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Exploring a Knowledge-focused Trajectory for Researching Environmental Learning in the South African Curriculum

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Abstract

This paper explores the past twenty years of environmental learning in the South African curriculum in order to consider how one might best research a knowledge focus within the Fundisa for Change national teacher education programme. In exploring this knowledge focus, the paper draws on international literature. It also extensively, but not exclusively, draws on two key publications which informed the 2002 and the 2011 curriculum changes in South Africa. The paper draws on social realist curriculum theory, underpinned by critical realism. This theoretical perspective, which includes Bernstein's pedagogic device and particularly recontextualisation of knowledge across the pedagogical landscape, provides a language of description for critically reviewing knowledge and environmental learning. In particular, the review develops five perspectives on environmental knowledge as it pertains to curriculum which include:

- *Perspective #1) new environmental knowledge in the curriculum;*
- *Perspective #2) environmental knowledge in local and global contexts;*
- *Perspective # 3) dynamic knowledge for open-ended and futuristic thinking;*
- *Perspective #4) depth and complexity of environmental knowledge; and*
- *Perspective #5) combining discipline-specific core knowledge and skills with a systems perspective.*

The paper argues for a re-emphasis and review of new environmental knowledge and learning support materials. It suggests a consideration of context-rich but not context-bound explorations of local and global environmental issues and the need for adopting open-ended and futuristic thinking in the context of the dynamism of environmental knowledge. This involves exploring systems of meaning and structures of knowledge in dealing with the complexity of environmental knowledge and acknowledging the challenges of a transformative ideology within such a complex knowledge system. Additionally the paper argues for creative ways of working across disciplines to develop better understanding of discipline-specific concepts and their potential to contribute to meaningful learning. The paper concludes by suggesting a research trajectory for future environmental education research in the context of the new South African Curriculum and Assessment Policy Statement (CAPS) *extending the emphasis in this paper on the official recontextualising field, to fields across the entire pedagogic device.*

Introduction

Le Grange (2002) reports that ecology was introduced into the South African curriculum in the 1970s, which for many years was the key entry point for environmental learning activities in South African curriculum work, primarily in the natural sciences. This ecological foundation lent itself to approaches to environmental learning consistent with 'nature study' and 'conservation education'. Such approaches to environmental learning focused on nature at risk for which 'ecology provided the symbolic capital of concepts' (O'Donoghue, 2007:147) and these approaches were often driven by state conservation agencies and associated with outdoor, hands-on, in-nature activities (ibid.). At this time many environmental learning activities facilitated within the formal school curriculum were not designed to challenge the socio-economic or political fabric of society and their emphasis on natural resources and their management or 'wise-use' (Irwin, 1990; Stevenson, 1987) were comfortably incorporated into the goals and structural organisation of schools. Provincial outdoor education programmes such as the racially exclusive ex-Transvaal's 'VeldSchools'[1] (for white children only) and outdoor education programmes in Bophutatswana (a former Bantustan established under apartheid in South Africa) and similar programmes run by the National Environmental Awareness Council in Soweto operated in co-operation with education departments (Irwin, 1990), mostly on the periphery of formal curricula. It was only in post-apartheid times (after 1994) that an inclusive and national curriculum set the scene for mainstreaming environmental learning (as will be detailed in later in the paper) in schools. An additional significant change in school-based environmental learning at the end of the apartheid era was brought about by national environmental education curriculum and policy initiatives (discussed below) which brought a human rights/social justice orientation to environmental work into the post-apartheid policy space (NEEP-GET, 2005b). Hence, it is this post-apartheid era, with an inclusive, integrated, social justice approach to environmental education, which is the time frame chosen for this exploration of the South African curriculum.

Environmental learning in the curriculum is explored in relation to three phases of the post-apartheid (post 1994) South African curriculum: The 1997 Curriculum 2005 (C2005), the 2002 Revised National Curriculum Statement (RNCS) for General Education and Training together with the National Curriculum Statement (NCS) for Further Education and Training, and the 2011 Curriculum Assessment Policy Statement (CAPS).

The paper explores a particular aspect of curriculum – namely a knowledge focus – which has been identified by a South African national network of environmental educators, the Fundisa for Change network, as a key research interest (Lotz-Sisitka *et al.*, 2013). Thus one key purpose of this paper is to serve as a positioning paper for the Fundisa for Change research programme. I have a particular interest in this programme, being the appointed research programme co-ordinator and since I have long been involved in the design of teacher professional development programmes that have led to the Fundisa for Change model and approach (Schudel, 2013). Drawing on a variety of sources, the paper will illustrate that the question of knowledge is central to the crisis of curriculum in South Africa, as captured particularly in two publications edited at the time of, and influential in, the transition from

Curriculum 2005 to the RNCS/NCS and then later in the transition from the RNCS/NCS to the CAPS. These publications with papers and input from leading academics in the country were: 'South African Curriculum for the Twenty First Century: Report of the Review Committee on Curriculum 2005' (Chisholm, 2000) and the 'Report of the Task Team for the Review of the Implementation of the National Curriculum Statement' (Dada *et al.*, 2009) respectively. To understand the knowledge-centred issues in the curriculum context, it is helpful to work with a social realist view of knowledge.

A Social Realist Knowledge Interest in Environmental Education Curriculum Research

One of the key interests of curriculum sociologists is the development of a social realist view of knowledge in and for curriculum research. Social realists argue that a realist approach to understanding knowledge in the curriculum is necessary to replace outmoded distinctions between traditional and progressive approaches which fail to highlight and give insight into the knowledge question (Moore, 2000) and subsequently result in the marginalisation of knowledge in curricula (Wheelahan, 2007). This concern is raised particularly in relation to the marginalisation of content knowledge in the outcomes-based iterations of the South African curriculum as well as the challenge of selecting and developing resources for teaching 'new' environmental knowledge to support curriculum work in South Africa (see Perspective #1 below).

A social realist view of knowledge requires a focus on epistemic relations. Maton describes two types of epistemic relations, the first being 'discursive relations between knowledge and other knowledges' (Maton, 2014:175). I draw on this notion of discursive relations to explore the relationship between local, indigenous and everyday knowledges and abstract discipline-specific knowledge (see Perspective #2 below).

The second type of epistemic relation as referred to by Maton (ibid.) involves the role of curriculum knowledge in providing access to the nature of the world (Wheelahan, 2010), that is, the intransitive world. This interest in the nature of the world, the intransitive world, or the 'objects' of the world are described by Maton as – the 'ontic relations between knowledge and its objects of study' (Maton, 2014:175). In this regard, this paper reflects on challenges presented to South African environmental educators as mediators of coming to know the nature of the object of environmental learning. Environment as 'object' of environmental learning is dynamic, changing and open-ended and thus knowledge emerging from this object displays these same properties (see Perspective #3 below). Additionally environment as object, and knowledge of environment requires systems of meaning and structures of knowing in the face of the depth and complexity of the object 'environment' (see Perspective #4 below).

The emphasis on epistemic relations (ontic and discursive) is an extension of the work of sociologists such as Bernstein whose work focused on socially powerful knowledge (Wheelahan, 2010) and its associated concerns with inequality and oppression. So, in addition to the role of providing access to the nature of the world (in the form of epistemic relations) as described above, Wheelahan describes a second key role of knowledge namely to provide

access to 'society's conversation' (Wheelahan, 2010:122). In acknowledging a critical realist view of curriculum as a moral/political entity, while at the same time neither viewing curriculum as ontologically essentialist, ethically prescriptive, nor ahistorical/atemporal; the paper, in Perspective #4 below, explores the ideological underpinning of the South African curriculum and its role in guiding curriculum conversations.

Finally, in the section discussing Perspective #5 below, social realist interests in both systems of meaning as well as ensuring strong discipline-specific knowledge and skills is explored in relation to the South African curriculum's changing knowledge structure. This is especially related to inter-disciplinarity and the fluidity of learning area/subject/learning programme boundaries which are often required for a full understanding of environmental histories, systems, concerns and environmental solutions or solution-oriented knowledge.

Before the different interests and challenges of the South African curriculum are discussed in detail in relation to the above-mentioned social realist and critical realist perspectives, a brief summary of the development of an environmental focus in the South African curriculum since 1994 is outlined.

A Brief Summary of the Development of an Environmental Focus in the South African Post-Apartheid Curriculum

The main instigation for the post-1994 mainstreaming of environmental education in the education and training sector was the call for inclusion of environmental education across the education and training system in the 1995 *White Paper on Education and Training* (Lotz-Sisitka & Raven, 2001). This arose from the ANC environmental desk, who actively supported an environmental focus in educational deliberations for post-apartheid curriculum transformation in the early 1990s in association with the Environmental Education Policy Initiative and its follow up structure, the Environmental Education Curriculum Initiative (Lotz-Sisitka, 2002). Resulting from this political engagement with curriculum and in relation to the emergence of an environmental rights clause in the post-apartheid Constitution, the earliest policy response in schooling to this call was the inclusion of 'environment' as a cross-curricular phase organiser[2] in Curriculum 2005. Curriculum 2005 was based on an outcomes-based curriculum design, and was introduced to South African schools in 1998. A key mechanism for integration of knowledge in this curriculum design was the use of these 'phase organisers' (ibid.).

When phase organisers were discontinued in the next curriculum revision four years later, environmental concerns in the RNCS/NCS were acknowledged in a guiding principle concerned with the 'relationship between human rights, social justice, a healthy environment and inclusivity' (South Africa. Department of Education, 2002b:10). Like Curriculum 2005, the RNCS/NCS was an outcomes-based curriculum and an environmental interest was integrated explicitly in critical outcomes and specific learning outcomes defined by the curriculum. Additionally it was also highlighted in the role and features of learning areas and in core knowledge foci of the Social Sciences, Natural Sciences and Economic and Management Sciences (Schudel, 2013; Lotz-Sisitka, 2002). These core knowledge foci included topics such as biodiversity and sustainable use of resources. This extensive and comprehensive attention to environmental concerns across all these

design features of the curriculum was testimony to the intensive policy engagement amongst environmental educators at a national level during the development of a curriculum for the new South Africa (Reddy, 2011; le Roux & Maila, 2004; Lotz-Sisitka, 2002).

In the 2011 change to CAPS nine years later, the principle described above has been retained and an explicit environmental interest is also evident in its general aims. For example it aims to develop learners that can 'use science and technology effectively and critically showing responsibility towards the environment and the health of others' (South Africa. Department of Basic Education, 2011b:5). This aim reflects the original 'critical and developmental outcomes' that guide all qualifications, teaching and learning in South Africa, and this has been retained since first developed in 1996 and applied to C2005 (see below in Perspective #4). Environment is also evident in the CAPS in the 'specific aims' of some subjects. For example the CAPS Life Skills subject (Grades 1 to 3) has as one of its specific aims that learners need to develop 'an understanding of the relationship between people and the environment' (South Africa. Department of Basic Education, 2011b:8). Furthermore, in the CAPS, environment is integral to the curriculum in the form of specific content knowledge in environmental concepts such as the notion of sustainability, environmental issues such as pollution and climate change, and concepts such as ecology and biodiversity which are foundational to understanding the biophysical dimensions of environmental issues and risks.

Perspectives on Environmental Knowledge Pertaining to Curriculum

Perspective 1: New environmental knowledge in the curriculum

The introduction of the outcomes-based Curriculum 2005 in South Africa was an attempt to 'shift away from a rote and transmission-oriented learning approach' to curriculum (Sayed, 2004:257) – a conservative curriculum tradition in which 'concerns are with social order and appropriate relations of deference rather than inducting students into the controversies and debates with the academic disciplines and in society' (Wheelahan, 2010:106). The new outcomes-based system undermined knowledge in a different way as suggested in an early critique of Curriculum 2005 by Sayed who stated that there was 'a risk that providers might focus only on teaching methods, and ignore the need to provide trainee teachers with the content knowledge they also require' (2004:257). This indeed became the case and was exacerbated by curriculum policy where 'the proper and comprehensive use of textbooks was discouraged and undermined by Curriculum 2005' (Dada *et al.*, 2009:9). Environmental educators responded to this 'textbook' gap at the time by emphasising 'resource-based learning' which focused on the provision of contextualising learning and teaching materials elaborating on environmental themes and providing pedagogical guidance on the use of these (Lotz-Sisitka & Russo, 2003; NEEP-GET, 2005a; Russo, 2003; Schudel *et al.*, 2008).

An early post-apartheid response to the environmental content knowledge challenge in South Africa was the Science and Sustainability Project based at the University of Stellenbosch which contemplated the problem of how to present 'new'[3] environmental knowledge through searching for relevant principles or themes. This was during the development of the *Windows on the Wild* educational materials focusing on biodiversity in South African ecosystems. Besides

biodiversity, this project identified themes related to resource use, carrying capacity of the environment, recycling, ability of the environment to self-heal, and roles played by different species in ecosystems. These were all seen as significant knowledge foci under an umbrella theme of sustainability (Schreuder, Reddy & le Grange, 2002). Another early response to the need for new environmental knowledge was the development of a set of South African-centred *EnviroFacts* (Paxton, 2001). This set of fact sheets focused on key concepts relevant to environmental learning such as sustainability and development, sustainability practices such as permaculture and recycling, environmental issues such as pollution and biodiversity, special and endangered species such as cycads and rhinos, habitats such as wetlands and rivers, biomes such as the fynbos, and more. These fact sheets were intended to be used in environmental learning programmes 'in response to a growing need amongst South Africans for information about their environment' (ibid.).

Even with a re-emphasis on content knowledge in the RNCS, this curriculum revision was still criticised for knowledge that was 'thin, interspersed and inconsistently presented' (Dada *et al.*, 2009:45). This concern is consistent with reports from environmental education research that teachers experienced difficulties with finding relevant content knowledge (Schudel, 2010) and unfamiliarity with environmental concepts new to their frame of reference (Lotz-Sisitka, 2009). It might also be ascribed to the dichotomising of new and old curricula resulting, for example in 'outcomes' being favoured over 'content' (Chisholm, 2000; Harley & Wedekind, 2004).

In the curriculum review which lead to the development of the CAPS, Dada *et al.* reported that 'the intention is to streamline the curriculum documents into single documents for each grade and each subject in which content and assessment are specified' (2009:6). Such curriculum imperatives are a central concern of social realist researchers such as Wheelahan (2010) who argues for discipline-based theoretical knowledge to be the core aim of education (see also Muller, 2000; Young & Gamble, 2006; Allais, 2007; Bertram, 2009). Spearheading engagement with CAPS foundational knowledge in the environmental field is the work of the Fundisa for Change Programme which has identified that 'environment and sustainability content permeates a wide range of subjects' (Lotz-Sisitka, 2011:7). In response to this new curriculum content, this programme has developed topic, phase and subject-specific materials for teacher professional development seeking to address issues of knowledge progression, conceptual development, scope and depth of knowledge at various phase levels, and expanded knowledge of teachers (that is to expand teachers' knowledge beyond the specific curriculum content of the CAPS) (Fundisa for Change Programme, 2013).

Earlier on, when critiques of OBE first became more substantive, Moll (2002) offered an insight into the problems being experienced. He suggested that part of the problem was a naïve interpretation of constructivism in which group work was over-emphasised and in which learners were left to construct their own meaning of new concepts without teachers acknowledging the need for the mediation of new knowledge (Dada *et al.*, 2009). This may partly be ascribed to the dichotomisation between the new and old curricula with 'learner-centred' pedagogy being favoured over 'teacher-centred' pedagogy (Chisholm, 2000; Harley & Wedekind, 2004). This challenge to content knowledge was also raised through research in the Learning for Sustainability Project,[4] which reported evidence that learners were working

in a knowledge vacuum due to an over-emphasis on group-work which actually distracted learners from core conceptual learning, and from 'consolidating knowledge and developing new understandings' (Lotz-Sisitka, 2000:108). This led to what Lotz-Sisitka described as 'learner-centred emptiness' (2002:114). This naïve approach to constructivism undermined the development of knowledge in a different way to the pre-1994 conservative tradition as described above, this time via an over-emphasis on 'processes of meaning-making that focus on the tacit, contextual and applied at the expense of disciplinary knowledge' (Wheelahan, 2010:113).

Perspective 2: Environmental knowledge in local and global contexts

Wheelahan's critique of an over-emphasis on the tacit, contextual and applied is a crucial critique for environmental educators in South Africa who historically have foregrounded the development of knowledge in local contexts as emphasised by 'local enquiry, problem solving and action learning' (O'Donoghue, 2007:150). This interest in South Africa was supported through learning and teaching support materials such as the ShareNet Hands-On Series (Rosenberg, O'Donoghue, & Olvitt, 2010) which support fieldwork activities in different South African ecosystems. Two interventions described in the following two paragraphs – one a course and another a set of materials – illustrate that environmental educators in South Africa are conscious of critiques such as Wheelahan's and are focusing their energies on developing activities and materials that ensure that the tacit, contextual and applied nature of local knowledge is used in ways that strengthen rather than weaken disciplinary knowledge.

In the first intervention – a course-based intervention – Schudel (2013) explored the role of local enquiries in different disciplines. Through case studies of this course-based intervention in six Foundation Phase classrooms, she identified a number of specific 'modes of enquiry' used in different learning areas in the RNCS. These included asking questions, finding information, and organising, analysing and synthesising information (Social Science – History); exploring issues with representation methods such as graphs, tables, maps, photographs and images in order to support this (Social Science – Geography), experimental modes of enquiry with data representation methods such as posters, pie charts, graphs, concept maps and diagrams (Natural Sciences); collecting, sorting, describing and explaining collections of objects with pictographs as a dominant data representation (Mathematics).

The second intervention discussed here is the recent Handprint Series (O'Donoghue & Fox, 2009) – an intervention featuring comprehensive materials which explore local sustainability practices, providing scientific and technical explanations and associated local culture and heritage stories. These materials are illustrative of the publisher – ShareNet's – valuing of 'contextual responsiveness, social relevance and curriculum validity' (Olvitt, 2002:26, in Olvitt, 2004). Again, environmental educators' concerns for the integrity of disciplinary knowledge is highlighted in this quote. In working with sustainability practices the Handprint Series illustrates how strongly grounded scientific knowledge can be used in situated ways that are not just focused on technical acquisition. They also respond to a particular challenge highlighted in the NEEP-GET pilot research report that, with the imperative to do something 'environmental' within the curriculum framework (in Curriculum 2005 when environment was a phase

organiser), teachers may develop activities that only superficially respond to environmental issues and do not serve learning area requirements (Lotz-Sisitka & Raven, 2001; Schudel, 2006).

Another potential problem with a focus on local enquiry is that of local conservatism (Lotz, 1999) where an over-emphasis on local sustainability practices fails to position learners and learning in the broader societal context or where activities are 'mostly reliant on what learners [know or can] deduce from a particular environment' (Lotz-Sisitka & Raven, 2001:47) or practice. Such research indicates why it is important that environmental learning activities respond to the CAPS call for 'grounding knowledge in local contexts, while being sensitive to global imperatives' (South Africa. Department of Basic Education, 2011c:3). For example how does making a water filter relate to issues of water quality and wetland loss at national and global level? Or, how does growing indigenous plants relate to biodiversity loss in specific threatened biomes and in relation to international threats to biodiversity? This relational perspective between the local and global in environmental learning can ensure that a focus on solely the local does not lead to a situation where knowledge becomes 'an epiphenomenal outcome of practices that is ephemeral and context bound' (Wheelahan, 2010:113) and therefore not useful outside of a particular context.

Furthermore at both the local and global level attention needs to be paid to 'discursive knowledge' (Maton, 2014, see above) so that, for example, harvesting of indigenous wild plants and livelihoods in a local community (indigenous and local knowledge) as well as species extinction or food security at national or global level (everyday knowledge found in many news items of today) can be related to abstract concepts in specific disciplines. The Fundisa for Change programme has begun to do this work in its subject-specific explorations of environmental topics in the curriculum, for example these local and global challenges have been related to the three levels of biological diversity, namely genetic, species ecosystem biodiversity; or to the relationship between biodiversity and human well-being in the Life Sciences (Shava & Schudel, 2012). Thus, I am proposing that local, indigenous and everyday knowledge of local and global significance plays an important role in developing discursive epistemic relations and in developing 'systems of meaning' as highlighted by Wheelahan (2010:119).

Perspective 3: Dynamic knowledge for open-ended and futuristic thinking

So, if the above section has argued that context bound knowledge has limited use to a learner (with emphasis on the limitations of boundedness rather than on the limitations of contextualizing knowledge), then a further question would be: How can we prepare learners in order to use and develop their knowledge in new and unexpected contexts? Knowledge for all contexts can't be predetermined because of the critical realist contention that, no predictions can be made of a society which is open-ended, contingent and contextually dependent. Bhaskar argued that 'there are no explanatory significant empirical regularities yielded by social science, so the social domain is *de facto* open' (1993:156). Archer elaborated in arguing that social systems are both extrinsically and intrinsically open. This means that it is impossible to attempt to definitively describe society even with the proviso of excluding external influences because systems are peopled by creative and innovative agents whose reflexivity will ensure constant engagement in thought experiments and constantly changing practice (Archer, 1998).

This understanding of open systems is consistent with a view of the environmental crisis as expressed by the South African National Research Plan which states that 'a complex system of non-linear interacting factors incorporating time-lags and spatial heterogeneity is unlikely to change in a smooth and predictable fashion when nudged in a particular direction' (South Africa. Department of Environmental Affairs, 2010). Indeed, it is also consistent with the scientific enterprise whose main objective is ongoing discovery of new knowledge of human and natural systems and processes. When this gets translated into curriculum however, it tends towards representing knowledge as fixed, static and already discovered.

Environmental educators are accustomed to working with the open-ended nature of the social world. For example, Wals describes our world as one of 'continuous change and ever-present uncertainty' (2007:37). The uncertain and contested nature of environmental knowledge has been identified as a core challenge within the Fundisa for Change network (Fundisa for Change Programme, 2013). In response to this challenge Wals calls for a 'systemic and reflexive way of thinking and acting' (Wals 2007:37) and Lotz-Sisitka argues that knowledge should be developed in a way that is 'expansive and critically constructed in relation to its basic tenets' (2011:55). A further challenge of this complexity is that it demands of students 'considerable tolerance for ambiguity and uncertainty, autonomy for making judgments, and the confidence and insight to challenge conventional wisdom' (Stevenson, 1987:77). This means working with CAPS-based environmental knowledge 'in open-ended, and innovative ways with learners, who need to develop a deep understanding of the dynamic nature of this knowledge, and its implications for society, now and in the future' (Lotz-Sisitka, 2011:28). For example one particular topic in the Life Sciences of the Further Education and Training Band of the CAPS requires learners to investigate 'human impact on the environment: Current crises for human survival: Problems to be solved within the next generation' (South Africa. Department of Basic Education, 2011e:51).

Drawing on a critical realist ontological position that the world is not reducible to what we experience or the events that take place (Bhaskar, 1978), Wheelahan argues for an open-ended perspective on the future that 'there is much that could happen and understanding this is necessary if we are to think the unthinkable and the not-yet-thought' (Wheelahan, 2009:230). However, thinking the unthinkable could become a challenge in a country that has struggled with freeing itself from pre-apartheid authoritarian ideologies, consistent with a performance-based curriculum model of tight control (Taylor, 1999). Such authoritarian approaches to education can be related to behaviourist/mechanical pedagogy which emphasises pre-determined behaviours at the expense of learning processes (Jensen & Schnack, 1997; Jickling, 1997).

A critical realism perspective rejects 'essentialist views of human nature, deontological ethical prescriptiveness, and ahistorical/atemporal justifications for particular ways of life' (Scott, 2000:112) which are associated with such behaviourist approaches to curriculum. A problem with pre-determined behaviours could be seen for example in an assessment standard in the RNCS which expected that a learner 'participates in a recycling project and explains how recycling contributes to environmental health' (South Africa. Department of Education, 2002a:17). Here there appeared to be an assumption that recycling was 'good' and critical

engagement was a distinct 'gap' in this proposed activity (Schudel, 2013). However, at the same time, the South African RNCS appeared to be seeking an alternative to an authoritarian approach to learning through its commitment to a 'lifelong learner who is confident and independent, literate, numerate and multi-skilled, compassionate, with a respect for the environment and the ability to participate in society as a critical and active citizen' (South Africa. Department of Education, 2002b:8). This tension between critical and behaviourally driven intentions has been a concern amongst environmental educators for some time as is evident in Stevenson's argument that: 'whereas a curriculum in environmental education is emergent and problematic in that the content arises as students are involved in specific environmental problems, most school curricula are predefined since they are designed to serve predetermined behaviourally specific ends' (Stevenson, 1987:75). Stevenson argues furthermore that in the 1980s, (in the United States of America) a conflict arose between the 'ideological and political enquiry' central to environmental learning and the 'dominant practices in schools, which emphasise the passive assimilation and reproduction of simplistic factual knowledge and an unproblematic "truth"' (1987:69). This conflict was also evident in South Africa during the implementation of Curriculum 2005. The conflict was underpinned by a persistence of transmission and rote learning teaching methods and implied authoritarian ideologies (to which teachers had been exposed as learners in schools and as student teachers during the apartheid era), which contrasted with the democratic and rights-based approaches in new curriculum policy (Chisholm, 2000).

A potentially useful notion for understanding how such ambivalence arises in curriculum situations is illustrated in work by Lotz-Sisitka who explored tensions between a curriculum intention to enable 'generative power for social change' and an emerging governmentality, that is, 'government instituting techniques and concerns for self-government' (2005:15). A further example of such tension between generative and governmental intentions was evident in the RNCS with the uncritical promotion of economic growth in the Environmental and Management Sciences curriculum while ignoring possibilities for alternative economic models and highlighting the role of schools in preparing citizens for a role in a capitalist economy (Schudel, 2013).

The envisaged 'active and critical' citizen discussed above is also taken forward in the CAPS, which calls for an 'active and critical approach to learning, rather than rote and uncritical learning of given truths' (South Africa. Department of Basic Education, 2011b:8). The coupling of the words 'active' and 'critical' implies an intention that curriculum interpretation should not simply be the 'internalisation of the foundations of knowledge' but one that promotes a 'more reflexive society that is able to critique and overturn existing routines, values, norms and interests which we (can) know or intuitively feel are deeply unsustainable (Wals, 2007:43). The new CAPS appears to be promoting a reflexive approach throughout all phases in the languages. These incorporate reflection on values, for example, in the Foundation Phase a learner in an English class 'reads books and discusses the main idea, the characters, the "problem" in the story, the plot and the values in the text' as one part of regular daily reading (South Africa. Department of Basic Education, 2011a:26). In higher grades the languages also enable a view of values as contestable, complex and not always liberating as evident in the Senior Phase Home

Language call for learners to 'reflect on stereotyping and other biases' (South Africa. Department of Basic Education, 2011f:16). Such critical perspectives on curriculum are important from a critical realist perspective as they enable forward and creative thinking and because, as Bhaskar argues 'if one is to act at all, there must be grounds for preferring one belief … to another' (1979:58). This insistence on understanding that 'some claims to knowledge are less valid than others are' (Muller, 2000:163) is consistent with the social realist critique of interpretations of constructivism where knowledge becomes simply 'the reflection of differently positioned actors or voices' (Wheelahan, 2010:113).

Perspective 4: Depth and complexity of environmental knowledge

The previous section discussed the importance of the role of curricula in developing active and critical thinkers who can do more than simply internalise knowledge, however the 2009 curriculum review of the RNCS/NCS instigated an intensive content knowledge coverage prescribed in the CAPS. The challenge here will be to ensure that depth of learning is not sacrificed for the sake of breadth so that 'students know very little about many things [without] developing high-level thinking skills' (Taylor, 1999:122). The CAPS curriculum has varied responses to assessment across the different subjects which highlight the importance of such high-level thinking skills. Some subjects distinguish between lower, medium and higher order thinking skills in assessment processes; for example, English Home Language requires learners to comprehend, reorganise, infer, evaluate and appreciate (South Africa. Department of Basic Education, 2011a). Other subjects such as the Further Education and Training History CAPS specify different cognitive levels (South Africa. Department of Basic Education, 2011d). Essentially though all subjects specify particular verbs that are important for developing depth and complex understandings, all of which need to be considered in the planning of environmental learning. Dealing with complexity is highlighted in one of the new CAPS curriculum principles calling for 'progression [where] content and context of each grade shows progression from simple to complex' (South Africa. Department of Basic Education, 2011c:6). This is important from a social realist perspective which highlights the importance of 'systems of meaning and structures of knowledge' (Wheelahan, 2010:119).

A further challenge of complexity in the South African post-1994 curriculum has been that of equality and redress in response to past oppression (Dada *et al.*, 2009). Harley and Wedekind's description of the mission of the post-apartheid curriculum, namely that of 'uniting all citizens as equals in a democratic and prosperous South Africa' (Harley & Wedekind, 2004:195), can be related to a reaction against an apartheid curriculum agenda to 'prepare different groups for dominant and subordinate positions in social, political and economic life' (ibid.:195). This curriculum interest is an explicit example of critical realism's insistence that the learning environment is a moral/political entity being 'in part normative, [and] meaning it entails decisions about what could or should be the case' (Brown, 2009:26).

An explicit transformative ideology was also implied in the RNCS principle discussed in summary of curriculum transition above. This principle was reiterated in the CAPS as an interest in 'human rights, inclusivity, environmental and social justice' (South Africa. Department of Basic Education, 2011c:6). Constitutional imperatives were highlighted and

endorsed in both the RNCS and the CAPS, which both committed to democracy, social justice and human rights and explicitly healing past divisions and improving quality of life for all (South Africa. Department of Basic Education, 2011b; South Africa. Department of Education, 2002b). In support of transformation in society, one particular teaching resource that presented a rights-based approach to the RNCS was *Hadeda Island* – a set of materials designed to explore freedom of speech, listening skills, respect for others' opinions, and voicing needs in a community – paralleled with an exploration of the adaptation, biology, diversity and behaviour of birds (Olvitt, 2003 in Olvitt, 2004).

The rights-based approach made explicit in the RNCS was elaborated by critical outcomes expressed across all learning areas, for example the learning outcome discussed in the in summary of curriculum transition above that required learners to 'use science and technology effectively and critically showing responsibility towards the environment and the health of others' (South Africa. Department of Education, 2002b:11). This was further elaborated as open-ended learning area-specific learning outcomes such as in the Natural Sciences that: 'the learner will be able to make informed decisions regarding personal, community and environmental health' (South Africa. Department of Education, 2002a:5). These learning outcomes are no longer the dominating educational objective as they were in the RNCS. These ideologies are now explicit in the general aims of the curriculum (the above-mentioned critical outcome is now labelled a general aim in the new CAPS curriculum). Furthermore environmentally significant ideologies can be found in the explanations of the purpose of the specific subjects, for example the Further Education and Training Life Sciences CAPS requires learners to 'understand the contribution of science to social justice and societal development as well as the need for using scientific knowledge responsibly in the interest of ourselves, society and the environment' (South Africa. Department of Basic Education, 2011e:12).

With a focus on both social relations (in the rights-based curriculum principle) and epistemic relations (central to, but not exclusive to the principle concerned with progression of content), there is potential in the new CAPS curriculum to develop understanding of 'the socially mediated basis of our access to knowledge and its relationship to its referent (its aboutness) [making] it possible to critique knowledge producing social practices that contribute to privilege and power while at the same time valuing the epistemic insights such knowledge provides' (Wheelahan, 2010:116).

Perspective 5: Combining discipline-specific core concepts and skills with systems perspective

The previous section dealt with the complexity of knowledge. A further knowledge question is the degree of fluidity of discipline boundaries in helping to provide varied perspectives on the complexities while at the same time keeping the integrity and strength of discipline-specific knowledge and skills intact. Across the three curriculum changes, South African environmental educators sought different ways of approaching an environmental interest in the curriculum. Explorations of cross-curricula integration in Curriculum 2005 and the RNCS suited the re-organisation of the South African curriculum into 'learning areas' instead of 'subjects'. A learning area was defined as 'a field of knowledge, skills and values which has unique features

as well as connections with other fields of knowledge and learning areas' (South Africa. Department of Education, 2002b:9). This meant a curriculum structure with more fluid boundaries and opportunities for integration across different 'fields of knowledge'. Integration became a key feature of lesson planning and teachers were expected to integrate across learning outcomes (within learning areas) as well as across learning areas (ibid.).

However in practice, in South Africa, a problem with the integrated cross-curricular approach to environmental learning (as promoted by environment as phase organiser as well as the principle of integration across learning areas in the RNCS) was that the lessons developed for cross-cutting themes were not furthering the aims of the learning area nor deepening knowledge or process skills from specific learning areas (Lotz-Sisitka & Raven, 2001). Similarly the 2009 curriculum review raised the concern that the RNCS failed to 'adequately provide the coherent, systematic content and knowledge to satisfy the specific aims of the curriculum' (Dada *et al.*, 2009:13).

Wheelahan's circumspect perspective on some interpretations of inter-disciplinarity, can help navigate this problem with the explanation that 'rather than negating disciplinary boundaries, the explicit negotiation of these boundaries helps us to understand when we are drawing on one discipline to develop another and to develop a better understanding of the complexity of these concepts and their contribution' (Wheelahan, 2010:82). From this point it can be argued that inter-disciplinarity requires first the development of strong discipline-focused skills before these can be usefully employed in cross-curricular or inter-disciplinary endeavors. In South Africa, such a move amongst environmental educators to a primary emphasis on strengthening the discipline was evident in an explicit emphasis on working with the environmental focus *integral to* each learning area in the RNCS, rather than over-emphasising the cross-curricular opportunities in environmental education (Lotz-Sisitka & Raven, 2001).

While inter-disciplinarity has less emphasis in the new CAPS, it has had relevance in the Foundation Phase across all three iterations of the curriculum. That is, through the phase organisers in Curriculum 2005, as well as through integration across the three Learning Programmes in the RNCS (Life Skills, Mathematics and Language). In addition the RNCS Foundation Phase Life Skills Learning Programme[5] integrated learning outcomes internally – that is an integration of the main learning area, Natural Sciences, with Social Sciences, Technology, Economic and Management Sciences, and Arts and Culture. Currently, within the CAPS Foundation Phase Life Skills subject, teachers are expected to use 'topics … as a means to integrate the content from the different study areas where possible and appropriate' (South Africa. Department of Basic Education, 2011b:14). For example, the Grade 3 Life Skills CAPS topic of waste (South Africa. Department of Basic Education, 2011b:55) requires learners to understand:

- 'What happens to our waste [supporting a Natural Science understanding of issues of land pollution in informal dumping, air pollution in burning, and issues of space and leaching in burying]
- Re-using, Recycling, Reducing and knowing what can't be recycled [supporting a Social Science understanding of resource use]
- Recycling at home and at school [supporting a Life Orientation interest in citizenship]

- Making compost out of things that rot [supporting a Natural Science understanding of 'living soil'].'

If such topics are approached with a clear understanding of the discipline specific core concepts and skills needed to give meaningful insight into real world problems then it enables possibilities – as with interdisciplinary research described by Bhaskar (2010) – for enabling empathy, understanding and creative employment of concepts, models, analogies and insights across fields and disciplines. Additionally, by focusing on topics in this way, learners can develop important systems perspectives on knowledge, such as understanding the patterns of change, discovering how living things fit into their surroundings, cause and consequence, conservation action to make the world a better place, interrelationships and interdependence, diversity, and place (Lotz, 1996).

In the CAPS, from Grade 4 upwards, subject boundaries are drawn more tightly and the danger is no longer so much one of 'watering down' core knowledge and skills but one of preventing a reductionist and atomistic presentation of curriculum concepts. The challenge for curricula is that knowledge should not become 'little more than the "construction of meanings" or "a conversation" – regardless of what these meanings are, what the conversations are about, or whether they give learners any reliable understanding of the world, or power over it' (Young, 2008:191). The CAPS general aim which requires that knowledge is used to 'demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation' (South Africa. Department of Basic Education, 2011e:5) highlights the importance of not losing sight of the integrated and applied potential of knowledge.

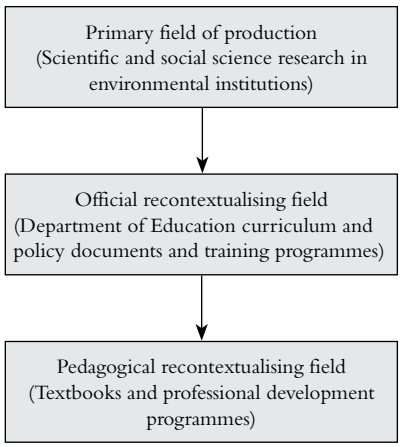
Essentially knowledge needs be seen as a 'causally important objective in its own right because of the access it provides to the nature of the world and to society's conversation' (Wheelahan, 2010:106). This means ensuring that core knowledge and skills are developed in such a way as to promote understanding of issues, and 'social innovations that provide ways forward and "out of" or "in response to" the issues presented in the CAPS' (Lotz-Sisitka, 2011:55). For example, issues such as pollution, climate change, or biodiversity loss which are presented as explicit environmental challenges in the CAPS curriculum. This requires still emphasising a systems perspective while employing the ever-more specialised enquiry skills and sophisticated understandings offered by subject specialisation.

Implications of this Review for Further Research

The social realist and critical realist commentary on the development of, and associated potential and challenges with, environmental learning in the South African curriculum over the past twenty years has suggested the value of considering the curriculum knowledge questions for environmental learning from a range of perspectives. The perspectives outlined above, could help to guide curriculum research in environmental education for those that are interested in the knowledge-curriculum relation. What was also evident from the review above, but not discussed as such, is that the knowledge that appears in the curriculum (via

various curriculum designs and policies e.g. OBE, phase organisers, CAPS, etc.) is knowledge that is recontextualised from the field of production (where knowledge is first produced). For example, biological scientists and ecologists produce knowledge of biodiversity, which is then recontextualised by curriculum developers, textbook authors, teacher educators and teachers themselves. Bernstein (1990), also a social realist, provides a model of the 'pedagogic device' (see Figure 1 below) which allows one to see that knowledge is not just constructed in the mind of the learner in pedagogic interactions, but that knowledge arises from years of scientific practice in the field of production. Education systems then have various strategies for recontextualising this knowledge.

Figure 1. Production, recontextualisation and reproduction of environmental knowledge across Bernstein's pedagogic device



Source: Adapted from Bernstein (1990).

As I move towards concluding this paper, I draw on Bernstein's recontextualisation theory, to suggest potential research trajectories for the ongoing Fundisa for Change work with the new CAPS curriculum, drawing on the insights developed through this thinking process. Reflecting on the analysis provided above in Perspectives #1–5, drawing on a Bernsteinian (1990) perspective, it is possible to suggest that the discussions on knowledge above are limited to the way environmental knowledge has been recontextualised in the official recontextualising field (Bernstein, 1990). As noted above, the perspectives offered in the review are limited to a consideration of environmental knowledge as visible in changing curriculum policy documents and reviews of these. Some of the examples drawn on also show how such knowledge has been recontextualised into the pedagogical recontextualising field (ibid.) with some reflections on textbook use and the development of supplementary environmental education materials, particularly by environmental educators. The proposed research trajectories below will also include suggestions for extension of research in these fields as well as propose research in the field of production (the scientific work of environmental institutions internationally, nationally

and locally) and the field of reproduction (the realm of environmental learning in the classroom) in order to further explore the knowledge challenges across the 'entire pedagogic device' (ibid.). The latter, the field of reproduction is particularly pertinent to a critical realist insistence that 'the learning environment is partly but not wholly linguistic, and the creation, reproduction and sharing of meanings are core activities of the learning environment' (Brown, 2009:31). The field of reproduction, with its emphasis on the mediation of knowledge, is also pertinent to the critical realist understanding that while we 'may lack unmediated access to external reality, we do have mediated access to it' (Benton & Craib, 2001:74).

- Based on the above analysis, and the perspectives on curriculum recontextualisation offered by Bernstein, and discussed briefly above, I suggest the following potential research trajectories for further exploration within the CAPS curriculum environment: A subject and phase specific audit of new environmental knowledge in the CAPS curriculum will extend the Fundisa for Change exploration of the extent of new environment and sustainability content (Perspective #1) and the extent to which it is coherently and systematically represented (Perspective #5). This same question can be extended to textbooks used to support the teaching of the CAPS curriculum as well as used to explore the how this new knowledge relates to the knowledge of teachers and the recontextualisation of this knowledge in classroom practice.
- An exploration of key international and national science and social science reports dealing with environmental concerns can provide an analysis of the relationship between the field of production of environmental knowledge and the new environmental knowledge as presented in the official recontextualising field (in the curriculum) and in the pedagogical recontextualising field (in textbooks specifically) (Perspective #1).
- Particularly, but not exclusively in classroom contexts, situated learning processes can be explored for their potential to link local and global contexts in ways that are not context bound but context rich and which have the potential to strengthen systems of meaning (Perspective #2) and the respond to open-ended, contingent and contextually dependent situations (Perspective #3) in ways that draw on progressive development of the understandings of the complexity of environmental issues and which are founded on coherent and structured knowledge (Perspective #4).
- Research in the official and pedagogical recontextualising fields (curriculum design and textbooks) as well as in the field of reproduction (classrooms) can explore the mechanisms influencing reflexive spaces for critiquing unsustainable practices and the learning processes that emerge from these spaces. Such research could also explore how these do or do not develop the unthinkable or the not-yet-thought, and whether or not these are presented in ways that are neither ontologically essentialist, ethically prescriptive or ahistorical and/or atemporal (Perspective #3).
- Further exploration of the CAPS curriculum and textbooks can include a study of the nature of disciplinary boundaries in the different phases and subjects in the CAPS curriculum and reflection on how these influence systems perspectives and the coherence and systematic representation of discipline-specific knowledge and skills

(Perspective #5).

- All fields across the pedagogic device can be explored in terms of the extent to which environmental knowledge is engaged in a way that acknowledges its dynamic nature – allowing for open-ended, active and critical engagement (Perspective #3) as well as the development of higher order thinking skills (Perspective #4).

Conclusion

As can be seen from the above discussion, this paper has focused on the curriculum as a guiding document for 'setting the scene' for working with environmental content knowledge in teacher education and schools. The paper has provided a social realist analysis of environmental knowledge as found over time in the three iterations of the post-apartheid national curriculum. It shows both continuities and discontinuities in the recontextualisation process, but also shows up an ongoing concern for deepening and strengthening the way in which knowledge is worked with in curriculum. It has provided a number of perspectives on environmental knowledge which, I have argued, could provide a useful framework for opening up further research, specifically in the Fundisa for Change programme which seeks to strengthen teachers' knowledge in and through teacher education in ways that also contribute to transformative environmental learning (Lotz-Sisitka *et al*.; 2013). However, the framework and insight offered above may also be used in other curriculum research contexts.

Importantly, while it is possible to undertake research into curriculum knowledge as outlined above, researchers should ideally work on this in teams or with an integrated approach to avoid a reductionist approach to researching curriculum knowledge. Engaging the full range of perspectives within a social realist frame, and working with Bernstein's pedagogic device can assist researchers not to fall into the trap of 'picking one perspective' and researching it in isolation.

Having focused on content knowledge specifically in this paper, a logical further interest is on **pedagogical** content knowledge and the capacity to think about 'the most regularly taught topics in one's subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations - in a word, the ways of representing and formulating the subject that make it comprehensible to others' (Shulman, 1986). This would be an important extension of the knowledge question if drawing on these insights, for example, in teacher professional development programmes. Ongoing reflexive review of the relationship between curriculum knowledge, its representation, use and engagement from pedagogical and societal perspectives, as well as from the perspective of the rapidly changing nature of environmental knowledge itself would also be needed to ensure reflexivity and 'renewal' of discourses on knowledge and curriculum to avoid static, reductionist and technicist views of curriculum knowledge.

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Endnotes

1. Veld schools were part of the formal curriculum during the apartheid era in what was then known as the Transvaal Province. Only white children were included in this programme and most children experienced two of these trips during their school career. A veld school trip included a few days away from home in an 'outdoor' environment and through a series of 'nature' experiences and lectures was designed as a rite of passage to 'prepare the learners for the spiritual, moral and socio-economic threat that was lodged against the youth of South Africa as perceived by the government of the day' (Swart, 2009).
2. Phase organisers were a curriculum design tool to deal with significant cross-cutting issues in society and which were intended to be integrated into lesson plans across all learning areas.
4. 'New' is presented here in inverted commas because environmental knowledge was not new to science at the time, but 'new' to the school curriculum.
5. Learning for Sustainability was one of the first teacher professional development programmes operating at a provincial level to strengthen environmental learning in Curriculum 2005. It operated in Mpumalanga and Gauteng from 1997–2000.
6. In the RNCS Foundation Phase, a learning programme was structured by the requirements of a main learning area integrated with other relevant learning areas.

References

Allais, S. (2007). What's wrong with the NQF? Unpublished Presentation for A joint Umalusi/Wits P&DM Public Seminar, August 29, 2007, WITS/Umalusi, Johannesburg.

Archer, M. S. (1998). Introduction: Realism in the social sciences. In M. Archer, R. Bhaskar, A. Collier, T. Lawson & A. Norrie (Eds), *Critical realism: Essential readings*. London: Routledge, pp. 189–205.

Benton, T., & Craib, I. (2001). *Philosophy of social science: The philosophical foundations of social thought*. New York: Palgrave.

Bernstein, B. (1990). *The structuring of pedagogic discourse: Volume IV: Class, codes and control*. London: Routledge.

Bertram, C. (2009). Procedural and substantive knowledge: Some implications of an outcomes based history curriculum in South Africa. *Southern African Review of Education,* 15(1), 45–62.

Bhaskar, R. (1978). *A realist theory of science*. Atlantic Highlands: Humanities Press.

Bhaskar, R. (1979). *Possibility of naturalism*. London: Harvester Wheatcheaf.

Bhaskar, R. (1993). *Dialectic: The pulse of freedom*. London: Verso.

Bhaskar, R. (2010). Contexts of interdisciplinarity: Interdisciplinarity and climate change. In Bhaskar, R., Frank, C., Hoyer, K. G., Naess, P. & Parker, J. (Eds), *Interdisciplinarity and climate change: Transforming knowledge and practice for our global future*. London: Routledge, pp.1-24.

Brown, G. (2009). The ontological turn in education: The place of the learning environment. *Journal of Critical Realism,* 8(1), 5–34.

Chisholm, L. (2000). *South African curriculum for the twenty first century: Report of the review committee on* Curriculum 2005*: Report presented to the Minister of Education, Professor Kader Asmal*. Pretoria: South Africa. Department of Education.

Dada, F., Dipholo, T., Hoadley, U., Khembo, E., Muller, S. & Volmink, J. (2009). *Report of the task team for the review of the implementation of the* National Curriculum Statement. Pretoria: South Africa. Department of Basic Education.

Fundisa for Change Programme. (2013). *Fundisa for Change: Introductory core text*. Rhodes University, Grahamstown: Environmental Learning Research Centre.

Harley, K., & Wedekind, V. (2004). Political change, curriculum change and social formation, 1990 to 2002. In Chisholm, L. (Ed.), *Changing class: Education and social change in post-apartheid South Africa* Cape Town: HSRC Press, pp. 195–220.

Irwin, P. (1990). The concept of environmental education and the development of environmental education in South Africa. *Southern African Journal of Environmental Education,* 11, 3–7.

Jensen, B.B. & Schnack, K. (1997). The action competence approach in environmental education. *Environmental Education Research,* 3(2), 163–177.

Jickling, B. (1997). If environmental education is to make sense for teachers, we had better rethink how we define it! *Canadian Journal of Environmental Education,* 2(Spring), 86–103.

le Grange, L. (2002). Towards a 'language of probability' for environmental education in South Africa. *South Africa Journal of Education,* 22(2), 83–87.

le Roux, C. & Maila, W. (2004). Issues and challenges regarding environmental education policy. *Africa Education Review,* 1(2), 234–244.

Lotz, H. (1996). The development of environmental education resource materials for junior primary education through teacher participation: The case of the We Care Primary Project. Unpublished Doctorate of Education, Stellenbosch University, Stellenbosch.

Lotz, H. (1999). *Developing curriculum frameworks: A source book on environmental education amongst adult learners*. Howick: SADC Regional Environmental Education Centre.

Lotz-Sisitka, H. (2000). The Learning for Sustainability Project: Insights into policy implementation in South Africa. In Janse van Rensburg, E. & Lotz-Sisitka, H. (Eds), *Monograph: Learning for sustainability: An environmental education professional development case study informing education policy and practice*. Johannesburg: Learning for Sustainability Project, pp.103–113

Lotz-Sisitka, H. (2002). Curriculum patterning in environmental education: A review of developments in formal education in South Africa. In Janse van Rensburg, E., Hattingh, J.,

Lotz-Sisitka, H. & O'Donoghue, R. (Eds), *EEASA Monograph: Environmental education, ethics and action in southern Africa* (pp. 97–120). Pretoria: EEASA/HSRC, pp.97–120

Lotz-Sisitka, H. (2005). *Engaging ambivalence: A critical examination of a rights-based environmental education discourse in South Africa's new* national curriculum statements. Unpublished manuscript.

Lotz-Sisitka, H. (2009). Epistemological access as an open question in education. *Journal of Education,* 46, 57–79.

Lotz-Sisitka, H. (2011). Teacher professional development with an Education for Sustainable Development focus in South Africa: Development of a network, curriculum framework and resources for teacher education. *Southern African Journal of Environmental Education,* 28, 30–71.

Lotz-Sisitka, H & Raven, G. (2001). *Active learning in OBE: Environmental learning in South African schools*. Pretoria: National Environmental Education Project, Department of Education.

Lotz-Sisitka, H. & Russo, V. (2003). *Development, adaptation and use of learning support materials: In support of environmental education processes. SADC Regional Environmental Education Programme: Course Developers' Toolkit*. Howick: ShareNet.

Lotz-Sisitka, H., Vogel, C., Schudel, I., Nsubuga, Y., Songqwaru, Z., Rosenburg, E. *et al*. (2013). Pedagogical and epistemological dynamics of new environmental content knowledge. Unpublished research proposal produced for the National Research Foundation, November 27, 2013, Rhodes University, Grahamstown.

Maton, K. (2014). *Knowledge and knowers: Towards a realist sociology of education*. London: Routledge.

Moll, I. (2002). Clarifying constructivism in a context of curriculum change. *Journal of Education, 27*(February 2002), 1–28.

Moore, R. (2000). For knowledge: tradition, progressivism and progress in education: Reconstructing the curriculum debate. *Cambridge Journal of Education,* 30(1), 17–36.

Muller, J. (2000). *Reclaiming Knowledge: Social theory, curriculum, and education policy*. London: Routledge.

NEEP-GET. (2005a). *A critical dialogues monograph. Building capacity for environmental learning in South Africa's education system: Openings for the UN Decade on Education for Sustainable Development*. Howick: NEEP-GET/ShareNet.

NEEP-GET. (2005b). *Lessons learned: Institutionalising environmental learning in the GET band*. Grahamstown: Rhodes University Environmental Education and Sustainability Unit.

O'Donoghue, R. (2007). Environment and Sustainability Education in a changing South Africa: A critical historical analysis of outline schemes for defining and guiding learning interactions. *Southern African Journal of Environmental Education,* 24, 141–157.

O'Donoghue, R. & Fox, H. (2009). *Handprint action towards sustainability (series)*. Howick: ShareNet.

Olvitt, L. L. (2004). *The adaptive development and use of learning support materials in response to the 1st principle of the* Revised National Curriculum Statement*: The case of Hadeda Island*. (Unpublished Master's in Education thesis). Grahamstown: Rhodes University.

Paxton, L. (2001). *EnviroFact series*. Howick: ShareNet.

Reddy, C. (2011). Inaugural address: Environmental education and teacher development. *Southern African Journal of Environmental Education,* 28, 9–29.

Rosenberg, E., O'Donoghue, R. & Olvitt, L. L. (2010). *Methods and processes to support change-oriented learning*. Howick: C.A.P.E. Conservation Education Programme/Rhodes University.

Russo, V. (2003). A resource-based learning approach to professional development: The case of the ACEE (Rhodes University Advanced Certificate in Environmental Education). Unpublished Master's of Education (Environmental Education thesis), Rhodes University, Grahamstown.

Sayed, Y. (2004). The case of teacher education in post-apartheid South Africa: Politics and priorities. In Chisholm, L. (Ed.), *Changing class: Education and social change in post-apartheid South Africa*. First edition. Cape Town: HSRC Press, pp.246-265.

Scott, D. (2000). *Realism and educational research: New perspectives and possibilities.* London: Routledge/Falmer.

Schreuder, D., Reddy, C. & le Grange, L. (2002). Environmental education as a process of change and reconstruction: The Science and Sustainability Project. In Tilbury, D., Stevenson, R., Fien, J. & Schreuder, D. (Eds), *Education and sustainability: Responding to the global challenge*. Gland, Switzerland: IUCN Commission on Education and Communication, pp.133-139

Schudel, I. (2006). Researching materials in use: A case study of the use of DWAF 2020 Vision education materials in the *Environment and Sustainability in Schools* teacher professional development course. Unpublished research report, Rhodes University, Grahamstown.

Schudel, I. (2010). Schools and sustainability evaluation report: Towards a deeper understanding of environmental education in context. Unpublished evaluation report, Rhodes University, Grahamstown.

Schudel, I. (2013). Examining emergent active learning processes as transformative praxis: The case of the Schools and Sustainability professional development programme. Unpublished doctoral thesis, Rhodes University, Grahamstown.

Schudel, I., le Roux, C., Lotz-Sisitka, H., Loubser, C., O'Donoghue, R. & Shallcross, T. (2008). Contextualising learning in Advanced Certificate in Education (Environmental Education) courses: Synthesising contexts and experiences. *South African Journal of Education,* 28, 543–559.

Shava, S. & Schudel, I. (2012). *Environment, science, society and sustainability: Biodiversity* (draft exemplar). Unpublished: Teacher Development Network.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher,* 15(2), 4–31.

South Africa. Department of Basic Education. (2011a). Curriculum Assessment Policy Statement*: Foundation Phase: English Home Language: Grades R–3*. Pretoria: Department of Basic Education.

South Africa. Department of Basic Education. (2011b). Curriculum Assessment Policy Statement*: Foundation Phase: Life Skills: Grades R–3*. Pretoria: South Africa. Department of Basic Education.

South Africa. Department of Basic Education. (2011c). Curriculum Assessment Policy Statement*: Foundation Phase: Mathematics: Grades R–3*. Pretoria: Department of Basic Education.

South Africa. Department of Basic Education. (2011d). Curriculum Assessment Policy Statement*: Further Education and Training Phase: History*. Pretoria: Department of Basic Education.

South Africa. Department of Basic Education. (2011e). Curriculum Assessment Policy Statement*: Grades 10–12: Life Sciences*. Pretoria: Department of Basic Education.

South Africa. Department of Basic Education. (2011f). Curriculum Assessment Policy Statement*: Senior Phase: English Home Language: Grades 7–9*. Pretoria: Department of Basic Education.

South Africa. Department of Education. (2002a). Revised national curriculum statement *Grades R–9 (schools) policy: Life Orientation*. Pretoria: Department of Education.

South Africa. Department of Education. (2002b). Revised national curriculum statement *Grades R–9 (schools) policy: Overview*. Pretoria: Department of Education.

South Africa. Department of Environmental Affairs. (2010). *Environmental sector skills plan for South Africa: A systems approach to human capacity development and sector skills planning.* https://www.environment.gov.za/sites/default/files/docs/environmentalsector_skillsplanfor_southafrica.pdf, visited 12 December 2014.

Stevenson, R. (1987). Schooling and environmental education: Contradictions in purpose and practice. In Robottom, I. (Ed.), *Environmental education: Practice and possibility*. Geelong, Australia: Deakin University Press, pp. 69–81.

Swart, R. (2009). Towards a prospectus for Freirean pedagogies in South African environmental education classrooms: Theoretical observations and curricular reflections. Unpublished Master's in Education thesis, University of Pretoria, Pretoria.

Taylor, N. (1999). Curriculum 2005: Finding a balance between school and everyday knowledges. In Taylor, N. & Vinjevold, P. (Eds), *Getting learning right: Report of the President's Education Initiative Research Project*. Braamfontein: Joint Education Trust, pp.105-130

Wals, A. (2007). Learning in a changing world and changing in a learning world: Reflexively fumbling towards sustainability. *Southern African Journal of Environmental Education,* 24, 35–45.

Wheelahan, L. (2007). The marginalisation of theoretical knowledge in vocational qualifications in Australia: A blended Bernsteinian and critical realist analysis. Unpublished doctoral thesis, Monash University, Australia.

Wheelahan, L. (2009). The problem with CBT (and why constructivism makes things worse). *Journal of Education and Work,* 22(3), 227–242.

Wheelahan, L. (2010). *Why knowledge matters in curriculum: A social realist argument*. Oxon: Routledge.

Young, M. (2008). *Bringing knowledge back in: From social constructivism to social realism in the sociology of education*. London: Routledge.

Young, M. & Gamble, J. (Eds). (2006). *Knowledge, curriculum and qualifications for South African further education*. Cape Town: HSRC Press.