as the teachers are taught how to mainstream, are prepared to change the way they perceive their roles, their subjects and their learners, and are ready to make a difference in the lives of the learners they teach. One particular responded said:

> We just realized that we don't need the administration's involvement in order to teach about HIV/AIDS. We can effectively teach about HIV/AIDS without including it on the timetable. There is no excuse why each subject cannot teach about HIV/AIDS; opportunities exist. I have been empowered to be self-sufficient in imparting HIV/AIDS education to students.

The woodwork teacher confirmed this:

> I am no longer worried about pestering the school administration to include HIV on the school timetable because I have leant to infuse the subject in the teaching of woodwork, especially when I guide students on proper handling of tools.

Teachers realised their own potential and capacity to counter the realities of HIV/AIDS, an effort which draws on the aspect of quality education that overcomes and addresses various challenges posed in different educational settings. In this case, where school authorities and systems adhere to traditional modes of education geared for examinations, HIV/AIDS teaching suffers neglect. Moreover, in this particular school, it was not even appearing on the timetable.

The practice of labelling some subjects as core subjects and others as non-core subjects creates the impression that certain subjects are more important than others. Government policy with regard to which subjects are core subjects may need to be reviewed, as it poses a serious constraint on the teaching/learning of HIV/AIDS and other ESD concerns. The existing obsession with academic subjects being core subjects may be detrimental to the country and learners needs. In fact, if we are to improve the quality of education in a broader sense, there is a need to strike a balance between the importance accorded to academic subjects and that accorded to skills development-oriented subjects, including HIV/AIDS. Towards the end, the teachers had developed an understanding that integrating HIV/AIDS in all subjects in the school curriculum, particularly the core and examinable subjects, brings relevance to what learners learn.

Another lesson drawn from the findings is that teacher training is key to successful implementation of HIV/AIDS education. Agency for teaching HIV/AIDS is sometimes constrained by a lack of skills/training, as hinted at by Sen's capabilities and functionings approach. Teacher education thus needs reorientation to embrace skills for teaching in contexts of risk, vulnerability and uncertainty, and to embrace life skills education and the techniques for creating child-friendly and healthy environments for both physical and psychosocial

support within the school system. There is a need to promote experiential, participatory and collaborative-learning platforms which are ideal for achieving interactive learning and enhancing the quality of learning. We need to develop a new kind of teacher who is creative, adaptive, and sensitive to learner needs, and who teaches for diversity.

There is also a need to offer psychosocial support to teachers to enhance quality and relevant classroom interactions. One particular teacher indicated that 'the teacher's burdens need to be addressed before he/she can address those of the students … we need a resident counsellor for both students and teachers…'. It is therefore critical for school administrators to embrace HIV/AIDS and life skills education in the way schools are run and managed in order to improve the quality of education.

Another key lesson drawn is that learning becomes meaningful and empowering if it is based on things that can be directly applied in real-life contexts. As we discussed the various risks related to HIV/AIDS and who was at the greatest risk of HIV infection, one teacher said that 'we all drink from a poisoned well'. The teachers demonstrated a natural willingness to take part in the project because it involved things they valued, and things they could easily connect with and could be directly and immediately applied to solve real-life problems within the community they lived and worked in. Engaging in ESD initiatives like this action research project enabled teachers to explore and realise aspects of their capabilities, action competence and agency, as shown above. Teachers acknowledged the awareness that had developed during the workshops as a result of participating in, and deliberating on, HIV/AIDs-related issues.

Conclusion

The quality of teaching/learning of HIV/AIDS is compromised by several factors. The subject is perceived as not important, since it is non-core and not examinable. As such, it is not prioritised on the school timetable and, sometimes, is not taught at all. Compounding this is that many of the teachers tasked with teaching the subject have no formal training to teach the subject. There is also a stigma attached to the teaching of the subject, and the sensitivity around HIV/AIDS poses serious limitations on how far the school curriculum could provide for such teaching. Opportunities however exist for improving the quality of HIV/AIDS learning in the school. These include, but are not limited to, the existence of a peer education club, a national HIV/AIDS policy, books and related teaching/learning materials on HIV/AIDS, teachers trained in guidance and counselling, and, more importantly, teachers who are motivated to take up new challenges and are willing to learn new methods of teaching in a bid to fight the negative impacts that HIV/AIDS has on education quality.

Even though we did not spend enough time in the field to check on the effectiveness of the intervention, it can be stated that the intervention capacitated teachers to improve their practice in a number of ways. The intervention improved on the delivery of HIV/AIDS in the school and had a direct bearing on the quality of education and the quality of life of the learners. Quality as defined by relevance and inclusivity dimensions was evident in the way the teachers changed their roles and attitudes to their learners and the teaching of the subject. Teachers developed agency for positive social transformation as defined by ESD and assumed

the roles of friend, counsellor and advisor, and this helped learners to open up and share their problems. Learners also benefited from the improved knowledge and agency of their teachers. Before the action research intervention, there was a general sense of helplessness among the teachers. However, after the training, they felt more empowered to deal with HIV/AIDS at both individual and communal levels. The next phase of the project will further probe these areas, because the current research did not gather data from learners, but relied on reports given by teachers.

HIV/AIDS knows no disciplinary boundaries; it can be taught by any teacher in any subject, as long as the teachers have the requisite support, capacity and motivation to do so. Mainstreaming may provide the solution to the teaching of this crucial subject, which is perceived as not so important simply because it is regarded as non-core and non-examinable, like many other related ESD concerns. Developing insight into how to engage such issues within a quality and relevance framing for education is what this article has sought to provide.

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Rethinking Forestry and Natural Resources Higher Education in Ethiopia: An Education for Sustainable Development Perspective

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Abstract

This article reports on an action research project to reorient forestry and natural resources higher education in Ethiopia. The study used a combination of methods, including questionnaires and secondary information, to understand the existing higher-education system in Ethiopia. Based on the initial analysis, a workshop was held to deliberate the findings and to draw up guidelines for forestry and natural resources higher education that reflect education for sustainable development (ESD) approaches.

The results of the study show that the state of higher education with regard to forestry and natural resources has, in about half a century of such education, been influenced by several internal and external factors. It progressively evolved from endeavours dependent on foreign aid to a self-sufficient Ethiopian system. During this time, the structural distribution of graduates moved in emphasis from an earlier emphasis on the diploma to a BSc-level emphasis. Little progress has been made with regard to female graduates, student enrolment is limited and the desirability of forestry education has declined. Despite this, most of the 31 public universities in the country offer natural resources education. Curricula were found to be inadequate for the challenges of the times, as was the national demand for expert professionals. Existing epistemological foundation adheres to forestry as a commodity rather than as a social-ecological system influencing conceptual definitions of forest, forestry and forester.

Within an ESD perspective, forests are identified as social–ecological systems, forestry is seen as a sustainability science and a sustainable development sector, and the forester is viewed as a systems thinker and change agent. It is agreed that higher education relating to forestry and natural resources in Ethiopia requires guidelines that encompass a non-reductionist and comprehensive disciplinary base where synergy of multidisciplinary approaches is emphasised, as in ESD. The guidelines outlined indicate how to adapt higher education in respect of forestry and natural resources to changing societal needs in Ethiopia. The emerging guidelines also point to a reorientation of academic institutional foundations and leadership and to the need for a relevant epistemological framework to guide higher-education curricula on forestry and natural resources. The emerging guidelines further stress that higher education should engage more strongly with pertinent global and national issues.

Introduction

The importance of forests for sustainable development is increasingly being recognised, not only as a source of wood and timber, but also for carbon sequestration, as a source of renewable energy, for cultural and spiritual values, and recreation, among others (Morell, 2001; Neeff, Luepke & Schoeme, 2006; Dieter & Bernier, 2012; Sisay, Menale & Mungatana, 2009). Even

so, deforestation has not abated. The United Nations Environment Programme (UNEP, 2008) reports, for example, that deforestation is the most widespread environmental issue affecting the African continent.

A sound scientific base can play an invaluable role in the protection, as well as sustainable management and use, of forests (Rebugio, 1998; Werland, 2009; FAO, 2011). However, effective utilisation of this knowledge base requires 'strong' development and extension services. Worrying in this regard are reports that forestry education and extension are weakening and declining. Declining student enrolment, dwindling education quality, and compromised practical components are but some of the issues reported (Dourojeanni, 1986; El-Lakany, 2004; Temu, Chamshama, Kung'u, Kaboggoza, Chikamai & Kiwia, 2008; Hull, 2011). Such reports and associated cases of this phenomenon (Brown, 2003; El-Lakany, 2004; Green, 2006; IFSA, 2009) call for transformations in forestry education.

The current global context, however, provides for various global and national opportunities that can help to revitalise forestry education, such as the Millennium Development Goals (MDGs), climate protocols such as Kyoto, the scientific work of the Intergovernmental Panel on Climate Change (IPCC) and the establishment of the United Nations Forum on Forests (UNFF). Nationally, the environmental policy of Ethiopia integrates environmental education in all school curricula, at tertiary level, and in courses in sustainable resources and environmental management. One of the four pillars of the recently established Ethiopian Climate-Resilient Green Economy (CRGE) strategy is protecting and re-establishing forests for their economic and ecosystem services, including carbon stocks (FDRE, 2011).

Studies reporting the weakening of forestry education, such as that of Temu *et al.* (2008), invariably recommend the revitalisation of forestry education. Specific approaches suggested, however, are extremely varied. There is also a lack of baseline data on the meaning(s) of quality forestry education. In addition, analysing the problem through reviews of temporal change in terms of enrolment, desirability, quality and curriculum may indicate what has happened (i.e. reveal the trend) without necessarily disclosing the reasons for the trend (Harcharik, 1995; Innes, 2009). One of the critical issues that this article responds to is the range of diverse and 'unsettled' definitions of forestry, and the implications that this can have for science and curricula (Legilisho-Kiyiapi, 2004; Miller, 2004). Meanings of 'forest', 'forestry' and 'forester' ground the epistemology of forestry education on which curricula are formulated and evaluated (Morell, 2001; Neeff *et al.*, 2006; Orenius & Rekola, 2008). This furthermore helps to justify the relevance of forestry education in order to relieve it from the prevailing predicament of being seen as an undesirable discipline.

The relevance of forestry is furthermore confirmed by massive deforestation in recent years in Ethiopia and by contemporary national development initiatives (EFAP, 1994; WGCF-NR, 2003). Ethiopia is currently pursuing watershed-based rural development initiatives, including the construction of large-scale irrigation and hydroelectric dams (PASDEP, 2006; FDRE, 2010). This requires functioning upstream conservation schemes using forests. The urban areas, which are growing rapidly, also need forests to improve the human well-being of the urbanite by creating green spaces. Besides this, forests provide multiple ecosystem services for people living in rural areas.

In the past, the ideological stances and a sense of urgency created within the state apparatus and funding agencies pertaining to environmental problems led to top-down forestry management activities where local realities were effectively ignored (Hoben, 1995). As a result, forests have become a 'battleground' between dissatisfied local populations and the forestry departments. There was also unparalleled forest loss preceding the change in government in 1991 (Melaku, 2003). Part of the inconsistency and discontinuity in respect of the forestry sector is attributed to these situations. As a result, forestry as an economic sector lost its importance (Sisay *et al.*, 2009; Demel, 2002), which has also influenced education. Similarly, forestry education is confronted by a lack of strategic support, diminished organisational power, and declining rigour and relevance (WGCF-NR, 2003; MoE, 2008; HESC 2008).

Therefore, there is a need to examine the state of higher education in general and forestry education in particular in Ethiopia in order to establish a guideline that can help in the design of curricula relevant to the national need and global discourses (Negarit Gazeta, 2009). This article analyses the state of Ethiopian forestry education in line with the ESD perspective and proposes guidelines for revitalising forestry education by addressing epistemological and ontological foundations with regard to definition and curriculum guidelines. Specifically, it sketches the history and desirability of the existing curriculum.

Study Methods

The methods used for this study included a critical review of the system of higher education related to forestry and natural resources, with special emphasis on existing predicaments. This informed an action phase involving the development of guidelines for reorienting the system using a search conference method (O'Brien, 2001). One of the purposes of the search conference method was the participatory engagement of concerned bodies needing to develop a new strategy, direction and action. Three main steps were followed:

1. Exploring experiences of higher education in forestry and natural resources by reviewing published works with the expectation of identifying major issues;
2. Examining experiences from Ethiopia with regard to history, quality, desirability and curricula based on secondary information, interviews and reflections on the authors' lengthy experience of forestry and natural resources education; and
3. Holding a search conference of scholars and faculty members of the College to sketch guidelines with the potential for reorienting education.

The search conference was set up to engage four pertinent issues:

1. Employers' reports and concerns related to the decline of graduate competence (quality of education);
2. Loss of desirability of forestry education among students joining Ethiopian universities;
3. Emerging global and national opportunities that had brought forestry back into the limelight; and

4. The need for increasing the visibility of Wondo Genet College of Forestry and Natural Resources (WGCFNR) (a key forestry education centre for Ethiopia) as a centre of excellence where the academic programmes are rigorous and relevant.

Three groups were formed to deliberate on one issue each:

1. Adapting higher education in respect of forestry and natural resources to changing societal needs in Ethiopia;
2. Necessary academic institutional foundations and leadership for the future of forestry and natural resources education; and
3. Epistemological framework for higher-education curricula with regard to forestry and natural resources.

Each issue was subdivided into key discussion points and assigned measures of expected outcomes. In this regard, Issue 1 addressed:

- Possible links between landmark development programmes in Ethiopia (e.g. the Growth and Transformation Plan, and the Climate-Resilient Green Economy Strategy) and the forestry sector; hence forestry education;
- The required needs of occupational competence and knowledge mix relating to future foresters;
- Ways to address the dilemma of undergraduate education whether to produce subject specialists or generalists; and
- Effective forestry and natural resources-related outreach programmes that academic institutions can adopt.

The group was asked to deliver the following: strategic development–academic collaboration *modalities*; occupational competence and skills mix *guidelines*; subject specialist or generalist *measures*; and forestry outreach *standards*.

Issue 2 addressed:

- Establishing the need for centres of excellence for higher education in forestry and natural resources;
- Types of research/theses models needed that simultaneously fulfil the quality requirement and development relevance;
- Identifying strategic collaborative partners at national, regional and global level; and
- Working at achieving a balance between implementing new technologies and learning from indigenous knowledge.

The group was asked to deliver the following: centre-of-excellence *measures*; research/theses *guidelines*; relevant *principles* for identifying collaborative partners; and mainstreaming indigenous knowledge *standards*.

Issue 3 addressed:

- Outlining conceptual and operational definitions of 'forest', 'forestry' and 'forester' in the Ethiopian context;
- Defining guiding principles in respect of forestry and natural resources education in the context of sustainable development;
- Listing measures of rigour and relevance regarding higher education in forestry and natural resources in the context of changing societal demand; and
- Strategising proactive forestry and natural resources education in relation to emerging challenges and as a reaction to the ongoing strategies and development endeavours.

The group was asked to deliver the following: conceptual and operational *definitions*; academic and research strategy *guidelines*; rigour and relevance quality *standards*; and dynamic curricula-implementation modalities *measures*.

Conceptual Framework

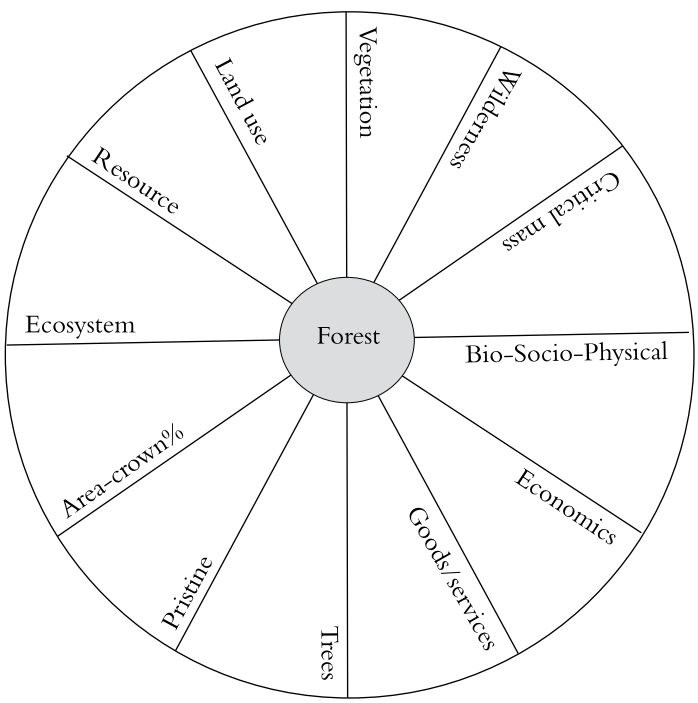
Achieving a sustainable way of life requires a change of mind and heart, as well as a new sense of global interdependence and universal responsibility (ECC, 1992). It also requires interdisciplinary and problem-solving approaches in education (Clark, 2010). Forests are unique natural resource systems that involve biophysical, socio-economic and governance concerns and have a strong link with sustainability, and are continuously evolving as we understand more about our socio-environmental system (Bagheri & Hjorth, 2007).

Sustainable development involves a synergy of several knowledge systems and complex conceptual constructions covering a diversity of perspectives provided for in sustainable economic thinking and/or sustainable sciences (Munasigghe, 1994, Clark & Dickson, 2003). Complementary to this, ESD (UNESCO, 2006) recognises the interdependence of environmental, social and economic perspectives and the dependence of humanity on a healthy biosphere. It seeks to reorient education towards the needs and components of sustainable development (SD) (SWEDESD, 2008). The working definition for ESD, as used in this study, is founded on social–ecological systems thinking (e.g. Holling & Gunderson, 2002), is centred on sustainable-development ideals (e.g. Clark, 2010), and embraces adaptive management (e.g. Folke, Hahn, Olsson & Norberg, 2005) within a transformative learning approach (e.g. Mezirow, 2003). It also includes the consideration of transdisciplinary/interdisciplinary/multidisciplinary approaches, adheres to higher-education rigour and relevance measures (e.g. McKeown, 2002; Mogensen & Schnack, 2010), and aims at producing professionals that are systems thinkers and change agents (e.g. Maguire, 2000). It has been strongly recommended that the need to embed ESD in curricula include different types of knowing that embrace value-based concerns and competence development (Willy, 2008). Equally important are the epistemological foundations of the curricula and course objectives viewed within a quality, relevance and social-change perspective (Bourgeault, Kuhlmann, Neiterman, & Wrede, 2008). Forestry education today requires a multidisciplinary foundation and a comprehensive approach (Brown, 2003) that

can weave the knowledge from existing disciplines into new concepts and methods so as to address the many facets of sustainable development, that is, from concept to actual practice. This is similar to what ESD promotes (Willy, 2008); hence ESD can potentially provide a useful conceptual framework to revitalise forestry education and address pertinent sustainable-development ideals.

The foundations of forestry education are determined by the way in which forests are defined. This influences the terms 'forestry' and 'forester', as well as the demand for sustainable development by the forestry sector. However, it is important to note that definitions and interpretations are always contentious, because meanings change over time (Evans, Carle & Del Lungo, 2009). Figure 1 shows that forests are holistic resources. In consequence, a comprehensive understanding of the value, goods and services that they render to society and the environment, as well as of their relevance to wider anthropogenic and natural landscapes and systems, is needed (Neeff *et al.*, 2006; EEA, 2007; FAO, 2005; Temu *et al.*, 2008). This will place the resource in a broader perspective with respect to purpose-goods/services in different temporal settings (the past, the present and the future), societal demands in respect of forests, and the ability to utilise forests wisely (UNFF, 2011). Such a contextual setting can establish forestry as a conceptual and scientific foundation for forestry education.

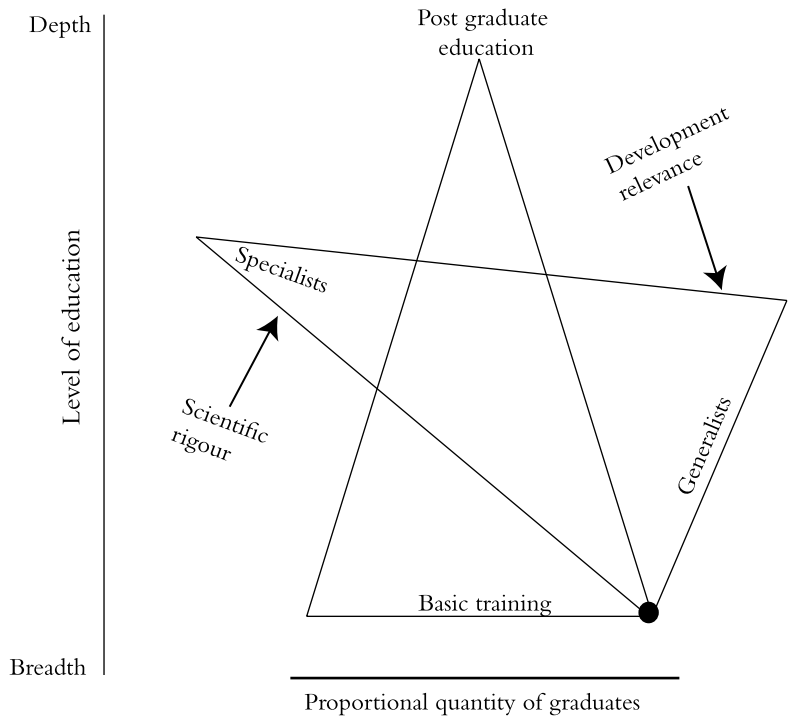
Figure 1. Comprehensive foundation for the definition of forests



As ESD is aimed at achieving sustainable development, forestry education's objective has to be sustainable forest management, because this maintains and enhances the economic, social and environmental values of all types of forests for the benefit of present and future generations (FAO, 2005). Sustainable management of forest ecosystems requires knowledge of their main functions, and of the effects of human practices on them, in order to ensure sufficient understanding of the potential long-term impacts of current practices on sustainable development. The IPCC (2007) has stated that important environmental, social and economic ancillary benefits can be gained by considering forestry-mitigation options as an element of the broad land-management plans, by pursuing sustainable-development paths, by involving local people and stakeholders, and by developing adequate policy frameworks.

Forestry education, like any other higher-education discipline, seeks to achieve a balance between depth or breadth and the requirement of rigour, at the same time seeking relevance. While the rigour dilemma imposes challenges to promote learning that is both intellectually demanding and provides appropriate preparation for professional practice, breadth versus depth assumes that insufficient knowledge rather than inappropriate types of learning causes the theory practice gap (Brown, 2003). The checks and balances of optimal curricula involve assessing the educational dynamics of maintaining the balance between rigour and relevance, as shown in Figure 2.

Figure 2. Conceptual foundation/checks and balances in respect of curricula formulation



Higher Education in Forestry and Natural Resources in Ethiopia

Higher education in Ethiopia

Understanding the higher-education landscape of Ethiopia is important in planning for rigour and for relevant higher education in respect of forestry and natural resources in line with ESD. In Ethiopia today, a massive expansion of tertiary-level education is under way. Between 1991 and 2008, the number of public universities increased from just two to 22 (FSS, 2009), Today, they number 31. Similarly, in 2010/2011, higher-education enrolment reached over 0.46 million, 95% of which were undergraduates, 5% postgraduates (4% masters' and 1% doctoral), and 26% female (MoE, 2011). Since 2008, public universities in the country have adopted common education guidelines that contain six bands with different importance levels (MoE, 2008). The six bands are engineering and technology (40%), natural and computational sciences (20%), medicine and health sciences (5%), agriculture and life sciences (5%), business and economics (20%), and social sciences and humanities (10%). All higher-education institutions in the country have established academic management that suits this division and are designing curricula under each band (MoE, 2008). Universities are free to offer curricula from all the bands as long as they adhere to the enrolment allocations: 70% science and 30% social science and the humanities.

While this open system has given universities the freedom to chose and to ensure required minimum enrolment of students, it has undermined centres of excellence, particularly in institutions where long-standing disciplinary specialisation has existed. Furthermore, strategic disciplines which may not be desired by students can easily be affected, as government budgets are allocated as per student numbers. One can argue that centres of excellence may, in time, survive such competition, yet existing experiences and capacities of specialised universities can erode in the process of adhering to the blanket prescription regarding higher education in the country. Massification in the form of increasing the number of universities (30 universities in 20 years) and the extent of student enrolment (half a million today) is a very considerable achievement. Nonetheless, the mismatch between required facilities and expected rigour and relevance of higher education (HERQA, 2009) can have undesired outcomes relating to inadequate quality of graduates for development needs.

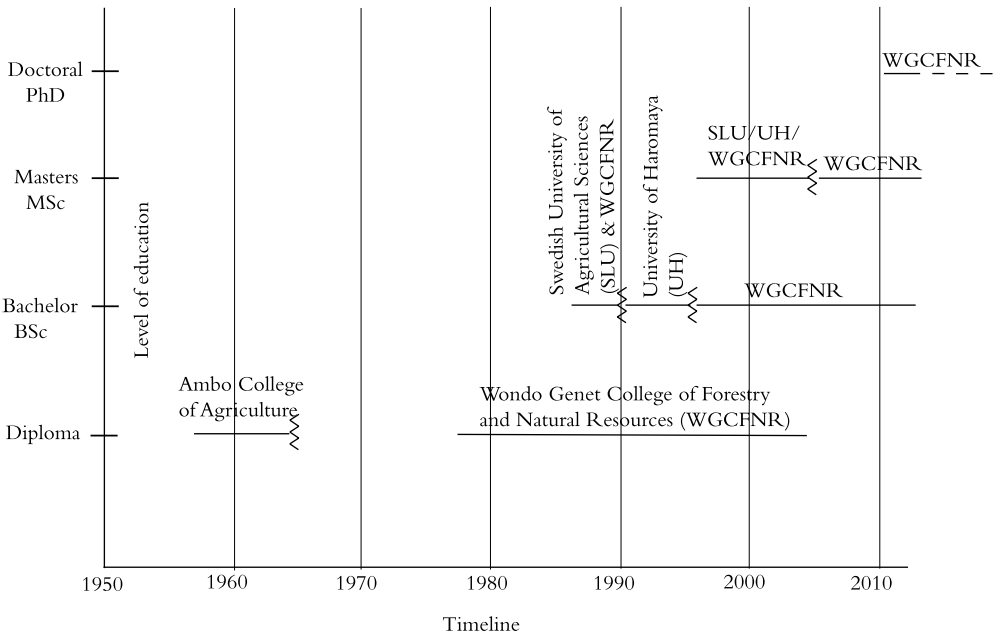
History of forestry and natural resources education

Higher education in respect of forestry in Ethiopia has, over the period of half a century, evolved from a diploma to the PhD level, is offered in three places and has been transformed from an external, fund-driven activity to one of local self-sufficiency. During this time, the focus of curricula shifted from general forestry to subdivisions of programmes including agroforestry, production forestry and forest management.

The two-year diploma programme in general forestry offered by the WGCFNR was in existence for 25 years before it was officially terminated in 2004. The WGCFNR is a college that has specialised in forestry, and its offering is unlike other earlier forestry programmes located in the agriculture-focused college in Ambo. When bachelor-level forestry education commenced, its aim was to educate mature students who had completed the two-year diploma programme and who had served in the field for at least two years. This was a 'sandwich'

arrangement between the SLU (Swedish University of Agriculture) and the WGCFNR, with the former controlling all academics and issuing the degree, while the latter provides physical space and some lecturers. After 45 students were trained in Swedish, East African and Ethiopian experiences, a local programme was initiated at the University of Haromaya that lasted for four batches and terminated after 120 students had graduated. Another interruption occurred here before forestry education was transferred to the WGCFNR in 1999 (see the timeline in Figure 3). The WGCFNR was one of the three founding colleges of Hawassa University when it was established in April 2000.

Figure 3. Timeline in respect of forestry education in Ethiopia



Postgraduate programmes were introduced in a similar way as the bachelor sandwich programme and mainly involved external lecturers in the fields of natural forest management, farm forestry and production forestry. Today, the postgraduate programme runs eight academic programmes, including climate change and development programmes.

Ethiopian forestry education is founded mainly on Swedish aid, Swedish experts and Swedish forestry practices. Swedish International Development Cooperation Agency (SIDA), which was the sole supporter of the College, invested 10 million krona per year in the College between 1987 and 2007 (SLU, 2009). Another experience that influenced forestry education in Ethiopia was African in nature and in the form of diploma-level curricula, particularly at Nyabyeya Forestry College in Uganda. Curriculum design and review are, in general, externally and internally derived. Some examples are the Ethiopian Forestry Action Plan (EFAP, 1994), a landmark forestry action plan that shaped forestry management in general and forestry

education in particular, and the formation of the Ministry of Natural Resources Development and Environmental Protection immediately after the Rio Summit.

In the changing paradigm shifts, institutional memory is important yet a challenge. While adapting to the changes demands transforming curricula and scholarship, sudden shifts can derail the established epistemological foundation and institutional set-ups. The challenge here is to maintain dynamism and at the same time consistency, and continuity and at the same time stability. Figure 3 shows that forestry education in Ethiopia has undergone a progressive evolution, yet has not been free of destabilisation owing to lack of independence (being placed in the agriculture college or big universities), having to move from place to place, and instability of the employment sector.

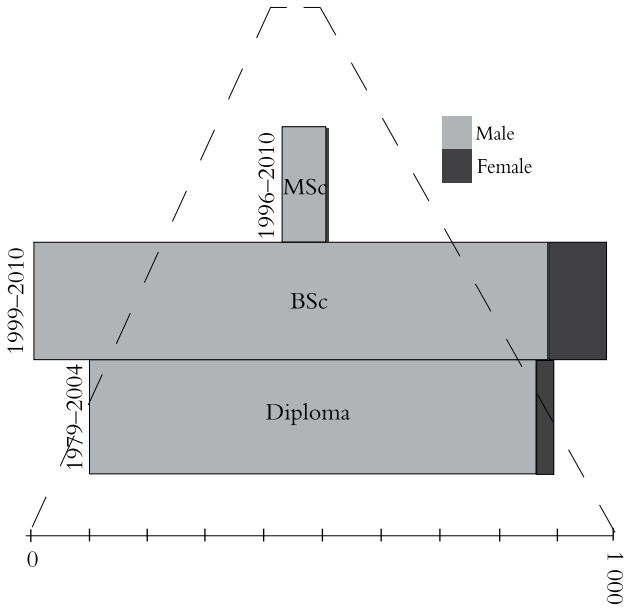
The Ethiopian experience in respect of forestry education is not different in terms of knowledge flow from non-African foresters and comprises mainly European forestry knowledge. This has not only brought with it forest-management strategies, but has also shaped the direction in which science has developed, as scholarship is oriented through the funds made available. While productivity-based forest management was emphasised and sustainable flow of cut was targeted, sustainable forest management was not addressed. This contributed to the delinking of the forests from the ideals of sustainability without comprehensive integration of their environmental, social and economic significance. Ethiopian forestry education has, as yet, not been given an opportunity to emphasise the locally important eco-zone and indigenous forestry system of the country. Nonetheless, changes in Ethiopian forestry education curricula over time seem to correspond with paradigm shifts that involve plantation forestry, agroforestry, social forestry, community forestry, biodiversity and climate change during the past 50 years (Nair, 2008).

Distribution structure of forestry and natural resources professionals in Ethiopia

A survey of the distribution structure of professionals includes number at different levels (i.e. sufficiency) and quality in line with relevance to the types of available and emerging employment sectors. The Ethiopian forestry expert pool comprises mainly graduates from local higher-education institutions, most of whom are graduates of the WGCFNR. High-level experts at MSc and PhD levels have been educated in European and American universities, most significantly the SLU in Sweden. Figure 4 shows the distribution structure in respect of forestry experts in Ethiopia based on the total number of graduates from the WGCFNR. The figure also shows that BSc graduates constitute the larger proportion (with the number increasing), while the diploma programme was terminated in 2004. Female graduates at all levels are very small in number. The broken line is shown in order to indicate the optimal proportion of experts required, assuming that the structure tapers from the base, where more are needed at the grassroots level.

The quantitative structure pertaining to the experts in Figure 4 implicitly indicates the qualitative structure in a form of theory:practice ratio where, at the lower level for example, diploma: practical is emphasised, while theory and scientific research tend to be emphasised higher up. The termination of the diploma programme at universities, which was moved to the technical and vocational schools, implied de-emphasis of the practical component of education in universities. While this can be seen as a 'shift of place', the shift has failed to address the type of education university diplomas used to offer.

Figure 4. Sample structure of forestry experts distribution in Ethiopia



In order to plan for the future, in addition to the structure in the form of proportional number of experts, it is important to consider the number of graduates. This is determined not only by the existing employment capacity of the sector, as this can be reactive, but also by assessing future demand and needs, including changes in emphasis and direction.

Student enrolment in forestry and natural resources education

Examining the enrolment level with regard to academic programmes can on the one hand indicate the priority given by government as well as highlight the employing sectors' preferences. On the other hand, it emphasises the future prospects of the programmes. As indicated above, the Ethiopian government's 70:30 ratio undermines agricultural education in general and forestry education in particular. For example, forestry education is part of the Agriculture and Life Sciences Programme, together with resources management and natural resource economics. The number of students allocated for forestry and natural resources is 8% of the target share of students under the Agricultural and Life Sciences Programme, to be shared by all public universities offering forestry and natural resources education. Currently, the students enrolled in the forestry and natural resources programme are divided among 15 programmes and 22 universities (MoE, 2011). Natural resources management is most dominant among all bachelor programmes and is provided for in 14 out of 22 universities, while three universities each offer forestry, soil resources and watershed management, and wildlife management.

Desirability of forestry and natural resources education

Examining desirability from the students' perspectives can highlight the prevailing perception about the academic programme that is often held based on employment prospects, personal benefits and career development. Low desirability can have a lasting impact on the future of forestry and natural resources education, among other things because low-performing students who cannot enter other popular disciplines tend to be those who enrol. Enrolment is forced rather than desired, academically weak rather than scholastically superior, and unmotivated rather than passionate.

There is a general trend among Ethiopian university students for agriculture and natural resources education to be the least desired. Table 1 shows that the desirability of forestry is 3 to 47 for every 100 available spaces. Student enrolment for 2011/2012 at Hawassa University indicates that the desirability index of agriculture is better at 19 to 46 for every 100 available spaces. The level of desirability decreased over time for forestry from 500 to 700 applicants for every 100 spaces available when the College offered the diploma programme, particularly in the late 1970s and in the 1980s. The quality of students enrolled has also declined from a minimum 75% ESLCE (Ethiopian School Leaving Certificate Examination) score to less than 60% today (see Table 1).

Table 1. Desirability index of agriculture and natural resources education among students enrolling at Hawassa University during 2011

Educational programme	College location	Enrolled students			ESLCE points	Desirability index*
		M	F	Total		
Animal and Range Science	Hawassa	29	9	38	55.3	34
Plant Science	Hawassa	30	10	40	55.6	46
Horticulture	Hawassa	29	10	39	55.5	34
Rural Development	Hawassa	26	16	42	60.3	396
Agricultural Resource Economics and Management	Hawassa	29	9	38	55.3	400
Food Science and Post-harvest Technology	Hawassa	25	9	34	54.6	19
Human Nutrition	Hawassa	28	12	40	66.3	436
Natural Resource Economics and Policy	WGCFNR	30	10	40	55.1	47
General Forestry	WGCFNR	30	12	40	54.8	37
Geographic Information Science	WGCFNR	22	8	30	56.1	36
Forest Product Management and Utilization	WGCFNR	22	8	40	54.4	3
Agroforestry	WGCFNR	30	10	40	54.1	31
Natural Resources Management	WGCFNR	30	11	41	55.6	57
Wildlife Wetland and Fishery Management	WGCFNR	33	2	35	54.3	3
Soil Resources and Watershed Management	WGCFNR	30	10	40	54.3	12
Ecotourism and Cultural Heritage Management	WGCFNR	25	10	35	54.2	10

* Index value shows the number of students desiring the programme as the average of first, second and third choices for every 100 spaces available per programme.

Source: Hawassa University student placement data, Office of the Registrar WGCFNR.

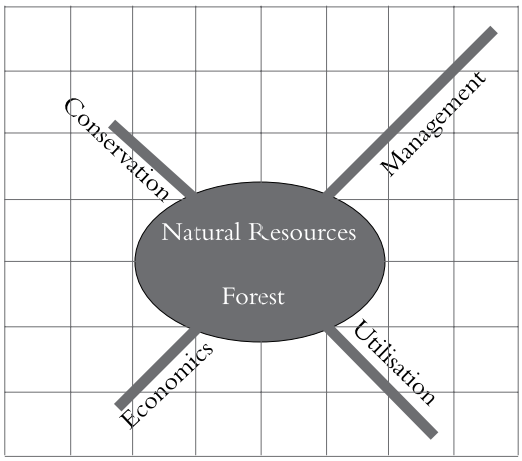
The location of the forestry college in a forested area in a rural location contributes to low desirability in Ethiopia. Table 1 shows that agriculture that is located in a regional town had a higher desirability index compared with forestry and similar courses located at rural sites. The two places have very different indices. Agricultural Resource Economics and Management located in Hawassa has a desirability index of 400, while Natural Resource Economics and Policy located at the WGCFNR has a desirability index of 47. The location factor is further explained by a survey of Natural Resources Management students at the WGCFNR. A pairwise ranking survey of the desirability of forestry among third-year Natural Resources Management students at the WGCFNR reveals a different picture. Forestry was chosen instead of engineering, agriculture, teaching and geology, but rejected in comparison with medicine, computer/information technology, economics, law, and natural resources management. Medicine and natural resources management are highly valued disciplines. The low desirability of forestry education is not unique to Ethiopia. Several studies from different part of the world report the same trend (Wanjohi & Muthuri, 2008; Brown, 2003; Rodriguez, 2004; Temu & Kiyiapi, 2008). This phenomenon is linked to many factors (Akande, 2008), such as lower priority given to the profession by governments, curriculum issues, minimal private involvement in forestry, lack of scholarships, and the popularity and status associated with white-collar jobs, among others.

Rigour and relevance of forestry and natural resources curricula

'Rigour' is generally defined as intellectual challenge and scholastic demand, while 'relevance' refers to the contribution of higher education to the economic, social and environmental advancement of the country. Experts who were interviewed asserted that one of the major problems with forestry curricula in Ethiopia is an inability to follow the frequently changing direction of forestry development. A survey evaluating forestry education in Ethiopia (HESC, 2008) showed limitations with regard to course administration, theory as opposed to practical skills, graduate competence, and mode of course delivery, instructional media and endogenous experience. The same source suggests that forestry education in Ethiopia is failing to produce experts who are committed, knowledgeable, equipped with practical skills and self-employing. There is also the issue of lack of harmonisation of curricula that gives rise to other rigour challenges (MoE, 2011).

In the Ethiopian public university system, natural resources programmes in general and forestry programmes in particular coexist mainly with conservation and economic management and utilisation (MoE, 2011). In the light of sustainable development, where three pillars are emphasised, here the social aspect seems less emphasised. However, this Ethiopian example seems universal (Vanhof, 2010). In the context of ESD, where systems thinking is important, the approach here is mainly commodity-oriented (Alemu 2008; Demel, 2002; EFAP, 1994). Management is strongly emphasised in the form of forest management, natural resources management, watershed management, land management and wildlife management (Figure 5). Utilisation, the next highest, is linked with forests in the form of production, processing, harvesting and technology. Conservation and economics are linked with natural resources and the environment in the form of soil conservation and natural resources economics. The social aspects of forestry are generally absent or poorly covered.

Figure 5. Scale of hybridisation of programmes and forestry and natural resources curricula at technical, bachelor's and master's level in Ethiopia



Another form of hybridisation in Ethiopia links forest with climatic conditions in the form of dry-land forestry, with mixed land uses such as agroforestry, and with settlement patterns like urban forestry (WGCFNR, 2009). This is no different from the general practices in Africa (Temu *et al.*, 2008) that also include temporal paradigm shifts with regard to global forestry (Nair, 2008). The manner of mix is not only about combining subjects, but also about bringing together different levels, for example: introduction, basics, fundamentals, synthesis levels (including watersheds and agro forestry systems), and functional levels (including processing, planning and management). With regard to courses, the number of subjects mixed in forestry and related areas varies between 1.93 and 2.45 (Table 2) NRE and AF respectively. While NRE emphasises one-subject courses, AF stresses courses that combine two and three subjects.

Table 2. Mix of subjects in a course and frequencies of the number of mixes for different academic programmes at the WGCFNR

Academic programmes	Number of courses	Average competence	Mix of competence			
			4	3	2	1
AF (Agroforestry)	47	2.45	6	16	18	7
FMU (Forest Management and Utilisation)	45	2.02	1	13	17	14
GF (General Forestry)	49	2.02	1	12	23	13
GIS (Geographic Information Science)	39	1.95	1	7	20	11
NRM (Natural Resources Management)	46	2.17	3	16	13	14
NRE (Natural Resources Economics)	44	1.93	1	12	14	17
SRWM (Soil Resources and Watershed Management)	41	2.07	2	13	12	14
WLM (Wildlife Management)	42	2.36	6	13	15	8

Source: Summarised from the WGCFNR academic programmes course list and description.

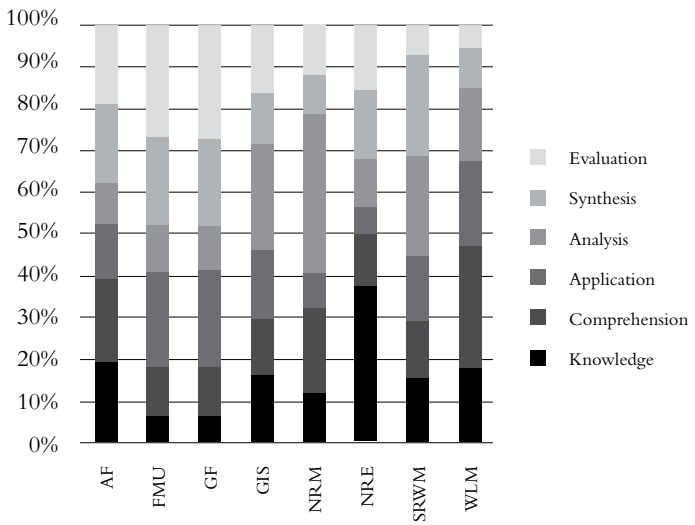
The table shows courses that: are non-mixed, for example introduction to economics; comprise two subjects, namely remote sensing and GIS; combine three subjects, namely tree seed and nursery technology; and integrate four subjects, namely watershed management and land use planning. The assumption is that the student needs to cover concepts and/or subjects that can be stand-alone courses in other circumstances.

By analysing the graduate profiles for programmes based on Bloom's taxonomy (Bloom, 1956), differences can be observed (see Figure 6). In NRM, more emphasis is placed on analysis, while application is minimal; in NRE more emphasis is placed on knowledge, while application is minimal. In AF and WLM, application is assigned a high value. What is interesting are FMU and GF; here, evaluation and application are strongly emphasised. The level of emphasis distinguishes generalists from specialists.

In the context of ESD, 'rigour' can mean an understanding of complexity in its heuristic nature where multidisciplinary synthesis and analysis are a prerequisite. One of the challenges here is disentangling human and environmental perspectives while at the same time comprehending the synergistic effect of the two on temporal and spatial scales. Knowing complexity on the one hand requires dynamic system-level modelling, but, on the other, demands simplified articulation of development implications to augment policy frameworks.

By the same token, 'relevance' is mainly adherence to the knowledge production in the country that supports national and local development strategies. This implicitly requires creating a critical knowledge hub and databank, understanding the field setting where the graduates are expected to operate, the institutional setting that can be elastic in order to address proactive and reactive engagements, and a system that can maintain institutional memory.

Figure 6. The level of emphasis placed on different learning outcomes by the curricula of academic programs at the WGCFNR, with reference to Bloom's taxonomy



Source: Summarised from graduate profiles stated in the curriculums of academic programmes of the WGCFNR.

Epistemological foundations of forestry and natural resources education

Texts, curricula documents, course objectives, field guides, emphasis of visits, and project plans have shown the epistemological foundation of forestry education in Ethiopia to be oriented towards productivity of forests.

The orientation is towards a plantation-prioritised knowledge system where silviculture, management, utilisation, inventory, protection and economics form the foundation of the curricula. Production per hectare in terms of volume or biomass is an important guideline, and, with it, sustainable flow of cut governs the orientation. The objectives of all the management plans of the campus forest emphasise sustainable cut rotation. Similarly, major plantation operations have been established after the natural forests were clear-felled. Moreover, graduates are trained to perform as competent field rangers equipped with practice-oriented knowledge/skill and the behavioural orientation of exotic-tree managers.

The definition of 'forest', concepts of the forestry sector and knowledge system, and the competences of the expert and practitioner are closely linked. 'Forests' are defined as commodities that are physically characterised, where forestry is considered as a stand-alone knowledge system harvested from forest land alone. 'Foresters' are specialists in respect of timber at least and trees in a given landscape at best. The Ethiopian forest sector organisation was, in the past, a commodity arrangement comprising four pillars:

1. State forests made up mainly of plantation forests and natural forests;
2. Community forests encompassing community plantations and homestead trees;
3. Soil and water, comprising mainly soil-conservation practices; and
4. Wildlife, that is, responsibility for national parks, sanctuaries and hunting areas.

This prevailing epistemological foundation differs from what is required in the context of ESD, as shown in Table 3 below.

It has also been noted that forest systems are more likely to have sustainable outcomes with regard to high-tree species richness and subsistent livelihoods when local forest users participate in forest rule-making, whereas unsustainable forest system outcomes are more likely when users do not participate in rule-making (Persha, Agrawal & Chhatre, 2011). Consequently, forestry changed from emphasising trees and forests to incorporating the landscape in general and social issues, as well as from wood-restricted values to environmental services (UNFF, 2011). This transformation called for sustainable forest management that defined forestry education in line with ESD.

Characteristics of such education (Table 3) include sustainable forest management thematic elements (UNFF 2006), a framework of course subjects (Temu & Kiyiapi, 2008; Arevalo, Pitkanen, Tahvananinen & Enkenberg, 2009; Langin & Ackerman, 2008), non-forestry complementarities (Temu, Okali & Bishaw, 2006), the contents of forestry curricula (Koffa & Nyenka, 2008), and non-technical knowledge (Werland, 2009; Brown, 2003). Additionally, such education needs to overcome major challenges of higher education (UNESCO 1998) and global forest governance (Werland, 2009).

Table 3. Components of forestry education in the realm of ESD

Key areas	Descriptions
Sustainable forest management thematic elements	1. Extent of forest resources; 2. Forest biological diversity; 3. Forest health and vitality; 4. Productive functions of forest resources; 5. Protective functions of forest resources; 6. Socio-economic functions of forests; and 7. Legal, policy and institutional framework.
Forestry education framework of subjects	Fibre products, genetic resources, water quality and yield management, landscape values and environment, science and innovation, climate change, and non-wood products.
Non-forestry complementarity	Integrating social, cultural and environmental aspects.
Modern forestry education curricula	1. Public sector and community joint management of forest resources; 2. Forestry and its role in biodiversity conservation and protection; 3. Forests as recreation sites, including ecotourism; 4. Partnerships with the private sector for purposes of research, management and timber processing; 5. Forests as carbon sinks and the international implications of trading in carbon sink credits; 6. Civil society information delivery relating to forests and forestry issues; 7. Forest policy formulation and implementation; 8. Forestry education and training for non-traditional target groups; and 9. Interrelationship of forestry with other sectors such as agriculture, natural resources management, education, tourism, infrastructure and trade
Non-technical knowledge	Propositional knowledge: skilled action and deliberative analysis in decision-making, problem-solving and planning; Process knowledge: experiences, personal theories and memories; Personal knowledge: socialisation into the professional approach; and Ethical principles: gaining a sense of professional identity.
Higher-education challenges	High-quality education based on societal demands; partnerships involving higher education and the public and private sectors; innovative multidisciplinary and interdisciplinary approaches in higher education; and enhanced international cooperation and exchange in higher education.

Towards guidelines for forestry and natural resources curricula in higher education, aligned with ESD

As indicated, the analysis above informed the conference search result deliberations (see Appendix A). The conference search, in its deliberations, focused on issues of adapting higher education in respect of forestry to changing societal needs, on necessary academic institutional

foundations to that end, on the desired epistemological framework for curricula, and on ensuring dynamism and continuity of programmes. The outcomes were achieved as a result of the participants' representativeness, first-hand experience, as well as practical and academic knowledge.

In addition to the wider context of forestry education as described above, and the related contours of the higher-education system, the following more specific issues arose in the plenary discussions and the search conference workshop as a whole, all of which helped to formulate the guidelines (see Appendix A for further details):

- *The role of higher education:* Universal science is, it was stated, brought about by the level of rigour of academic teaching and research, but the contribution to strategic development was emphasised in terms of relevance of the programmes and social engagement of the higher-education institution. In this regard, the WGCFNR was criticised for not having strong units that could provide appropriate technologies, information and data to meet the serious demand in the country in relation to forestry and natural resources, implying a need for a reorientation of emphasis and a change in the institutional set-up in forestry and natural resources higher education system management towards greater emphasis on technological support and extension.
- *The role of graduates:* Expected roles for graduates were outlined as: (a) contributing to overall poverty reduction and the economic development of the country; (b) planning, managing and executing forestry activities; (c) involvement in village forestry, agroforestry, industrial forestry and environmental forestry; (d) understanding emerging forestry-related issues and converting them into action nationally; (e) being well versed in modern spatial information science and survey techniques; (f) contributing to the value-adding process in respect of forestry products and services; (g) creating networks with other professionals; and (h) working in multidisciplinary teams. These sets of roles were linked to the conceptual and operational definitions given to 'forest' and 'forestry' (see Appendix A). To strengthen the role of graduates, two important definitional elements were recommended: the legal definitions given in the country's forestry proclamation and the popular definitions as per the perceptions held in respect of forests.
- *Policy framework evaluation:* This refers to the need for engagement in critical and pragmatic evaluation of policy frameworks and strategic directions of the country. In the existing policies that govern education, the forestry sector may have limited higher-education value, but changes are already occurring at national strategic level (e.g. FDRE, 2011; FDRE, 2010). In this regard, higher education needs to adapt to the demands of such strategies in the form of green economies and sustainable development, thereby also helping to contribute to, and participate in, upscaling schemes of working forest management models, for example the participatory forest management schemes of the country.
- *Theory–practice relationship:* It was acknowledged that an imbalance between theory and abstraction at higher levels, and practice as emphasised at lower levels was occurring. A suggestion was made to reinstitute the diploma programme (Figure 4), as it had a 50%

practical-education emphasis. Moreover, its success in the past had been recognised. The need for postgraduate programmes (MSc and PhD) to address the emerging demand for academicians, researchers and decision-makers was also noted. In so doing, guidelines were established for minimising trade-off and maximising synergies in the curricula-formulation processes. This involves ensuring smooth and progressive links between undergraduate and graduate levels of education.

- *Non-reductionist approach:* It was said that an inclusive and system-oriented education in the form of ESD should be set up which also shows a deep understanding of the sector and the employment system. Higher education should not be detached from state and employer demands, and should pay attention to employers' needs and aspirations regarding graduates. A strong case was made for the introduction of quality measures and verification methods in addition to conventional criteria (HERQA, 2009). Particular mention was made of improving the quality of postgraduate theses as a way of overcoming the prevailing ethical decay. A suggestion was made that a modular research approach be introduced in which well-thought-out thematic areas, standardised methodologies, and explicit development implication measures determine theses production. The justification for this was ensuring quality, at the same time minimising theses that are shelved in libraries without practical contributions.
- *Networking:* Networking was suggested as a strategy for benefitting wisely from resources, experiences and knowledge exchange. While actively following the emerging global narrative and evolving scholarship is necessary for sharing in the universally growing knowledge field, establishing a degree of stability in accordance with the demands of the country was strongly emphasised. It was also strongly emphasised that higher-education institutions play a stronger leading role in guiding and informing forestry and natural resources knowledge management in the country.

Concluding Discussion

Enrolment in forestry education has declined all over the world mainly as a result of the failure to respond adequately to rapidly changing social, economic and political environments. This seems a generally accepted notion in several forestry education studies and it tends to form the bases for revitalising the discipline in the higher-education system. Of course, it is imperative to articulate clearly what constitutes 'the decline of forestry education' before the reasons are sought and solutions prescribed.

Can forestry be a stand-alone field that can contribute reasonably to global sustainability or will it be a better contributor if linked with other disciplines technically and scientifically? Forestry as a discipline borrows its scientific foundation from many other basic sciences. At the same time, its societal benefits are judged in relation to other natural resources. Becoming a viable form of education requires clarity on the epistemology and purpose of forestry education, as outlined in this article. As shown in this study, this requires engagement with sustainable-development concerns, as well as contextual, field-specific concerns, employment and policy concerns, and practice and theoretical concerns. There is also a need for broadening

from a production-only narrative guiding forestry education, to wider concerns. A review of the status of forestry education is also required in order to increase the desirability of the profession among students. In the light of the current decline in forestry education, there appears to be a pressing need for universities strong in forestry to change their vision in view of the changing knowledge and practice context. In particular, forestry education needs to embrace principles of ESD in order to play its role in responding to serious environmental concerns such as deforestation, climate change and the energy crisis. This can potentially also provide a new epistemological path for forestry education.

Forestry education is inseparable from the way forests, forestry and foresters are conceptualised. Engaging the interrelated environmental, economic and social aspects of sustainable development shifts the conceptualisation of forests from a 'plantation' to a social–ecological system with a local to global spatial setting. This gives forestry education more content, a more relevant and contemporary approach, and direction that involves multidisciplinary knowledge where the three pillars of SD are combined. This requires a new kind of curriculum that is rigorous and relevant and allows prospective foresters to attain a different knowledge, competence level, values base and skill mix from that which is currently on offer.

In conclusion, this article has sought to argue that forestry education in the context of ESD needs a different epistemological stance that outlines the necessary and sufficient conditions of knowledge, the sources of knowledge, and the structure and its limits. However, for this to come about, there is a need to fully understand the history and profile of forestry education as it currently stands, and to engage stakeholders and members of the forestry education community in reconceptualising forestry education. Moreover, it is necessary to understand the creation and dissemination of knowledge in the forestry education context. Consequently, another ontological setting is required that deals with questions concerning the forests themselves, with issues of deforestation, and with forestry education entities that exist, and how such entities can be grouped, related within a hierarchy, and engaged within the new epistemological formations based on their similarities and differences. A new conceptualisation is demanded of forestry education today.

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Appendix A. Suggested guidelines for reorienting forestry and natural resources higher education in Ethiopia (summary of the search conference outcomes)

Group 1: Adapting higher education in respect of forestry to changing societal needs in Ethiopia

Key discussion points	Search conference outputs
• Possible links between landmark development programmes in Ethiopia, e.g. GTP and CRGE, and the forestry sector; hence forestry education	• Producing sufficient numbers of forest professionals so that they are better able to cater for needs in respect of conserving our forests, watershed management, soil conservation, plantations, etc. • Our curriculum should contribute to the uplifting of the local community and therefore the existing curriculum has to be revised. • Being the oldest and premier institute in the field of forestry education in the country, we should take the lead in updating and having common consensus on the development of uniform curricula among various institutions and universities.
• Required needs of occupational competence and knowledge mix for future foresters	• Our curriculum should be more field-based and our students should be competent enough to solve forest-related problems, something which is lacking in the existing curriculum. • Mixing of traditional knowledge with that of the modern system of forestry education.
• Ways to address the dilemma in undergraduate education whether to produce subject specialists or generalists	• We should have a General Forestry Programme for undergraduates (broader perspective: Ethnoforestry, GIS, Watershed Management, Wildlife, etc.). • However, the programme should be extended from 3 years to 4 years.
• Effective forestry and natural resources-related outreach programmes that academic institutions can adopt	• Our research activities should focus on community issues and should be carried out with its participation, e.g. technology village. • The outreach programme should be part of our curriculum.

Group 2*: Necessary academic institutional foundations and leadership to secure the future of forestry education

Key discussion points	Search conference outputs
• Establishing the need for centres of excellence for higher education in forestry and natural resources	• Go-to-place (strong service delivery). • Continuous curriculum revision that considers emerging issues (advanced knowledge). • Developing guidelines/manuals. • Alternative recruitment and promotion mechanisms (e.g. recruiting researchers through special contracts, staff incentives, etc.). • Validating studies conducted by regions and other stakeholders. • Sharing forestry knowledge with relevant institutions and partners. • Start within and extend to outside (addressing challenges within the college first). • Opening research and extension centres-where the institute has comparative advantage (e.g. GIS, environmental history, climate change mitigation, hydrology, etc.).
• Types of research/theses models needed that at the same time fulfil the quality requirement and development relevance	• Strengthening the research and extension capacity of the college. • Encouraging knowledge multiplication, as well as multidisciplinary and teamwork approach. • Publication should encourage institutional/individual collaboration. • Developing thematic research. • Modular thesis approach (to attract students and funding, and promote knowledge dissemination).
• Indicating strategic collaborative partners at national, regional and global level	• Enhancing research, teaching, and development collaboration with government and development partners. • Reviewing forestry and related curricula of other universities and taking the initiative to be a leader in advancing forest and environmental sciences.
• Achieving a working balance between implementing new technologies and learning from indigenous knowledge	• Documentation of indigenous knowledge and integrate with scientific knowledge (validating available knowledge). • Working in close relationship with local community. • Participatory research through appreciation of farmers' knowledge.

* The group suggested that the issue here should read: 'Necessary academic institutional foundations, leadership and policy to [secure] the future of forestry education'.

Group 3: Epistemological framework for higher education curricula in respect of forestry and natural resources

Key discussion points	Search conference outputs
• Outlining conceptual and operational definitions of 'forest', 'forestry' and 'forester' in the Ethiopian context	• A forest is a parcel of land >0.5 ha, with 10% canopy cover and being above 2 m in height. • If this is the current and historical definition, the future curriculum and student in forestry and NR need to redefine it based on emerging issues related to this definition. • We define it without enough knowledge on how much is located where. The old definition of 'forest' is being/should be redefined to include: (a) restored degraded lands; (b) woodlands; (c) agroforestry; (d) areas with carbon sequestration; and (e) urban forests. This implies a multidisciplinary knowledge pool comprising: (a) ecological; (b) silvicultural; (c) economic; and (d) social. Which of these knowledge pools are drying up and which ones are emerging? This could be a basis for reviewing the existing curricula. Other issues are: land-use change has been pushing the boundary of forests for the last 50 years – (a) curricula should seek the causes and give answers; (b) students should be encouraged to provide practical solutions for these challenges; (c) how can a working definition of forests include ownership, purpose and vegetation type (name) and local knowledge; (d) a working definition that is comprehensive enough but not complete to trigger discussion and questions in academia. Forestry • Knowledge of managing forests (scientific and indigenous). • The science that deals with the interaction of forests with their biotic and abiotic elements and the people around them. • Here also, emerging science, knowledge and practice should trigger questions for academia and the curricula should try to answer. • Forestry should evolve from growing trees to sustainability of ecosystems..

Key discussion points	Search conference outputs
• Defining guiding principles in respect of forestry and natural resources education in the context of sustainable development	• Could start from basic biology/silviculture/systems thinking/interactions. • But the cutting edge is not to grow trees but to make them marketable in respect of services and values: This will help buffer deforestation. • Look for the intersection among the four capitals (biological, social, economic and cultural). • Do not look for fixed recommendations to optimise income, but for adaptive solutions suitable for local conditions.
• Listing measures of rigor and relevance of higher education in forestry and natural resources in the changing societal demand	• Centre of excellence. • Getting jobs for graduates. • Be able to solve practical problems. • Meet societal demands. • Create awareness about forest/forestry/ecosystems. • Evaluate the capacity of the current curricula to make the student think for long time period – modular as opposed to semester. • Involvement in macrolevel and microlevel issues: macro-earth system science and micro-ecosystem science.
• Strategising proactive forestry and natural resources education in relation to emerging challenges and as a reaction to the ongoing strategies and development endeavours	• Assessing emerging issues and their challenges. • Teaching not only subjects, but also problem-solving skills. • Teaching that is focused on mechanisms not events. • Updating with cutting-edge science. Maintaining the marriage between science and practice (especially community practice). (a) Start from what is known in both and develop to common ground. (b) Otherwise, science becomes irrelevant to people and society may no longer value science. • In creating jobs, discuss this with government departments (on a contractual basis) with a view to integrate their plan with the research plan of the university.

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Education for Sustainable Development
The Case of Masinde Muliro University of Science and Technology (MMUST)

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Abstract

The unit-based sustainability assessment tool (USAT) was administered at Masinde Muliro University of Science and Technology (MMUST), Kenya, between January and March 2012. The assessment focused on establishing to what extent the University integrated sustainability concerns into its core functions of teaching, research and community engagement. Using a unit-based assessment tool allowed for 'building the picture' of the whole university, as well as concentrating on specific units as required, that is, on one faculty at a time. The assessment revealed that, in terms of addressing sustainability concepts and issues, the overall university performance rating was 50.76%. The data clearly indicated that university performance was best in the teaching approaches cluster of indicators, followed by staff expertise and willingness to participate in sustainability teaching and research. Performance in community engagement and research and scholarships was lowest. The study revealed the need for resource mobilisation by the University for the purposes of additional training, community engagement, research and scholarships, increased sensitisation with regard to ESD (education for sustainable development) planning and implementation, and regular audits.

Introduction

Education for sustainable development (ESD) is described as 'education that enhances sustainable development' and whose mission is 'to provide an enabling environment and capacity for all sectors and stakeholders to contribute effectively towards the achievement of sustainable development' (NEMA, 2008:13). ESD can potentially help governments and development partners to ensure that capacity exists for achieving the Millennium Development Goals (MDGs), since ESD provides *learning goals* that help to achieve the MDGs (UNESCO, 2008). Education and learning lie at the heart of approaches to sustainable development and are therefore also matters of concern in higher education, as this article discusses in more detail.

The background of ESD in Kenya

The United Nations Conference on the Human Environment held in Stockholm in 1972 helped to focus attention on environmental concerns. In the years following the Conference, the global community acknowledged that more exploration was needed on the interrelationships between the environment and socio-economic issues of poverty and underdevelopment (UNESCO, 2008). Subsequently, the concept of sustainable development emerged in the 1980s in response to a growing realisation of the need to balance economic and social progress with

concern for the environment and the stewardship of natural resources. The concept gained worldwide momentum with the publication, in 1987, of *Our Common Future* by the World Commission on Environment and Development (UNESCO, 2011).

The Decade of Education for Sustainable Development (DESD) was a result of a series of international conferences, declarations and initiatives which began with the 1992 Rio Earth Summit and culminated in the 2002 Johannesburg World Summit on Sustainable Development. The Johannesburg Summit also reaffirmed the educational objectives of the MDGs (UNEP, 2008). The MDGs provide a universal framework for development, agreed to by all United Nations (UN) member states in 2000. They serve as a means for developing countries and development partners to work together in pursuit of a more sustainable future. Furthermore, the Johannesburg Summit proposed the DESD as a way of signalling that education and learning lie at the heart of approaches to sustainable development. Subsequently, at its 57th Session in December 2002, the UN General Assembly proclaimed the DESD for the period 2005 to 2014 (UNESCO, 2008).

As a response to the DESD declaration, Kenya, in 2008, developed a national ESD strategy supported by the National Environment Management Authority (NEMA). The strategy outlines the implementation of, and vision for, ESD in the Kenyan context and presents ways to engage in change for the sake of sustainable development. It proposes action-oriented strategies to guide stakeholders in their journey towards sustainable development (Republic of Kenya, 2008). In the strategy, ESD is described as 'education that enhances sustainable development in Kenya' and whose mission it is 'to provide an enabling environment and capacity for all sectors and stakeholders to contribute effectively towards the achievement of sustainable development'. The implementation and coordination of ESD is carried out by means of seven strategies:

1. Advocacy and vision-building;
2. Consultation and ownership;
3. Partnership and networks;
4. Capacity-building and training;
5. Research and innovation;
6 The use of information and communication technologies (ICTs); and
7. Monitoring and evaluation (Republic of Kenya, 2008).

Several regional centres of expertise (RCEs) have also been established to enhance this process (Republic of Kenya, 2008), one of which is located at MMUST. RCEs were established by the United Nations University in 2005 to achieve the goals of the DESD by translating its global objectives into the context of the local communities in which they operate (UNESCO, 2011), which has implications for the role of universities that are involved in RCEs, as will be discussed below in more detail. Additionally, in line with the DESD principles, in 2011, the Ministry of Environment and Mineral Resources (MEMR) of the Kenyan government published the National Education for Sustainable Development Policy. According to Republic of Kenya (2011:10), the goal of the policy is 'education that enhances sustainable development in Kenya'. This emphasis on ESD in Kenyan education does not exclude higher-education institutions.

ESD at Kenyan universities

In Kenya, at the level of higher education, environmental education is offered both at undergraduate and graduate level – as a full course in some universities and as a unit in others. Jomo Kenyatta University of Agriculture and Technology (JKUAT) developed an ESD policy to guide its programmes and operations, assisted by the Environmental Programme Support (EPS) within the NEMA, and funded by the Danish Development Agency (DANIDA) and the Swedish International Development Cooperation Agency (SIDA) (UNESCO, 2011).

Two key higher-education initiatives in Kenya include participation in the network of Mainstreaming Environment and Sustainability into African Universities (MESA) and the Education for Sustainable Development in Africa (ESDA) project. Developed by the United Nations Environment Programme (UNEP), the MESA brings environment and sustainability concerns into the mainstream in terms of teaching, research, community commitment, and the management of universities in Africa. As a result of this programme, six universities in Kenya have raised awareness within and beyond their institutions, promoting a new way of thinking about the environment, development and society (UNESCO, 2011).

The MESA programme has made e-learning a key focus of its activities. For instance, in the creation of partnerships with the UNEP's Online Access to Research in the Environment (OARE), the Global Virtual University provides training on the design and development of e-learning courses for MESA participants. The MESA has also contributed to enhancing the quality and development of teaching and learning materials. A number of MESA participants use the MESA ESD Innovations Tool-Kit to design new materials. They have also used UNEP MESA materials in their teaching, such as the Africa Environment Outlook Report (UNESCO, 2011).

The ESDA is a project of the United Nations University (UNU) Institute for Sustainability and Peace (ISP) and of Kenyatta University, whose aim is to develop and test graduate-level education programmes for professionals potentially engaged in sustainable development in Africa. Professionals at the graduate-school level are trained to acquire relevant knowledge, skills and experiences related to sustainable development. ESD developments in Kenya will be promoted through this training (UNESCO, 2011).

ESD at Masinde Muliro University of Science and Technology (MMUST)

According to Nguka (2012), an RCE Creation Seminar sponsored by the Nile Basin Initiative and facilitated by the NEMA and members of RCE Greater Nairobi was held in Kakamega, Kenya, from 3 to 5 December 2008. From 2009, the newly appointed Coordinator of RCE Kakamega Western Kenya, and other members of the RCE, began ESD activities in collaboration with the Deputy Vice Chancellor (DVC)'s Office of Academic Affairs at the MMUST. Activities have centred on building partnership and collaboration in order to spearhead ESD activities at the MMUST and in the western Kenya region.

Subsequently, in 2011, SIDA advertised an opportunity for African and Asian participants to attend the annual International Training Programme (ITP)1 ESD at various universities and institutions in 2012 in Sweden. A 20-member Working Committee, including MMUST lecturers, students and community members from Kakamega, was formed in February 2012

under the Office of the DVC Planning Research and Extension (PRE). The Committee was from then on referred to as the MMUST ESD Research Project Committee.

During Phase 1 of the ITP, the MMUST ESD Research Project Committee carried out an audit of the MMUST curricula of all centres, faculties and schools. The activity was urgent, for the Committee needed to design strategies in respect of the ESD/MESA. Baseline information was therefore important. The assessment at the MMUST would reveal levels at which sustainability concepts and issues were being addressed.

Research Aim, Objectives and Rationale

Main aim: To audit the curricula at Masinde Muliro University of Science and Technology (MMUST) in order to establish their quality regarding sustainable development with a view to building on and strengthening them and improving on their weaknesses.

Specific objectives:

1. To establish the level at which academic faculties at the MMUST offer courses which deal with sustainability concerns;
2. To determine the extent to which staff and students in academic faculties of the MMUST are involved in research and scholarship activities in the area of sustainability; and
3. To establish the level of involvement of academic faculties at the MMUST in sustainability-related, community-engagement activities.

Rationale: Sustainable development has continued to be a common concern at all UN conferences and there has been consensus that education is a driving force for the change needed. It has also been pointed out that peace, health and democracy are mutually reinforcing prerequisites for sustainable development. As noted above, a national ESD strategy was developed for Kenya by the NEMA in 2008. The national ESD implementation strategy proposes action-oriented strategies to guide stakeholders in their journey towards sustainable development (Republic of Kenya, 2008), but it does not provide guidance on generating baseline information in universities. Several studies have been undertaken in other parts of the world (Lozano & Peattie, 2011; Matarazzo-Neuberger & Filho, 2010; Mcmillin & Dyball, 2009). These authors point to the need to conduct an audit as a first step and a basis for identifying points of weakness in mainstreaming sustainability into academic programmes and for planning for improvements. This research formed part of the road map to achieving the DESD objectives at the MMUST, in Kenya, and internationally.

Methodology and Design

The unit-based sustainability assessment tool (USAT) developed by Togo (2009) and published by Togo and Lotz-Sisitka (2009) was used as a framework to gauge to what extent environmental sustainability in teaching, research and community engagement had been embraced at the University. The USAT forms part of a range of international sustainability-assessment tools

that allow universities to reflexively review their progress in engaging with environmental and sustainability concerns. The USAT allows for 'unit-based' assessment at the level of departments, and for different activities (e.g. policy, student activities, community engagement, etc.) within universities. It is a flexible tool that can also be contextually adapted to the institution and/or national context in which it is used. With the aid of this tool, the MMUST was audited within the first three months of participation in the ITP, which audit formed a baseline for conceptualising change initiatives in the University. An overall assessment of all the core functions was initially performed to provide an overall picture of ESD at the MMUST, Main Campus.

This was done in line with Archer's recommendation. In her theory of social change, Archer states that different strata may possess different emergent properties and powers, thus influencing the whole in different ways (Archer, 1995). The advantage of this method was that it would help to identify areas of change and successes by means of a relatively rapid assessment technique. The results, representing the performance of the various centres/schools/faculties, could then be averaged to obtain the overall performance of the institution.

The study adopted a survey-research design in which the respondents were interviewed, guided by a structured questionnaire. The target population was the entire MMUST. The study population was the 24 departments organised into six faculties, schools and centres (hereafter simply referred to as 'faculties') as follows: Faculty of Education and Social Sciences (6 departments), Faculty of Science and Agriculture (5), School of Health Sciences (6), Centre for Disaster Management and Humanitarian Assistance (CDMHA) (4), and Faculty of Engineering (3).

The unit of analysis was the department. The census method of data collection was adopted where one respondent from each of the departments was interviewed. The respondents were heads of departments, since they were assumed to have sufficient information about their departments. To supplement information from the interview, content analysis of course outlines and examination papers, as well as other evidentiary documents, was conducted to confirm and/or extend the information captured by the USAT.

Part A of the USAT was used for this research (see Appendix A). It had six indicator clusters: curriculum, teaching approach, research and scholarship activities, community engagement, staff expertise and willingness to participate in sustainability teaching and research, and, lastly, examinations and assessments (details of the specific indicators can be found in Appendix A). Assessment criteria in Part A were coded with clear descriptions (Togo & Lotz-Sisitka, 2009) as follows: The responses were scored on a scale of 0–4, where 0 denoted lack of sustainability, 1 indicated little sustainability, 2 represented adequate sustainability, 3 showed substantial sustainability, and 4 meant a great deal of sustainability. Data obtained was summarised in tables and was analysed by determining sums, means, and percentage-sustainability levels. The data was presented in the form of radar charts.

Results and Discussion

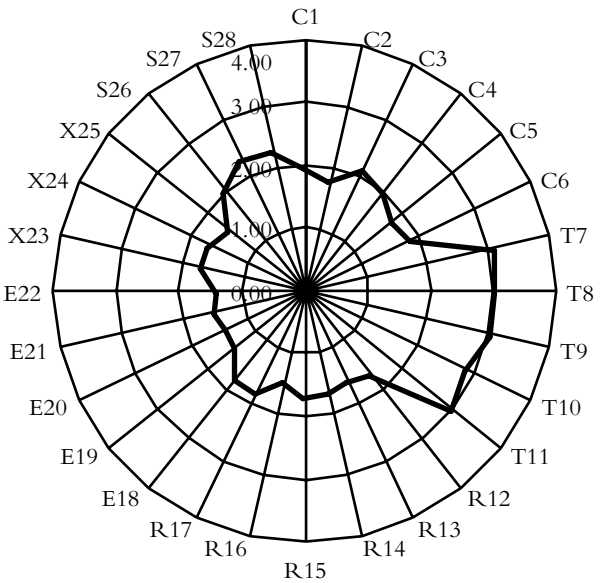
General performance by Masinde Muliro University of Science and Technology (MMUST)

The results are discussed in three subsections, namely: sustainability performance of the University, sustainability performance of individual faculties, and comparison of sustainability

performance among faculties. The general performance of the University in respect of ESD in its core business of teaching, research and outreach rated 2.04, corresponding to 50.90% (Figure 1) across all indicators.

The University performed best in the teaching approaches cluster of indicators (T7–T11), where the average score was 3.08 (77.12%), while the worst-performing cluster of indicators was for community engagement (E18–E22) at 1.52 (37.88%). Using this measure, it can therefore be said that the University is adequately embracing sustainability or sustainability-oriented teaching approaches, such as critical thinking, in its teaching. This may have been supported by the existence of the Faculty of Education, which offers courses in teaching methods, and by the practical nature of several programmes offered in the various faculties, given that the MMUST is a science and technology institution. The USAT suggests that teaching approaches that integrate theory and practice, and that embrace critical thinking and the active involvement of students in the learning process, are more strongly oriented to sustainability teaching (Togo & Lotz-Sisitka, 2009). The next-best performance result obtained from the use of the indicators was in expertise and willingness to teach and research on sustainability issues, which thus showed an interest in these issues amongst staff of the University. The two clusters of indicators were the only ones that scored above average. There is, however, need for improvement in the University's sustainability engagement in respect of all clusters of indicators. Curriculum assessment showed a need to integrate more sustainability issues across all faculties. Although teaching approaches performed better, there is still room for improvement. The University should also work very hard with regard to community engagement, as well as examinations and research and scholarships. The poor performance of these aspects may be attributed to limited funding at the University. Activities in these clusters require substantial funding.

Figure 1. Sustainability performance of the Masinde Muliro University of Science and Technology



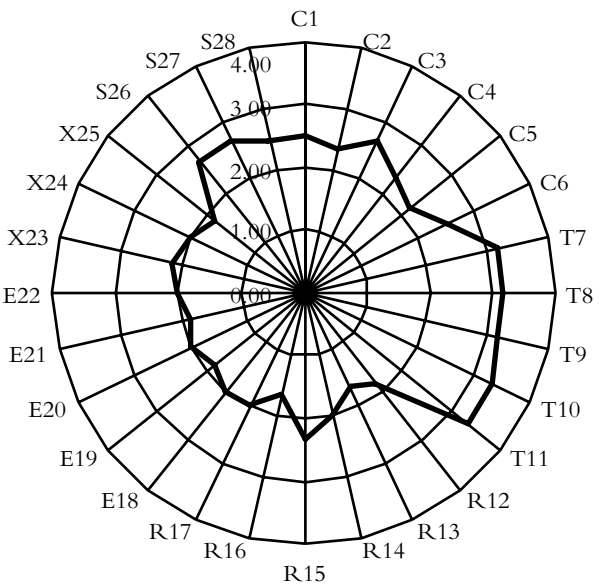
Sustainability performance of University faculties, centres and schools

There were clear differences in the performance of the faculties with respect to the key sustainability indicators. A summary of the results per individual faculty is provided below.

Faculty of Education and Social Sciences

The sustainability performance of this faculty is illustrated in Figure 2 and was generally above average, with an average sustainability score of 2.35 (58.63%).

Figure 2. Sustainability performance of the Faculty of Education and Social Sciences

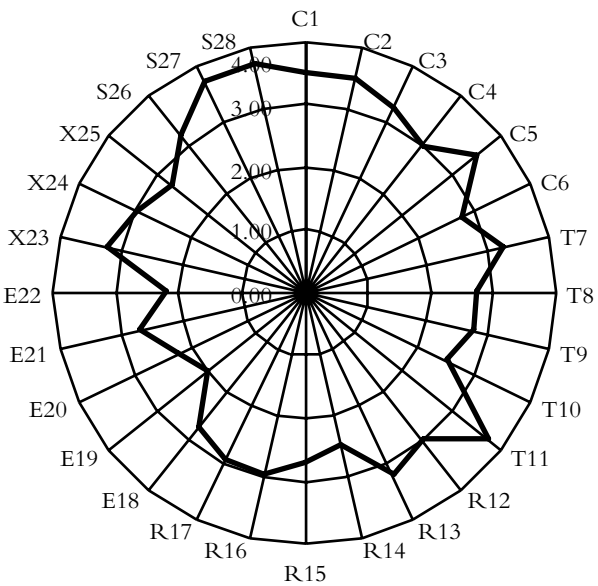


The Faculty rated highest in the teaching approaches cluster (T7–T11), in which all indicators scored between 3,17 and 3.33 out of a possible maximum score of 4. This could easily be explained by the fact that this is a faculty that trains teachers and so is likely to have integrated sustainability concerns in its curriculum. The lowest performance was recorded in the research and scholarship cluster (R12–R17), where scores ranged from 1.68 to 2.33. The performance in all the other clusters was moderate. The indicator that returned the lowest score was the degree to which global sustainability issues and challenges form part of the Faculty's research (R13). This could be due to the fact that the Faculty engages most in training teachers whose curriculum is highly localised and is designed to produce local teachers using specifically local content. There is a need for the Faculty to address this concern and to attempt to integrate global issues in its research and scholarship activities.

Centre for Disaster Management and Humanitarian Assistance (CDMHA)

The sustainability performance of the Centre is given in Figure 3. The Centre had an average score of 2.99 (74.8%) out of a possible maximum of 4. This can generally be regarded as a good score, and more so because the performance distribution was relatively uniform.

Figure 3. Sustainability performance of the Centre for Disaster Management and Humanitarian Assistance

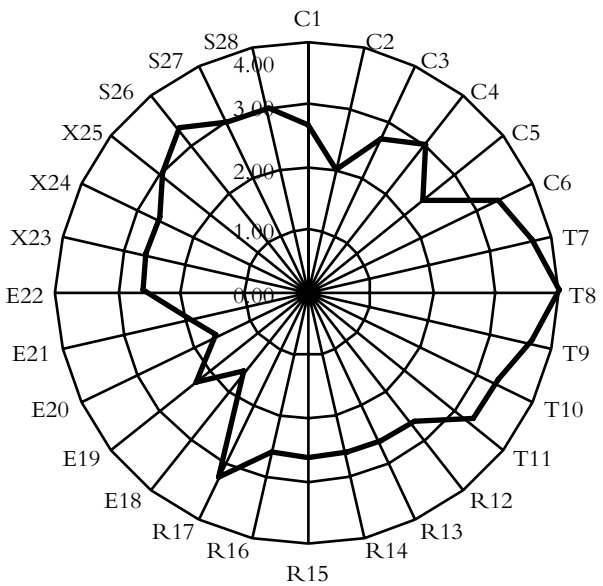


The performance across the clusters was more or less the same, although the clusters that scored almost entirely within the highest quarter were curriculum (C1–C6), which score ranged from 2.75 to 3.5, and staff expertise and willingness to participate (S26–S28), which scored between 3.25 and 3.75. The fairly high performance of the Centre can be explained by the nature of programmes that it is involved in, as these have major sustainability objectives. In most of the programmes, the Centre aims at managing disaster and providing for sustainable solutions to avoid recurrence. The lowest score (2.0) was in the community-engagement cluster and corresponded to the indicator showing the level of commitment of the Centre's resources in sustainability projects in the community (E19). By seriously focusing on this area, the Centre could expand the impact of its teaching programmes to communities surrounding the University.

Faculty of Engineering

The Faculty's sustainability performance is given in Figure 4. The average performance score was 2.81 (70.24) out of a possible maximum of 4. The performance within the indicator clusters was mixed, with the teaching-approach cluster (T7–T11) scoring highest (3.3–4.0) and the community-engagement cluster (E18–E22) scoring the lowest (1.67–2.67).

Figure 4. Sustainability performance of the Faculty of Engineering

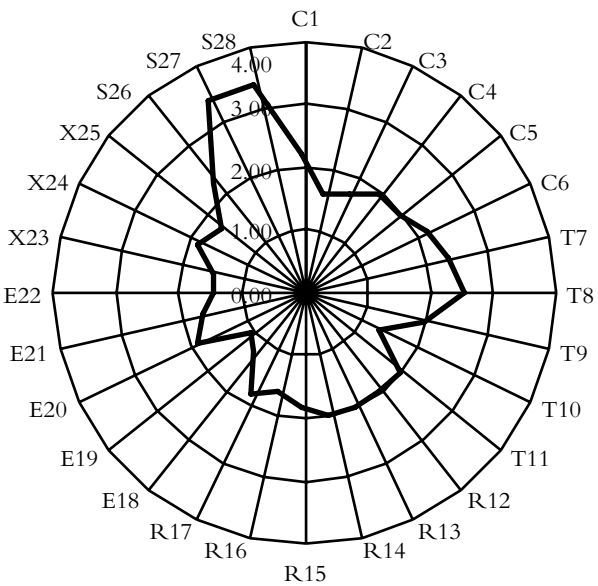


This Faculty emphasises a practical teaching approach, and this may have contributed significantly to the high performance in the teaching-approaches cluster. Within this cluster, the Faculty received the highest possible score in respect of the critical-thinking skills indicator (T8), which was most probably due to the nature of solutions that the programmes in the Faculty have to offer. There is a high demand for originality, ingenuity and innovation in the Faculty's programmes. All the same, there is need for improvement in the areas where the score was low, especially community engagement. The Faculty ought to think seriously about making use of the high, critical-thinking potential to address community problems in addition to providing global, industrial solutions. This would be in line with the views of Sterling (2001) that sustainability logically necessitates a deep learning response in educational thinking and practice and *anticipative* education, recognising the new conditions and discontinuities which face present generations.

Faculty of Science and Agriculture

These are in fact two faculties, but they were considered as one for the purpose of this study, based on the fact that they previously functioned as one faculty, had only recently been split, and the Faculty of Agriculture still had only one department. The sustainability performance of the Faculty is given in Figure 5.

Figure 5. Sustainability performance of the Faculty of Science and Agriculture

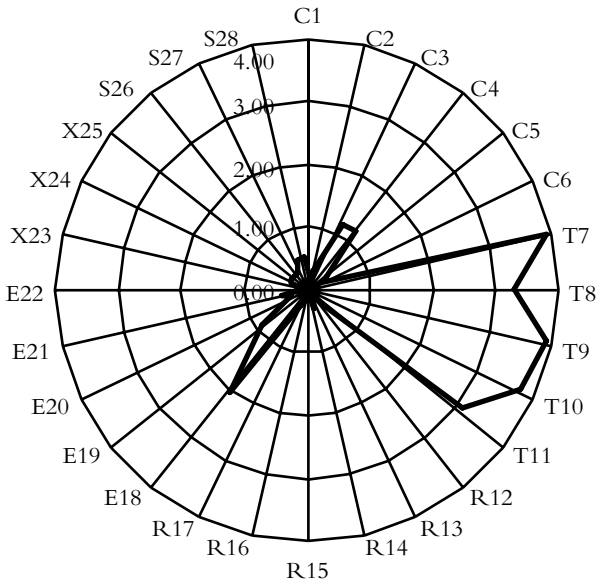


Performance was mixed, with a mean score of 1.93 (48.35%). The only cluster of indicators that scored more than 75% was staff expertise and willingness to participate in sustainability-related education. The clusters in respect of curriculum, community engagement and examinations were particularly poor, which shows that staff willingness to participate in sustainability education was not being translated into teaching practice or community-engagement activities. The indicator with the lowest score was the level of commitment of the Faculty's resources to sustainability projects in the community. The poor performance of the Faculty could be attributed to the rigidity of the programmes offered and the type of knowledge on offer in the Faculty. The Faculty offers mainly basic sciences, which are universally designed with little flexibility. These include courses such as Physics, Chemistry, Biology and Mathematics. This deviation from other faculties also underscores the need to recognise existing differences in the nature of the disciplinary programmes offered by different faculties and the obligation to offer courses that may have little or no relation to sustainability. This does not mean that possibilities do not exist for integrating sustainability concerns in ways that are discipline-congruent.

School of Health Sciences

The sustainability performance of the School was far below average (Figure 6). The average score for the School was only 1.06 (26.5%) out of a maximum possible score of 4.

Figure 6. Sustainability performance of the School of Health Sciences



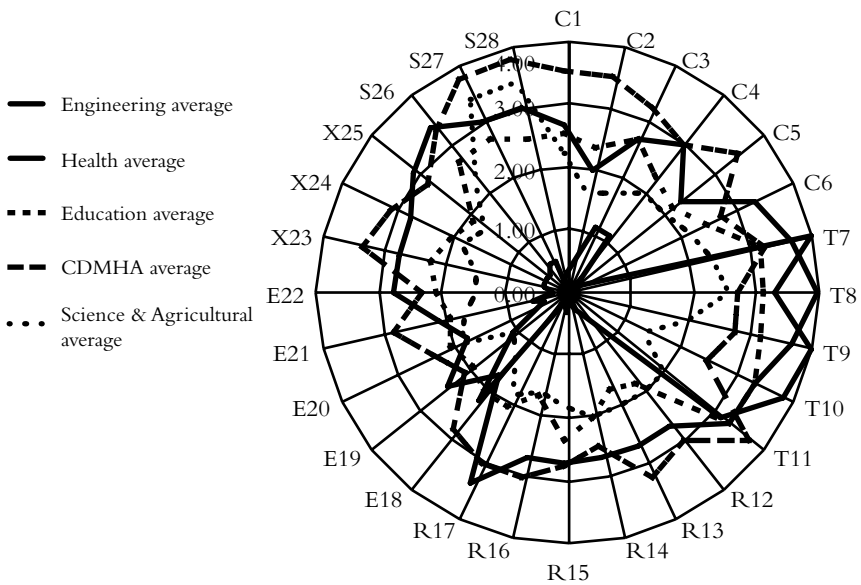
The scores were less than 25% for most of the indicators. The only indicator cluster that recorded a high score (3.17–4.0) was teaching approaches (T7–T11). Two indicators in this cluster, capacity to make informed decisions (T7) and a sense of responsibility (T9), even recorded the highest score possible of 4. Generally, for this cluster, the School performed above average. Just as for the Faculty of Engineering discussed above, this again relates to the practical nature of the courses offered in the School. The health-related courses require a high degree of practical application, personal judgement and critical thinking. Performance in all the other clusters was below average. The lowest score was 0.17 (4.25%), recorded in respect of five indicators (C1, R13, R15, R16, E22). The low score in the research cluster could be related to the nature of research undertaken, which is highly specific with a very high degree of ethical consideration. Also, with a stronger focus on social sustainability (rather than environmental sustainability), this score may well have looked entirely different, as was discussed in the follow-up workshop where the data was first presented. This may also explain the score of 'low' community engagement, as well as the low scores for the staff expertise and willingness clusters, even after considerable evidence was gathered to the effect that the School was seriously engaged in community work in the areas of public health and nutrition, and dietetics. This shows that the most probable explanation of the ratings here could lie in the respondents' understanding of sustainability concerns. This finding that different faculties tend to interpret sustainability differently was also reported on by Togo (2009), who, in her research, argued that there is a need to build a common understanding of sustainability across the institution. As mentioned above, sustainability generally refers to the integration of social, economic and environmental aspects. This brings a very important dimension of sustainability education to the fore, namely how the integration

of social, environmental and economic aspects within various disciplinary frameworks are to be interpreted and actualised in higher education. This also shows that researchers using the USAT and other sustainability tools need to be wary of 'making judgements' based on the assessments, unless underlying concepts used in the assessment tool are clear and are shared by researchers and those participating in the research.

Comparison of sustainability performance among faculties

Figure 6 summarises the comparison of performance among faculties. This is an important tool for whole-institution reflexivity, for self-assessment and for the setting of targets for improvement purposes. Combining results and making them available for discussion can also help with the development of a common understanding of sustainability in higher-education institutions, as was shown in the follow-up workshop where the results were discussed and the issues surrounding the School of Health Sciences results were discussed.

Figure 7. Sustainability performance of the faculties, Centre and School



From the performance across the faculties, Centre and School, it can be deduced that there are clusters in which there is generally good performance, while there are others with generally poor performance. These include teaching approaches (good performance) and community service (poor performance).

This comparison may help to highlight areas where the faculties, Centre and School need to make either individual or concerted, university-wide collective efforts to ensure improvement in performance. A faculty (or Centre or School) that finds itself performing very poorly, where all the others are performing well, could also engage in further self-evaluation in order to understand the points of deviation and address them where possible.

When making comparisons between the faculties, School and Centre, it is important to recognise inherent differences between programmes in order to avoid targeting those that have different orientations in certain clusters. As discussed earlier, for example, the Faculty of Science and Agriculture offering basic sciences may not be easily comparable with another faculty that has more practical and field-oriented programmes. As shown in this study, when making comparisons among faculties, it is also important to explore the meanings of sustainability and how sustainability is understood in various disciplinary contexts, as shown by the School of Health Sciences case above.

Conclusions and Recommendations

The present study was able to establish the extent to which the University has mainstreamed sustainability concerns in its core business of teaching, research and community engagement. Overall, the performance of the University was average and there is need for improvement. Departments that engaged in community-related programmes tended to perform better in ESD than those that did not with regard to indicators that relate to these engagements. This is because ESD pedagogy tends to promote integration of theory and practice. Also, departments with highly applied programmes as well as significant community engagements tended to perform better than those offering the basic sciences.

Sustainability performance in respect of the indicator clusters for curriculum, research and examinations was average and needs improvement. This raises issues around the links between teaching approach and curriculum content, as one would expect high performance in teaching approach to be linked to high performance in curriculum content and assessment practice for purposes of a holistic ESD approach. Generally, the University has substantial expertise in sustainability matters, and this together with its willingness to engage in sustainability teaching and research should be made use of. These were found to be positive indicators in the University and showed the potential for agency in improving curriculum, assessment, and community-engagement activities.

From the results of the present study, it is recommended that the University engage in fundraising and other collaborative activities in order to build the capacity of its staff with regard to sustainability teaching and research, and to fund community engagement and research activities. This could be done in collaboration with ESD partners within the UNU RCE structure involving potential partners such as the SIDA, the UNEP, UNESCO, the NEMA, various non-governmental organisations (NGOs), private companies/organisations and other stakeholders, as was discussed in the follow-up workshop at the MMUST where the sustainability audit results were discussed amongst participating units and faculties. It is also recommended that the University engage in regular sensitisation activities relating to sustainability, such as ESD workshops, and in regular audits to continuously mainstream sustainability into University engagements. Student involvement was not audited in this sustainability assessment, but also provides a potentially important area for strengthening University-based agency for sustainable development.

Notes on the Contributors

Patricia Kariaga (Chairperson), Mary Goretti Kariaga (Vice-Chairperson), Dr Vitalis Ogemah (Head of the Research Sub-Committee) and Violet Nyando (Secretary) are all members of the MMUST ESD Research Committee. Email: pkariaga@gmail.com.

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Endnote

1. The main participant, Patricia Kariaga of the Department of Criminology and Social Work in the Faculty of Education and Social Sciences, who was selected to attend the Sida/Natura International Training Programme in Higher Education for Sustainable Development from 20 April to 5 May (Phase 2) in Sweden. A selected co-participant, Mary Goretti Kariaga of the Department of Sugar Technology in the Faculty of Agriculture, Veterinary Science and Technology, also joined the main participant in a continuation of the training from 29 October to 8 November 2012 (Phase 4) at Rhodes University, South Africa.

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Appendix A

from Togo & Lotz-Sisitka, 2009

Unit-based sustainability assessment tool

Part A: Teaching, research and community service

Assessment criteria

Rating			
X	=	Don't know	no information concerning the practice
0	=	None	there is a total lack of evidence on the indicator
1	=	A little	evidence shows poor performance
2	=	Adequate	evidence show regular performance
3	=	Substantial	evidence show good performance
4	=	A great deal	excellent performance

Code	Indicator	Score					
		x. Don't know	0. None	1. A little	2. Adequate	3. Substantial	4. A great deal
	Curriculum						
C1	The extent to which the department offers courses that engage sustainability concerns						
C2	The level of integration of sustainability topics in courses referred to above						
C3	The degree to which local sustainability issues and challenges form part of the department's teaching programme						
C4	The degree to which global sustainability issues and challenges form part of the department's teaching programme						
C5	The extent to which the department enrols students in courses that engage sustainability concerns						
C6	The level of cross-faculty collaboration in teaching sustainability programmes						

Code	Indicator	Score					
		x. Don't know	0. None	1. A little	2. Adequate	3. Substantial	4. A great deal
	Teaching approach: **How far the teaching approach contributes to development of the following characteristics among students:**						
T7	The capacity to make informed decisions						
T8	Critical-thinking skills						
T9	A sense of responsibility						
T10	Respect for the opinions of others						
T11	Integrated problem-solving skills						
	Research and scholarship activities						
R12	The extent to which the department (staff and students) is involved in research and scholarship in the area of sustainability						
R13	The degree to which global sustainability issues and challenges form part of the department's research						
R14	The degree to which local sustainability issues and challenges form part of the department's research						
R15	The extent to which the department is collaborating with other faculties, institutions and stakeholders in pursuit of solutions to sustainability problems						
R16	The extent to which aspects of sustainable development are used in selection/execution of research						
R17	The level to which aspects of sustainable development are reflected in the department's research outputs						
	Community engagement						
E18	The extent to which the department (staff and students) is involved in community engagement in the area of sustainability						
E19	The level of commitment of the department's resources to sustainability projects in the community						
E20	The degree to which local sustainability issues and challenges form part of the department's community engagement						
E21	The extent to which the department collaborates with other stakeholders in addressing community sustainability challenges						
E22	The extent to which aspects of sustainable development are used in selection/execution of community-engagement projects						

Code	Indicator	Score					
		x. Don't know	0. None	1. A little	2. Adequate	3. Substantial	4. A great deal
X23	The extent to which sustainability aspects are assessed/ examined during the course						
X24	The extent to which sustainability aspects are considered in evaluating/assessing projects						
X25	The degree to which sustainability aspects are assessed in evaluating service learning programmes						
	Staff expertise and willingness to participate						
S26	The level of expertise of staff members in the area of sustainability						
S27	The extent to which staff members are willing to carry out research and service activities on sustainability aspects/ topics						
S28	The extent to which staff members are willing to teach sustainability topics						
	Others (please specify):						

Viewpoint Paper
Curriculum Development for the Kids in Parks Programme

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Abstract

As the curricula for environmental education programmes need to change continuously to reflect our constantly changing understandings of the environment and of environmental issues, clear and specific guidelines are required to assist in this process. This viewpoint paper reviews various resources that suggest what environmental education curricula should contain, as well as some strategies proposed to implement these in practice. Any curriculum design process normally seeks to identify processes that should feature in environmental education curricula, but environmental education curricula are often also 'context-bound', as they are dependent on and are situated in various environmental contexts – as in the case of this study of the majority of the biodiverse national parks managed by the South African National Parks (SANParks). Thus there is a tension between general aspects of curriculum and situated aspects of curriculum; and there is also a need to determine which of these in particular could assist with recurriculation of the Kids in Parks Programme offered at various national parks in South Africa. If implemented, these generic guidelines, together with their context sensitivity (as each national park is different), could serve as a core framework for all Kids in Parks programmes and be adapted for each park context. 'Curriculum' in this viewpoint paper does not mean 'school curriculum', but rather those guiding principles, concepts and approaches that guide teaching and learning with regard to the Kids in Parks Programme.

Introduction

Understandings of, and approaches to, environmental education have undergone numerous changes since the Tbilisi Conference in 1977 when the principles of environmental education were originally formulated. Current approaches suggest that environmental education is essentially a process leading to forms of social change and that an analysis of its development and various manifestations should lead to an improved understanding of what we understand by, and expect of, the concept. However, irrespective of the depth of this analysis, it is difficult to formulate an exact definition of environmental education precisely because of its evolving nature (Pace, 2010). Traditionally, environmental education was offered as nature study, conservation education and outdoor education (Moroye, 2009). Subsequently, it evolved into broader ecological education with a strong emphasis on the social dimension, and, more recently, education towards sustainable development. These changes have inevitably influenced environmental education programmes and curricula. According to Kyung-Ok Kim (2003), curricula and programmes need to be evaluated to determine if they reflect contemporary understandings of the environment and of environmental education, and,

consequently, it is necessary to reflect on current thinking when developing curricula and programmes.

Environmental Education and Sustainable Development

Environmental education is often viewed as a key step towards sustainable development (Benedict, 1999). Jickling and Wals (2007) comment somewhat critically on the view that education for sustainable development has been widely seen as a new and improved version of environmental education. They note, however, that such a trend is visible mostly at the national policy level of many countries. Since the earlier Rio Earth Summit in 1992, and the later World Summit on Sustainable Development in Johannesburg, South Africa, in 2002, efforts have been made to establish action plans to address global inequality and poverty, resulting in the Plan of Implementation to achieve the Millennium Development Goals designed to improve people's lives, which plan was agreed to by global governments in 2000. These goals form the basis of most national policy discussions related to sustainable development, although they, too, have been critiqued for being limited in scope (especially the environmental goal, No. 7), and education is still seen as one of the more effective means to confront these challenges (Hopkins & McKeown, 2002). Education programmes, such as Kids in Parks, have to keep abreast of these changes.

The Kids in Parks Programme

The Kids in Parks Programme was conceptualised in 2004, and implemented in 2005, and aims at promoting access for previously disadvantaged teachers and learners to a number of the national parks. The programme has been offered by SANParks in association with the Department of Education, the then Department of Environmental Affairs and Tourism (now the Department of Environmental Affairs) and a major national retailer. The memorandum of understanding among the partners was signed in 2005, initially for a period of three years, but it has subsequently been extended.

The curricula for the Kids in Parks programmes offered at the various national parks differ from one another, not only because each is situated in a unique natural setting, but also because each park's interpretive section is responsible for the development of its own programme curriculum. Because of this diversity in practice, the programmes vary considerably and some may not necessarily achieve the intended objectives. Environmental education programmes offered in the national parks have had to change from an almost total focus on (nature) conservation to the concept of sustainable utilisation, since this is a key interest of national biodiversity policy at present – although it is not practised as such in the national parks, which have a core conservation mandate in terms of national biodiversity policies (RSA, 2003; 2004). However, conservation concepts and practices have also been changing, and SANParks, for example, incorporates concepts of adaptive management into mainstream conservation management, and also increasingly works with ecosystem and ecosystem services concepts to guide conservation, as is also outlined in the national policy (RSA, 2003; 2004).

Given these changes in policy and practice, it may be necessary to identify generic guidelines that Kids in Parks environmental education programmes should comply with and which would contribute to achieving the objectives of the Kids in Parks Programme, such as to design environmental education processes to develop respect for national heritage and to promote a commitment to contribute to sustaining this heritage, and to provide meaningful environmental learning to equip the leaders of tomorrow with the knowledge, skills and values required to take action for the environment (Kids in Parks, 2008).

In line with the evolution of environmental education, the question can be asked: Which environmental education processes, concepts and approaches should feature in curricula, and which of these are particularly relevant to the Kids in Parks Programme? This calls for a review of recent trends in environmental education, and, in particular, of how these should be reflected in Kids in Parks given the unique context of this programme.

Trends in Environmental Education Curricula

With the intention of evaluating environmental education curricula to determine whether they do in fact adhere to a required substantive structure that delineates environmental education content knowledge, Gardella developed an inventory in 1986. He expanded the inventory in 1993, but it had to be revised to reflect changing thinking in environmental education. One such revision was undertaken by Kyung-Ok Kim in 2003, and, though elements of the social sciences and environmental sensitivity were addressed, it has become necessary not only to reflect on current trends in environmental education, but also to consider localisation and the specification of criteria that such programmes and curricula should meet.

Environmental programmes are social constructs and should be an extension of society, of culture, and of economic and physical conditions (Wong Bing Kwan & Stimpson, 2003). As environmental educators develop programmes, they translate their assumptions, ideas, values, and attitudes into objectives, content and pedagogy. 'It is not possible to talk about context-free environmental education curricula. It is the situatedness that defines what is valid knowledge' (Wong Bing Kwan & Stimpson, 2003:124). There are consequently various opinions about what the primary goal of environmental education programmes should be. Carrier (2009) suggests that environmental education should develop an environmentally literate society and that one obstacle to developing environmentally literate citizens is the lack of awareness of everything that influences environmentally responsible behaviour. According to Carrier, knowledge and attitude are essential contributors to environmental behaviour.

Environmental knowledge is often interpreted as scientific knowledge, but there is an important distinction between science and environmental education, 'because it [environmental education] adds the requirement, beyond personal and social moral principles, that what we do needs to be inherently right for the planet, hence environmentally moral, as well' (Hart, 2002:1244). Though agreeing that scientific knowledge is important, Summers and Childs (2000) argue that it is only one aspect of the complex knowledge base that is required. Effective environmental education should begin by providing a knowledge base that occurs in real settings and that involves active participation on the part of learners (Basile, 2000).

Besides knowledge, affective attributes should also be addressed. Kyung-Ok Kim (2003) refers to environmental sensitivity as an affective attribute and points out that environmental sensitivity has been described as: viewing the environment from an empathetic perspective; taking an interest in learning about the environment; feeling concern for the environment; acting to conserve the environment; and empathy for the environment. Affective attributes were not addressed in Gardella's inventory but were included by Kyung-Ok Kim's (2003).

Besides sensitivity, belief systems, morals and values contribute to attitudes, as these determine environmental actions (Carrier, 2009). Values are a personal belief that an individual or society considers important and are the code of conduct that demonstrates a particular belief (Hartsell, 2006). Beliefs start to be formed early in children's lives and lead to the formation of attitudes. This takes beliefs to another level, because they contain aspects of emotion and potential behaviour. 'The sum total of a person's beliefs and attitudes creates a belief system the formation of which is an ongoing, life-long process. A belief system is subject to continuous revision as a person's socialization style changes' (Hartsell, 2006:266). When someone's lifestyle continuously reflects specific, closely aligned attitudes, a value system has been internalised. Values are convictions that one particular level or mode of conduct is preferable to another, and they are an essential part of any learning experience. Environmental education should therefore aim to prepare current and future generations to think environmentally, ecologically, and towards sustainability, and to act accordingly.

Knowledge (or the cognitive) and the emotional (or the affective) are inseparable. The whole person has to be considered. However, particular skills are also required, and teachers or environmental educators should consequently keep in mind that they are teaching values clarification skills and not the values per se (Hartsell, 2006). To be able to take any environmental action, current generations should acquire skills that are essential for problem-solving, decision-making, interdependent work and holistic thinking (Tenam-Zemach, 2010). If we want learners to be able to make rational, defensible decisions, they must be given the opportunity to master action competence, because it would be pointless if learners knew that something should be done, but do not know how to go about addressing a particular issue. They need practice in making decisions, and the competence in what amounts to political organisation, to enact their choices (Tan & Pedretti, 2010). The success of this approach has often been questioned based on a perception that where poverty is rife, environmental concerns and, particularly conservation efforts, become irrelevant. Such critiques, however, tend to reduce conservation to 'green issues' and fail to see the close relationship that exists between natural resource use (sustainable use), conservation and livelihoods for many people who live in poverty (Shackleton, Campbell, Lotz-Sisitka & Shackleton, 2008).

Gilmiarova, Tsvileneva, Krasnogorskaya, Khalikov and Smejtek (2000) point out that environmental education practices differ depending on specific conditions in each country. They argue that, although the view is often held that environmental problems can only be addressed when societal conditions improve, economic and political problems are linked to environmental problems such as the depletion of natural resources and overconsumption. Consequently, the argument that people will only change their attitudes and behaviours in respect of the environment once their personal conditions improve should not serve as

justification for inactivity. Not only should people be able to identify environmental threats, but, as alluded to earlier, should also be able to do something about them. The Southern African Development Community (SADC) Regional Environmental Education Programme's 2006 assessment of what southern African environmental educators thought was relevant for education in the United Nations Decade of Education for Sustainable Development showed, for example, that there was a need to integrate action competence and knowledge of alternative, more sustainable practices into conservation and environmental education (Lotz-Sisitka, Olvitt, Gumede & Pesanayi, 2006).

The Implications in Practice

From the preceding discussion it becomes apparent that particular knowledge, attitudes and skills should be included in environmental education programmes. The difficulty lies in deciding what to select, how to realise the selection in practice, and how to determine the effectiveness of the selection and integration. In the context of the Kids in Parks Programme, this also needs to be done in relation to the unique biodiversity and ecosystem of each park environment.

Tenam-Zemach (2010) identifies five knowledge themes, namely climate change indicators, biodiversity, human population and overconsumption, the presence and impact of environmental pollution, and the earth as a closed system, that are integral to the environmental problems people currently face. As these are accepted environmental education issues, they are often included to varying degrees in curricula and programmes, albeit at an introductory level. Besides these common issues, there are other elements that should also be considered, and in a national parks context it could be expected that the curriculum would potentially emphasise biodiversity as a key element or knowledge theme, not necessarily to the exclusion of other themes. Social studies and cultural values play important roles in environmental education (Moroye, 2009). Alagona and Simon (2010:193) use the term 'environmental humanities' to refer to non-scientific areas of environmental education, such as environmental history, philosophy, literature, ethics, art and cultural geography. Their research proposes an interdisciplinary, place-based environmental programme to encourage learners to move beyond compartmentalised learning and to engage in 'holistic thinking that is necessary for humanistic scholarship and that is required to understand complex environmental problems' (Alagona & Simon, 2010:193). According to Tan and Pedretti (2010), place-based education is a contemporary idea that has attracted much attention among the education community, as it uses local environmental issues to contextualise abstract concepts. It recognises the importance of local issues over approaches that focus on a generalised, abstract social good. Place-based learning requires being 'outside the classroom in an attempt to connect with natural and human communities and engage in action and agency' (Tan & Pedretti, 2010:65), and 'environmental issues seem to offer ideal place-based education opportunities, balancing local and global contexts with powerful knowledge'. This supports the view of Smith (2007) who suggests that, through place-based education, learners are provided with authentic opportunities to address community and environmental problems. In this way, learners can develop a sense of affiliation with the places where they live and can enhance their familiarity with what is beautiful and worth preserving in the area they call home.

However, there are various approaches and strategies to provide such opportunities in practice.

When an environmental education programme is offered in an outdoor setting, it should not be limited to the scientific study of the natural environment, but should also involve exploration of the many cultural, aesthetic and recreational aspects of the natural environment (Wilson, 1994) and, as in the case of Kids in Parks, of the heritage and social–ecological relationships that exist too. Thus the activities and teaching methodologies used in environmental education programmes should contribute to the development and mastery of many aspects, including ethics, as most decisions concerning how to address environmental issues involve moral agency and social trade-offs (Ashley, 2000). Hart (2002) agrees, stating that ethics, particularly those related to moral values, may be more important than knowledge to motivate people to take action. Learners should learn the concepts and develop the skills to handle moral issues both independently and cooperatively within a social-learning framework. The issues that are considered should have relevance to the learners' daily lives.

Pace (2010) argues that environmental education should address the issues that are experienced every day at grassroots level, and that, to do so, environmental education programmes need to engage learners individually. If particular competencies need to be developed, programmes have to be learner-centred so that the learners can take steps to reflect on their own sustainable lifestyle patterns. As Pace (2010:321) points out, 'a competence is what one can do (ability) in a given context, based on what is learned (knowledge), to achieve a set aim and produce meaningful knowledge'. He identifies three main areas of competences. The first is cognitive and metacognitive competences that enable individuals to learn about the environment and understand its dynamics, including the interaction of the various environmental components, and to contextualise the knowledge they have learnt. Secondly, action and behavioural competences have to be developed to empower the individual to play an active role in addressing environmental problems. Finally, social and citizenship competences need to be addressed to enable learners to form groups and work effectively in these groups. Wiek, Withycombe and Redman (2011) also show that systems-thinking and anticipatory competences are part of sustainability competence. The context of a national park is a wonderful setting for teaching about ecosystems and how they relate to social systems.

The preceding discussion highlights particular requirements and guidelines that the curricula for environmental education programmes should consider, and how these can be realised in practice. Based on these requirements, a set of guidelines or a framework for assessing environmental education curricula, particularly for the Kids in Parks Programme, can be formulated.

What Could Be in the Kids in Parks Curriculum?

As the Kids in Parks Programme aims at promoting access for teachers and learners to their nearest national park, as well as opportunities to learn in these settings, the localisation of issues and the associated knowledge of these issues should feature prominently in the curriculum. As the programmes are nature-based and are offered in a biodiverse, rich natural setting, the knowledge base related to each particular natural context should feature prominently and

should be shared with learners through nature-based activities. The involvement of learners in identifying particular issues affecting their communities and 'their' park, and the development of the necessary skills to address these, is of critical importance. Learners should develop action competence, even if at a basic level, to enable them to address environmental challenges they may face in their daily lives. Besides the mastery of basic knowledge and the development of skills, attention should be given to the incorporation of a value system that encompasses sensitivity, beliefs and attitudes. Finally, as one of the objectives of the Kids in Parks Programme refers to sustaining the national heritage, this concept should be included in all its dimensions: natural, cultural and historical. Such an experience in a national park could help to develop the many competences seen as important in environmental and sustainability education mentioned above.

Conclusion

This viewpoint paper has reflected on what the curricula of environmental education programmes in the Kids in Parks Programme could contain. The discussion above provides broad guidelines for reviewing environmental education programmes, including the Kids in Parks Programme. It has also shown what could be considered for practice in the Kids in Parks Programme. The proposed focus on acquisition of relevant environmental, ecosystem and biodiversity knowledge, attitudes and values that reflect the relationship that exists between people, natural resources and heritage, and action competences or abilities to participate in alternative practices, and their application to a broad understanding of heritage, can be used as a guideline to review current Kids in Parks Programme curricula in the different park contexts. What would be of interest is to consider the implications of the unique, 'place-based' nature of the Kids in Parks environmental education programmes across diverse parks, as well as the more general perspectives offered above. This could contribute to the development of potentially enriched environmental education curricula for the programme.

Notes on the Contributor

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Viewpoint Paper
Exploring Educational Quality and Relevance through Integrating Environmental and Social Issues in Science Education

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Abstract

In this research, the researcher and participating teachers endeavoured to explore ways of contextualising chemistry education in relation to local environmental and social issues in two high schools in Mozambique. The research took place in two secondary schools, one in Beline and the other in Maputo. In this study, only the results of the Maputo school are reported on in detail, although the same process was followed in both schools. After undertaking a literature review, and initiating focus-group discussions on the contextualisation of chemistry teaching, and before dealing with the programme contents, a pretest took place in two Grade 9 classes, one in each school. Subsequently, the programme contents were taught in both classes. However, the new contextualised concept of learning and teaching was applied only to one of them. A post-test was held for both streams following the teaching of the programme. The analysis of the pretest findings showed no significant difference between the two classes, whereas the analysis of the post-test findings indicated a significant difference between the two. In the class where the new concept of contextualising the learning within learners' everyday lives was applied, it was found that learners participated actively in the chemistry lessons. This contrasted strongly with the class where conventional methodology was used.

Background

In the last 20 years, the Southern African Development Community (SADC) region has been characterised by political changes across the region. Most southern African education systems have their roots in a colonial history, but these political changes have resulted in improved access to education. Most southern African governments have extended educational access, with a concomitant increase in the number of learners in schools and formal education programmes. In Mozambique, there are, on average, 50 learners per class. Although Mozambique has made good progress in overcoming the colonial backlog in access to education, the task is formidable and will demand a disproportionate share of the country's resources for decades to come as it struggles to achieve the Millennium Development Goal of universal education.

Since a large proportion of the population in Mozambique lives in situations of poverty, environmental degradation, and increased health risk and food insecurity, these are key issues that need to be addressed through the education system. The localised curriculum (LC) policy initiative which requires teachers to include a component of local education in the curriculum, is one means of addressing this through linking the curriculum to the environmental and social issues experienced by learners on a daily basis.

Currently, the classroom situation in high schools in Mozambique is characterised by transmission modes of teaching and learners play a passive role in the process. Furthermore, learning in many cases is disconnected from the context of everyday life. Science (specifically chemistry) classes in Mozambique are dominated by 'chalk and talk' teaching methodologies, and experiments are very seldom conducted. This is mainly due to lack of material and technical equipment in schools and to inadequate science-teacher training. As a consequence, science is poorly understood by most learners. They only acquire a semblance of theoretical knowledge and have few opportunities for the application and development of practical abilities and skills. The result is a low pass rate, especially in natural-science subjects. There is a need for the introduction of new methods of teaching that relate to the everyday contexts of the learners. The possibility exists that this would better assist learners in their reflection on, and interpretation and understanding of, natural phenomena.

Innovative teaching methods would not only serve the purpose of improving the quality of education, but would also serve to help integrate environment and sustainability education into the mainstream curriculum. As such, this study forms part of a broader SADC Regional Environmental Education Programme (REEP) research programme which is investigating the relationship between education for sustainable development and educational quality and relevance, and is focusing on mainstreaming environmental and sustainability issues.

In this particular study, the project method was used as an innovative way of engaging learners in the learning process. In using this approach, the projects were suggested by the teachers, but they were planned and executed as far as possible by the learners themselves, individually or in groups. Such project work focused on not only imparting specific knowledge or skills, but also on applying these and on improving learner involvement and motivation in order to foster independent thinking, self-confidence and social responsibility. The purpose of the project was for learners to develop innovative approaches using their understanding of scientific (chemistry) concepts to improve their lives in the local context. This required learners to not only bring their understanding of the environmental and social needs in their own community to their learning, but also to apply scientific knowledge in these contexts.

Statement of the Problem, Aim and Objectives of the Study

Statement of the problem

After analysing the national school curriculum in Mozambique and the senior-school science curriculum, it was clear that the curriculum is almost entirely decontextualised from learners' everyday lives. This means that the educational content does not reflect the social, cultural and natural environments of the children or the issues they face daily, indicating a strong need to develop a strategy for teaching and learning processes to make education relevant and to bring science into the social, cultural and environmental contexts of the learners. This is despite the national commitment to a localised curriculum, which it appears is dealt with as 'something separate' to the other subjects, that is, localisation or making links between subject content knowledge and everyday life and experiences of learners is not considered in mainstream subjects such as science.

Aim of the study

To explore ways of contextualising chemistry education in relation to local environmental or social issues in two high schools in Mozambique.

Specific objectives of the study

- To establish how chemistry topics are taught at the schools;
- To explore with teachers and learners how these topics could be better contextualised for the learners through projects that relate to local environmental or social issues;
- To assist teachers in developing and implementing contextualised lessons plans and using a project approach; and
- To evaluate the use of the concept of contextualisation of learning in the curriculum.

Contextual and Theoretical Framework of This Research

Quality education in the Mozambican context

The National System of Education (SNE) in Mozambique was introduced in 1983. It is the first system designed by Mozambicans themselves after independence. Before 1975, Mozambique's education system consisted of missionary schools, public schools and private schools (IESE, 1983). The missionary schools catered for the 'natives', mainly in the rural areas. The public schools catered for the Portuguese and the 'assimilados'.[1] These were located mainly in the urban areas. The private schools (mostly church-owned) were mainly for the well-off Portuguese and 'assimilados'. One of the characteristics of the pre-independence education system was that it was very selective, and this selectivity has been retained by the post-independence education system. The SNE comprises five subsystems, namely: General Education; Adult Education; Technical/Vocational Education; Teacher Training; and Higher Education. The education system is organised into three levels: primary, secondary and higher education.

In 2000, the Ministry of Education initiated the process of decentralising curriculum development and monitoring. This system allows 20% of the national curriculum for basic education to be the 'local curriculum' (referred to as the 'localised curriculum initiative' above), implying that this portion of the curriculum was to be developed locally (INDE, 2003). This is one of the major innovations of the Basic Education Curriculum Transformation in Mozambique Programme. It is expected that the 'local curriculum' will provide for the specific learning needs of the learners.

The UNESCO Institute for Statistics (2009) presented reading and mathematics achievement levels as indicative of educational quality in southern and eastern African countries. Comparing Mozambican education quality with other southern African countries (South Africa, Botswana, Tanzania and Zambia), it was concluded that education quality in Mozambique was very low.

In Mozambique, UNESCO's programme, Families without Illiteracy, trains children to teach their own families to read and write. Partly as a result of this initiative, illiteracy in Mozambique has dropped from 90% to just less than 50% today UNESCO (2009).

While high educational quality is a widely recognised and shared educational objective, there is less agreement about what is meant by the concept and what it entails in practical terms. Gutek (2009) explains that the concept means different things to different people, depending on their perspective. Alexander (2008) blames the lack of clarity of what is meant by quality in education on the fact that the debate is dominated by policymakers instead of practitioners in the field. This results in more attention being given to inputs such as expenditure, teacher-to-learner ratios and textbook supply rather than to the teaching and learning processes.

Approaches to education quality relevant to this research

Tikly and Barrett (2009) differentiated between two major approaches to thinking about quality in education, namely the human-capital approach and the human rights approach. Their reflections on education and the relevance of education are also applicable in Mozambique. We believe that a person who has access to quality education can react against, and respond to, all kinds of injustice. An educated person is also well prepared to contribute to economic growth in his or her community, country and region.

A more recent and very promising approach to analysing education quality is based on Amartya Sen's (1999) notions of 'capabilities' and 'functionings'. Sen uses these concepts as alternative measures of human development, as opposed to increase in personal incomes or in the amount of material goods that people accumulate, measures that are favoured by the human-capital theorists. He defines 'capabilities' as the opportunities that individuals have to realise different 'functionings' that they may have reason to value (Sen, 1999). In this research, and in relation to questions of educational quality, this would mean that learners and teachers need to be involved in ways in which the curriculum gains meaning for them with respect to those aspects of life and being that they have reason to value. Also, it relates to how the curriculum can assist learners to turn their resources (personal, environmental and social) into valued beings and doings or functionings (see Chikunda, this volume). A contextualised curriculum has potential to enable such conversions to occur, as it is likely to assist learners with meaning-making and in developing a better understanding of the relevance of the subject content knowledge that they are acquiring for everyday life and decision-making.

Four perspectives (*society*, the *child*, the *teacher* and the *learning context*) on pedagogical quality focusing on children's opportunities for learning and development in preschool are suggested by Gutek (2009). This study explored how these four related aspects of pedagogical quality can be used for evaluation, to discern pedagogical quality as a whole and to understand how quality is experienced and valued from different perspectives; in this case, the science education chemistry curriculum. It is said by Burbules and Berk (1999) that developing critical thinking, reflexivity, and decision-making skills in learners, and involving them in democratic processes in their learning, better equips them to not only understand their work better, but also be become lifelong learners. These abilities are considered essential outcomes of transformative learning, which Merriam and Caffarella (1999) codify into three distinct phases: critical reflection; reflective discourse; and action.

Methodology

Overall study design

The study used a *participant–researcher case study approach*. It is a case study of two high schools, one in Bilene (located in a rural area) and the other in Maputo (located in an urban context) so that comparisons could potentially be made between the schools. This is not the focus of this article, as only one case is reported on in detail; the Maputo case. Initially, a number of teachers were interviewed, but, ultimately, the researcher worked closely with a single Grade 9 teacher and a group of Grade 9 learners in each school. A pretest was conducted in two Grade 9 classes in each school, but the new contextualised concept of learning and teaching was only applied to one in each case.

In this research, the learners also carried out practical activities (water analysis and treatment) following the principles of the project method proposed by Knoll (1995). Learners were divided into groups, and each group had to develop specific activities.

The selected project method has several steps: the teacher and the learners examine a particular environmental topic, they choose a problem that is important to them, and then they develop and carry out an action plan (Kilpatrick, 1929). With each step, the learners become increasingly independent in engaging with the environmental topic. Responsibility is passed on gradually from the teacher to the learners.

Overall, the study was structured into a baseline phase, a development and implementation phase, and an evaluation phase. Each is discussed briefly below.

Baseline phase

The baseline phase involved conducting semi-strutured interviews with teachers involved in this study. This was to establish how they teach chemistry topics and whether these topics are contextualised in everyday life for the learners. Seven teachers were interviewed at each school, but only two continued with the implementation phase of the study. Documents were also analysed. These included analysis of the lesson plans for particular chemsitry topics. This was done to futher understand what and how teaching takes place in the classroom.

Pretest and post-test

Before dealing with the programmed contents in one of the two classes in each school, a pretest took place in two classes in each school (Groups A and B), and, after that, the programmed contents were taught in both classes, with the new contextualised concept of learning and teaching being applied to only one of them (Group A). Subsequent to the running of the programme, a post-test was held for both streams (A and B).

Development and implementation phase

Since it would have been difficult to work with a large group of learners, a small number (20) of Grade 9 science learners in each school was randomly selected to participate in *focus-group discussions* and *workshops* on a particular science topic (water). The purpose of each workshop was to select a particular chemistry concept, and then identify ways that would help them relate to it better, based on their own backgrounds. The learners needed guidance in this regard, as it was difficult for them

to identify social and/or environmental issues associated with a particlar concept. Following this, the researcher worked closely with the teachers to help develop materials and prepare lesson plans covering particular chemistry topics, and for Group A lessons that could contextualise the topic to the problem scenario (using water). When these topics were taught in the classroom, the researcher was present in the classroom to observe how learners engaged with the topic.

Evaluation phase

The efficacy of the approach used was evaluated both through a small focus-group session with a number of learners, and by analysing their answers in an assessment that had been designed to test their understanding of the contextualised chemistry topic (i.e. the post-test).

Validity and ethical considerations

Since the researcher worked as a participant observer, he used member-checking of interviews and group discussions to ensure the validity of the collected data. He also obtained all the necessary consent from relevant stakeholders, such as heads of schools, teachers and learners.

Findings

The findings of the study reported below are related only to the one case study, the Maputo school. I report first on the pretest and post-test results, and then provide a more detailed description of the contextualised lesson in order to shed light on what occurred in the Class A group context. In the Class B context, 'normal' decontextualised science was taught to the learners, where they were told about pH, acids/bases, and chemical reactions in water. There were no experiments to demonstrate, and there was no contextualisation of the learning to wider issues of water pollution, water quality, and so forth, as in the contextualised lesson.

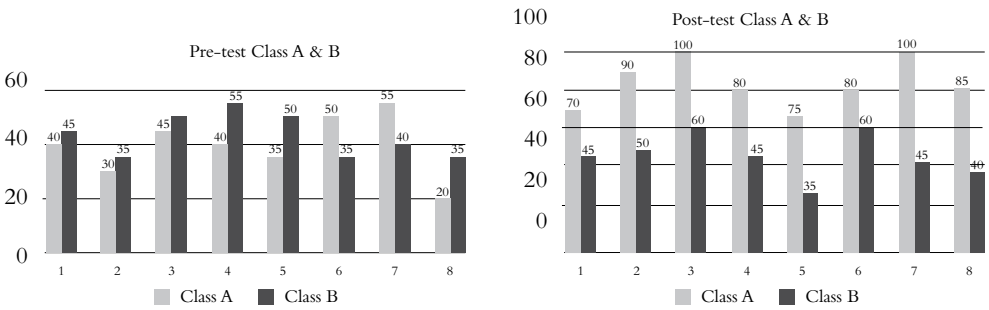
The pretest and post-test results

The analysis of the pretest findings showed no significant difference between the two classes, whereas the analysis of the post-test findings indicated a significant difference between them (see Figure 1).

Class A is the class that was offered the contextualised lesson. The pretest and post-test had 8 test items. For Question 1 in Class A, there was an improvement from 40% to 70%; for Question 2, an improvement from 30% to 90%; for Question 3, an improvement from 45% to 100%; for Question 4, an improvement from 40% to 80%; for Question 5, an improvement from 35% to 75%; for Question 6, an improvement from 50% to 80%; for Question 7, an improvement from 55% to 100%; and for Question 8, an improvement from 20% to 85%.

Class B is the class that was offered an ordinary lesson on the topic, not the contextualised lesson. The same pretest and post-test used for Class A was administered, with the same 8 test items. For Question 1 in Class B, the results stayed the same at 45%; for Question 2, the results rose from 35% to 50%; for Question 3, the results increased from 50% to 60%; for Question 4, the results dropped from 55% to 45%; for Question 5, the results dropped from 55% to 35%; for Question 6, the results rose from 35% to 60%; for Question 7, the results increased from 40% to 45%; and for Question 8, the results rose from 35% to 40%.

Figure 1. Pre-test and post-test comparative results (%)



The content and process of the contextualised lessons

Both groups, Classes A and B in each school, were taught science lessons focusing on chemical reactions in water. However, the contextualised lessons (taught to Class A) engaged more with chemical reactions in water in the context of water analysis and treatment. The lesson started by introducing the vocabulary associated with chemical substances in water as per the science curriculum, and concepts associated with water analysis and treatment (as per the contextualisation lesson's objectives). The lesson also sought to develop information collection and processing skills, as well as to teach learners about water as a chemical substance, and about chemical reactions in water. For the contextualisation group (Class A), the learners were also introduced to issues of pollution, focusing on understandings of pollution and sources of pollution.

Methods and procedures

The methods and procedures followed during the lesson included discussion, observation, experimentation, discovery, raising of problems, analysis, and individual and group work. The main task was to complete a project in groups so as to identify the sources of pollution in the Infulene River. The river is located around Maputo, where people have developed agricultural activities using pesticides and other chemicals. Also along the river are industries, some of them discharging their effluents directly into the river without adequate treatment and contaminating the water body with harmful compounds.

Introductory lesson process – vocabulary and understanding development

In the preparatory phase, learners worked with literature and interviewed some stakeholders in order to explore concepts related to water and water quality, such as water and pollution, and water and climate change. This literature review and consultation process was followed by discussions in class about these concepts.

The discussions developed the following insights among the learners: that water scarcity may be a result of climate change; and that countries (such as Mozambique) will have to take greater care of their water bodies, which includes reducing pollution and pollution flows into the rivers. Learners also discussed the concepts of water pollution, learning that water pollution

involves the contamination of water bodies (e.g. lakes, rivers, oceans and groundwater). They discussed how water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds. They learnt further that water pollution affects plants and organisms living in these bodies of water; and, in almost all cases, the effect is damaging not only to individual species and populations, but also to the natural biological communities. They also discussed the concept of water quality. 'Water quality' refers to the physical, chemical and biological characteristics of water, as stated by Snyder, Handrick and Brooks (1943). It is a measure of the condition of water relative to the requirements of one or more biotic species and/or to any human need or purpose. Water quality is most often defined by referring to a set of standards against which 'good' or 'acceptable' water-quality levels can be assessed. These are often informed by World Health Organization (WHO) standards for human health. Environmental or ecosystem standards are also set to ensure the health of the ecosystems, and high quality standards are most often set for drinking water or for human consumption.

Experimental phase of the lesson

In the second phase of the project work, some scientific parameters of water, such as pH, chemical oxygen demand (COD), and nitrate and phosphate concentrations, were defined. The experimental work started with the sampling and analysis of water. Water samples were examined using the Aquatest system. The Aquatest is a small, single-use device for testing water quality. It is a very simple and quick method of water analysis. The purpose of the sampling and analysis of the water was:

- To determine the background, natural concentrations of chemical constituents in the water;
- To determine the concentration of harmful pollutants in the water; and
- To compare the findings with internationally acceptable standards.

The analysed parameters included pH[2], COD, and nitrate and phosphate levels.

At the end of the experimental work, learners presented their results and compared the concentration of analysed parameters with the recommended standard parameters of the WHO. Learners discovered that the concentrations of nitrates, phosphates and dissolved organic compounds in the water in the Infulene River water were much higher than recommended by the WHO standards. They discussed the possible sources of the pollution and identified the industry along the river and the agricultural activities as the main reasons for the water pollution.

Evaluation and testing

After the lesson, the performance of learners was evaluated and they were asked questions about the topic using the post-test. The text below gives a summary of the 'model' answers for the post-test. There were variations on the answers given by the learners in the post-test.

1. What is the importance of water to human life? *Water is the basis of life; all living things – plants, humans and animals – use water for drinking and for many everyday activities.*
2. What is water pollution? *Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans and groundwater).*
3. When does water pollution occur? *Water pollution occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful compounds.*
4. What should be done about water pollution? *We must take care of water; we ought not to pollute and waste it, and we should keep our waterways clean so that future generations* [will] *have clean water.*
5. Is there a relation between water pollution and climate change? *There is a relation between water pollution and climate change, as climate change will cause water scarcity.* Here it was particularly interesting that a number of learners showed a misunderstanding of the relationship between water pollution and climate change, as they said, for example: *then chemical substances that contaminate water can contribute* [to] *global warming and climate change.*
6. How should water sampling take place? *This must be rigorous, ensuring that a representative sample is collected and at no time should the sample or sample bottle be contaminated by the collector.*
7. How should the sample be transported to the laboratory for the analysis? *Transport to the laboratory for analysis needs to be done under appropriate conditions, often in a dark cooler with ice packs.*
8. How should the water sample be processed? *Many samples need to be filtered before testing. In some cases, the filtering step must be done in the field as soon as the sample has been collected. The sample analysis needs to be carried out according to a protocol that doesn't introduce contaminants or otherwise compromise the sample.*

Discussion and Conclusion

In the classes where the new concept of contextualised pedagogy was applied, it was found that learners participated actively in chemistry lessons. Figure 1 shows that the majority of the learners in the experimental class (A) could give correct answers in the post-test. It would appear that, while learners in this class (A), where the concept of contextualising science was used, had gained sufficient background to give correct answers in the post-test, the learners in the control class (B), where conventional methodology was used, were not able to achieve good results in the post-test.

The main significance of the study was its attempt to show the increasing quality and relevance of educational processes through the inclusion of contextualised environmental issues in a science curriculum. It was also hoped that, through a better understanding of the sciences, in particular chemistry, the pass rate of learners might also improve, although this was not a focus of this study. However, the study could be used to inform the development or design of a larger, carefully designed study that can probe the manner in which contextualisation can enhance learner performance in subjects. Currently, there is little evidence of this in a Mozambican context, and even less research on the topic.

The use of the contextualised approach in the teaching of chemistry pH–acid/base and chemical reactions in the context of a broader lesson on water analysis and the treatment of local river water turned out to be a positive condition for learning as far as the learners were concerned. The use of the pretest and post-test approach showed improved results for Class A, which was also taught the contextualised approach. The questions of the post-test were, however, framed in this discourse, which favoured the Class A learners. In future, other questions that are more neutral and that might be oriented towards a 'middle ground' related more to the key concepts of the science (pH, acid/base and specific chemical reactions in water) should have a greater weighting in the test. This would probably enhance the validity of the test, and not bias the test too much in favour of the Class A learners. The study with the learners could also be expanded to further strengthen critical reflection, bring about more reflective discourse and also involve the learners in actions to address water pollution issues such as regular water quality testing of the river, and reporting the results to the municipality. These abilities, as reported on above, are considered essential outcomes of transformative learning (Merriam & Caffarella, 1999). The problem-based lesson approach initiated here in this small-scale research could be further developed along these lines in future. From a capabilities perspective, this research showed that a contextualised curriculum approach could help learners turn their resources (e.g. abilities to conduct scientific tests – in this case water quality tests) into functionings (testing water against standards of the WHO) in order to achieve capabilities of healthy and safe living.

However, this research was experimental in the sense that it was the first time that the researcher had engaged in contextualised curriculum development research. The outcomes of this small-scale study show much promise and can be used to plan more substantive research on this theme. It is my view that more research on the topic of a contextualised curriculum is needed in Mozambique and that we, as a research community, need to continue to develop research approaches and instruments to understand the relationship between curriculum contextualisation and learner performance. This was just one small-scale study oriented in that direction.

Notes on the Contributor

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Endnotes

1. 'Assimilado' is the term given to African subjects of the colonising Portuguese Empire from the 1910s to the 1960s who had reached a level of 'civilization', according to Portuguese legal standards, that theoretically qualified them for full rights as Portuguese citizens (Wikipedia, 2014).
2. In chemistry, pH is a measure of the acidity or basicity of an aqueous solution. Pure water is considered to be neutral, with a pH close to 7.0 at 25 °C.

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Viewpoint Paper
Towards Integrating Education for Sustainable Development at Initial Teacher Training: The Case of Lesotho College of Education

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Abstract

This viewpoint paper presents some findings of a participatory action research programme carried out by teacher trainers at the Lesotho College of Education (LCE) in order to integrate education for sustainable development (ESD) into its courses. It reveals how social learning brings about deep meaning as students connect subject content knowledge through participatory learning to their sociocultural backgrounds. Participants were later interviewed to ascertain their views on teaching for sustainable development and on interdisciplinary collaboration as a means of enhancing quality in teaching and learning. The findings indicate that some participants had, as a result of the action research project, been able to emerge from the culture of academic isolation through initiating collaboration with other teacher trainers outside the study area.

Introduction

This viewpoint paper reports on a participatory action research programme undertaken by teacher trainers at the Lesotho College of Education (LCE). The programme is a component of a study carried out by the Southern African Development Community Regional Environmental Education Programme (SADC-REEP) higher education institutions as part of the Environment and Sustainability Education and Educational Quality and Relevance Research Network. It seeks to enhance interdisciplinary collaboration that has been lacking among faculties at the LCE (Burke & Sugrue, 1994).

Education in Lesotho generally fails to address issues of sustainable livelihoods; hence innovation for job creation and the employability of people is hampered. To this end, section 28(a) of the Constitution of Lesotho requires 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.

Educational Quality in Lesotho and the Need for a Paradigm Change in Teacher Education

Lesotho needs to develop people as a resource that can support development (Lesotho Government, 2004a) and provide relevant education that equips young people with practical and marketable skills (Lesotho Government, 2004b), particularly in an era of job scarcity. Any parent concerned about the overwhelming dependency syndrome (Lesotho Government, 2009) prevailing among the Basotho desires to see young people equipped with skills that

will enable them to act responsibly in accordance with the prevailing circumstance (Lesotho Government, 2004b).

The government contends that, 'through the provision of a sustainable, improved, quality assured, universal, *free* and compulsory primary education' (Ministry of Education and Training, 2005:43), poverty can be reduced and development enhanced. However, despite the adult literacy rate in Lesotho (82% in 2002) (Kingdom of Lesotho, 2007; Ministry of Education and Training, 2005), there is evidence that educational quality is still poor. This is attributed to a number of factors that are cause for concern, such as the following:

- Poor education that places great importance on passing the final examination (Lesotho Government, 2004a; Mokuku, Jobo, Raselimo, Mathafeng & Stark, 2005), with the best teaching resources often being concentrated in the final year of study (Lesotho Government, 2004a);
- Inadequately trained teachers and diminishing numbers of qualified teachers servicing the education system; and
- A curriculum that is characterised by an excessive number of academic subjects that are generally irrelevant to many people, with minimum development of the practical skills (Mokuku *et al.*, 2005) that are essential for the integration of graduates into the employment market (Kingdom of Lesotho, 2007).

Educational quality, relevance and equity have been emphasised as fundamental requirements needed to turn the tide of underdevelopment and end the vicious cycle of poverty, unemployment and environmental degradation that severely threatens the country (Ministry of Education and Training, 2008). Nonetheless, policy documents fail to be explicit in spelling out pertinent issues of quality and relevance, and their interpretation has been 'left to individual education practitioners with no clearly articulated and comprehensive guidelines' (Ministry of Education and Training, 2008:i).

Lotz-Sisitka (2011) urges that governments should take the lead in spelling out meanings of contentious topics such as *quality* and *relevance* that are open to many interpretations, otherwise the implementation of programmes to address such critical issues is highly questionable (Ministry of Education and Training, 2008). The most recent Curriculum and Assessment Policy Framework identifies quality and relevance as key aspects of implementation in teaching and learning programmes. Teacher education institutions are called upon to review their training programmes to align them with this policy (Ministry of Education and Training, 2008) to ensure that teachers trained in this curriculum will have developed the capacity to put its requirements into practice. Consequently, teacher training institutions should improve both their curricula and their pedagogy. It is, however, regrettable that teacher trainers at the LCE do not seem to interrogate educational policies either with colleagues or with their student teachers, and are therefore not in a strong position to improve their curricula or their pedagogy.

Education in Lesotho has conventionally been following a separate-discipline approach at all levels. Only since 2013 has the Basic Education Curriculum (Grades 1 to 10; i.e. seven years of primary education and three years of junior-secondary education), based on an integrated approach through Learning Areas, been implemented. While this learning-area approach is

employed at the primary level, subject disciplines are still followed at the junior-secondary level. This poses challenges for teaching at both primary and secondary level, where teacher training still follows traditional disciplines with very limited integration within and between disciplines (Burke & Sugrue, 1994; Lefoka & Sebatane, 2003). This is despite the values embedded in multidisciplinary and cross-disciplinary learning. As a result, interactions of divergent cultures (Schweisfurth, 2011) within departments are limited. Schweisfurth (2011) views this as one of the perennial challenges to the implementation of new pedagogical approaches such as learner-centred education.

Education for sustainable development (ESD), also referred to as environmental education or environment and sustainability education, 'mirrors the concern for education of high quality', demonstrating characteristics of being:

- **Interdisciplinary and holistic:** learning for sustainable development embedded in the whole curriculum, not as a separate subject;
- **Values-driven:** sharing the values and principles underpinning sustainable development;
- **Focused on critical thinking and problem solving:** leading to confidence in addressing the dilemmas and challenges of sustainable development;
- **Multimethod:** words, art, drama, debate and experience employing different pedagogies for modelling different processes;
- **Participatory decision-making:** learners participate in decisions about how they are to learn;
- **Applicability:** learning experiences are integrated in day-to-day personal and professional life; and
- **Locally relevant:** addressing local as well as global issues, and using the language(s) which learners most commonly use (UNESCO, 2006a:4–5).

All lecturers in higher-education institutions need to engage in curriculum change processes that enhance educational quality and relevance (NEPAD, 2003). 'Sustainable development is seen as a context for delivering existing aims of education and not as a competing priority' (UNESCO, 2006b:35), since ESD employs different teaching and learning modes (Cotton, Warren, Maiboroda & Bailey, 2007).

While subject content knowledge, that is, Learning as Mastery, and democratic processes, that is, Learning as Participation (Lotz-Sisitka, 2011) are important, learning needs to be contextually situated in the learner's sociocultural experiences for it to be meaningful (Smith, 2010). Learning as Connection (Lotz-Sisitka, 2011, see also Lotz-Sisitka, this edition) is also covered widely in educational policies in Lesotho and is a discourse that complements and fosters inclusivity. It further enriches the other two important conceptions of educational quality, since it brings the sociocultural, contextual and historical dynamics of the life worlds and experiences of learners into their own classrooms (Lotz-Sisitka, 2011). See Figure 1 on page 32 (Lotz-Sisitka, this edition).

Statement of the Problem and Objectives of the Study

This study sought to mitigate the culture of academic isolation which currently exists within the LCE departments. Its objectives were:

- To initiate interdepartmental collaboration among teacher trainers in order to share ideas and so improve the quality of education during initial teacher training; and
- To establish teacher trainers' levels of understanding of the concept of education for sustainable development and the extent to which they can integrate it in their courses to enhance quality.

Research Methodology

An ESD conceptualisation workshop was held to lay the groundwork for the study. The research focused on the three faculties of Education, Sciences, and Arts and Social Sciences where 10 teacher trainers were involved, including the researcher. Teacher trainers came from the following disciplines: 2 from Chemistry; 2 from Agriculture; 1 from Geography; 1 from Education; 1 from Technology Studies; 1 from Physics; 1 from Biology; and 1 from Sesotho. Participants were selected because they were already involved in one way or another in an activity relating to sustainable development, and also because of their willingness to participate in the study.

The participating teacher trainers were workshopped on the concept of education for sustainable development, including undertaking a trail walk for familiarisation with how nature might be used for teaching. A Sesotho metaphor, *Lehae la Rona* (The universe as our home) was used to initiate debate and elicit questions concerning participants' views regarding *our home* (Mokuku, 2010). In a planning meeting that followed, participants decided to co-teach pairs or groups of three trainee teachers using the same metaphor in their classes. Participants were later interviewed to ascertain their perceptions of ESD and of working by way of an interdisciplinary approach to teaching and learning.

Findings

These findings are drawn from the following areas within the study: environmental education (EE)/ESD conceptualisation workshop; *Lehae la Rona*; the concept of sustainable development; promoting sustainable development through courses; and collaboration with other departments.

Conceptualisation workshop

Learning as Connection

The Universe as 'our home' was introduced through a metaphor: *Lehae la Rona*. The use of this metaphor enabled participants to engage with the sociocultural, contextual and historical dynamics of their life experiences as they interrogated, and participated in discussions about, their current teaching and learning experiences. *Lehae la Rona* was thoroughly deliberated by

participants, giving rise to ideas about the notions of *strange* and *familiar* and how the two concepts are usually viewed, for example how do people usually approach a strange person, land or animal, or a strange concept as opposed to familiar ones? Participants as well as the students contended that *strange* is usually approached with scepticism, while the *familiar* is viewed as bringing hope and comfort. Participants discussed areas of collaboration with colleagues in different disciplines.

The two brief stories below provide examples of Learning as Connection:

In a supportive and friendly environment where everyone's opinion is accepted, learners discuss issues and discover problematic situations that might need attention. They decide together on ways of addressing such challenges and plan to undertake activities that relate to the subject content at hand. A group of physics students learn, in this way, about *electric current*. Using a waste plastic bottle, a mobile-phone battery and water, they connect to their contextual world of persistent floods and have designed an electric boat. Another group of students uses a mobile-phone battery to power a fan in order to cool air in the classroom. This encourages learners to solve problems relevant to their real-life situation while engaging in Learning as Mastery, and Learning as Participation discourses.

The metaphor itself sensitised participants and students to the need to care for and save resources, regardless of where they come from. A metal technology teacher mentioned that the metaphor raised issues of limited resources in his class, with the students deliberating on how they could save metal in their workshop so that they could continue to enjoy the use of such a resource. On a similar note, the chemistry teacher said that conservation of chemicals and minimising waste is top priority in chemistry lessons, since resources are finite. In all of these cases, we see a link between the course content and the sociocultural, historical and contextual experiences of learners.

Understanding the concept of sustainable development

The concept of sustainable development did not seem to be straightforward for most participants. Some described it on the basis of the literal meaning of the term 'sustainable'. When asked what they understood about sustainable development, one said: 'Mmm, sustainable development? To sustain is to have something for longer, so sustainable development is making sure that, while you use what you have, you will continue to have it for longer.' This description is in line with the Sesotho version of the term 'sustainable development' coined by the former Prime Minister of Lesotho, the Right Honourable Dr Pakalitha Mosisili, when he said that sustainable development is *Ntšetsopele ea moshoelella*, meaning development that goes on and on. If the term is not adequately interrogated within the academic arena in order to arrive at a consensus understanding, it might be quite misleading. All participants gave examples of areas where sustainable development could be integrated into their courses. Concerns were centred on resource wastage, with examples ranging from energy (specifically electricity) to metal, chemicals, paper and water as needing immediate attention.

Promoting quality by integrating sustainable development into courses

Participants all agreed that sustainable development should be integrated in curricula, as it promotes learner-centred approaches. Student projects were viewed as important in order to

instil sustainability values in students, the argument being that, 'if they learn by doing, they will also be able to do the same when they teach'. Another one said: 'It is only when they do things that they [will] be able to solve problems in the communities where they live.'

Collaboration with other departments

Interdisciplinary collaboration was regarded highly by participants, particularly at the stage of curriculum review, as it can highlight areas of collaboration during teaching. The physics teacher pointed out that she would like to collaborate with the life skills teacher, arguing that her student teachers lacked assertiveness skills necessary for citizenry. Participants also suggested that the support of College management be sought so as to ensure the mainstreaming of ESD at the LCE. They said: 'This is the only way that could ensure that everyone does it'. They also saw a need for more capacity building, not just for the rest of the College's teacher trainers, but also for themselves, saying: 'We still need more training to be able to fully understand how to do it'.

In order to ensure curriculum integration, participants suggested thematic teaching using an environmental issue/theme as a means of interdisciplinary collaboration. They maintained that teaching around similar themes can instil values in students that might enhance a commitment to their institutional development (Cotton, Warren, Maiboroda & Bailey, 2007), as they share their learning experiences outside of their learning disciplines.

Trail walk – contextual learning

Participants appreciated experiential learning through a trail walk at the Lesotho Durhum Link. They saw it as a teaching method that brings the world near to the classroom in order to be experienced by learners in a 'real-world' situation. All of the participants alluded to the need to have a trail walk established at the College using an interdisciplinary approach so that different voices could be heard.

The limitations that discouraged participants from teaching by means of projects were: time; the large number of student teachers; overcrowding in classrooms; assessment demands limiting pedagogical approaches; and curriculum overload.

Conclusions

This short viewpoint paper has shown that teaching and learning approaches that embrace learners' contextual situations, and may also encourage learners to take actions that relate to their real-life situation, can potentially empower them to develop agency and become competent in confronting issues in the future, a point that was discussed among those involved in the project.

Following the interactions, it was found that teacher trainers at the LCE are positive about mainstreaming ESD as a vehicle for engaging in interdisciplinary collaboration so as to enhance quality education. Participants challenged students, requiring them to connect with their sociocultural, historical and daily experiences while they engaged with subject content knowledge. Participatory learning was enhanced through students' deliberations on issues of sustainable development.

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