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Linking technology and environmental education in the South African outcomes based curriculum, at grade 1

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Abstract
This study is contextualised within educational transformation in South Africa, and a ‘new paradigm’ of Outcomes Based Education (OBE). A starting point is a consideration of ‘values’ issues in technology education around technicist and human centred definitions of capability. Constraints and opportunities attached to the capacity of South African teachers to work towards outcomes that contextualise technology socially and environmentally are reviewed.

The history of environmental education in South Africa is summarised to show an evolving human centred perspective, that values learners’ life world understandings as a starting point for educational action. It is argued that since technological action is environmental action, environmental pedagogy may be helpful in contextualising and developing human centred approaches.

Interpretative research with a group of ten primary teachers is reported that combined environment and technology approaches within an OBE framework, where the Programme Organiser ‘Environment’ is available, and technology is a core Learning Area. Teachers’ reports indicated the value of further exploration of environmental education approaches in order to meet the requirements of OBE technology that: learners must be encouraged to arrive at solutions which are their own unique, creative and individual responses to real problems.

Introduction
Olsen (1997:387-388) criticised reductionist and technicist views of technology for being overly focused on the design process, because it is ‘an aspect of the whole most easily assessed’. He suggested that capability needs to be broadened to embrace the cultural and moral context of making things, to ‘lead us back into where we live and how to live better’ (my emphasis). Olsen’s human centred view of the role of technology education, resonates with South African Outcomes Based (OBE) proposals for technology in General Education (years 6 to 16). Here it is suggested ‘learners must be encouraged from the earliest stages of education to arrive at solutions which are their own unique, creative and individual responses to real problems’ (Technology 2005, 1996:11).

The view is supported in this study that for learners to identify and respond to problems that are real in their lives, technology programmes should commence with learners’ life worlds and the meanings they construct of issues that are significant to them; practical, cultural and moral.

Consequently this study seeks to engage a debate on how ‘contexts of meaning’ may be generated for South African technology education programmes, by:

• Reviewing the constraints and opportunities around the application of a human centred technology.
• Describing and drawing insights from a technology/environment intervention with Grade 1 (year 6) teachers working within a new outcomes-based approach.

Educational transformation and technology - constraints and opportunities
Fundamental to achieving change in South African schools is a radical agenda for curriculum change (ANC 1994). The national Department of Education (D of E) has adopted OBE from systems already working in New Zealand, Australia and Canada (D of E 1997b). In the new curriculum technology education (D of E 1997a) and environmental education...
(D of E 1995) play a significant role, the former as a core learning area, and the latter as an organising principle for all learning areas.

This relationship is embodied in the DNE’s vision, where technology is expected to be:

part of the education of every boy, girl, teacher and adult with a view to them becoming creative, adaptable, critical, autonomous, entrepreneurial and employable. Citizens who can contribute meaningfully to their own communities, South African society, the natural environment and the economy. (D of E 1996:2)

However much development work needs to be done on how environmental considerations may inform technology programmes.

From initiation in a handful of schools in the early 90’s, technology now enjoys the status of one of eight learning areas in the National Curriculum - the only one which is entirely new. It also enjoys a significant level of acceptance. Just five years ago no teacher education courses were available, today at least six South African universities and several NGO’s offer pre-service and in-service courses.

While progress is being made, technology is far from the government goal of universal provision in general education by the year 2005, within a ‘new OBE paradigm’ (D of E 1997b). The implementation of a new curriculum generates concern as to how well teachers will interpret technology and where their learners are expected to develop the:

- ability to solve technological problems by investigating, designing, developing, evaluating as well as communicating effectively in their own and other languages and by different modes.
- fundamental understanding of and ability to apply technological knowledge, skills and values, working as individuals and as group members, in a range of technological contexts.
- critical understanding of the relationship between technology, society, the economy and the environment. (D of E 1997b)

Will there be a tendency to narrow the teaching of technological capability through technicist approaches or will teachers be able to engage with more human centred, critical approaches that can link technology with society, economy and environment? The question has both local and international dimensions.

In Apartheid schools, Christian National Education sought to control, reduce and compartmentalise knowledge as instrumental to social division (Wilson & Ramphele 1989; Hartshorne 1992). The use of technology in society mirrored this situation since it was often instrumental to divisive social engineering policies (Cock & Koch 1991). It is not surprising that the then school subjects, precursors to contemporary technology, were in White and Coloured schools, Industrial Arts for boys, and Cookery and Needlework for girls. In Black schools it was Agriculture, reflecting expected future roles. As such, there was little interpretative space for teachers.

Jones and Compton (1998:52) helping New Zealand teachers grapple with the recent introduction of technology, observed obstacles related to existing ‘subject sub-cultures’. Mittell and Penny (1997:290) pointed to similar problems with UK technology teachers constructing their programmes within pre-existing technicist interpretations of their work and displaying ‘a notable absence of .... seeing design technology as a third way of knowing’, that is fundamentally different to exiting subject epistemologies. Olsen (1997:384) cautioned Canadian teachers against ‘doing design activities for the sake of them’.

Against this cautionary background, what opportunities can be identified? McLaren (1997:275) observed that teachers newly engaging the demands of teaching technology ‘require the confidence to explore their own values, and to question the beliefs and perceptions they hold ... through engagement with real life contexts with concern for social and environmental implications’. And Hansen (1997) suggested that teachers should reconstruct the broader cultural meaning of technology with reference
to the dialectic of artefacts, nature and people’s world views. This would give rise to questions like:

- What is the social and environmental context of an artefact?
- What is the variety of technological solutions in different cultures?
- What meanings do different cultures attach to technological practice?

The ‘Values Movement’ in technology is rich with proposals to develop judgements, meanings and decisions vis a vis the environment (Riggs & Dillon 1993; Budgett-Meakin 1993; Conway & Riggs 1992)

In South Africa a human centred perspective of environmental education has recently emerged from challenges to the limited way the environment had been conceptualised in Apartheid education as ‘nature with problems’ (Irwin 1990:2). Irwin pointed to the earlier dominance of Conservation Education, concerned with natural resources and ecology, and Outdoor Education focused on the natural environment. Seldom were these approaches concerned with the political, social or built environment, in contrast with a contemporary Socio-Ecological Model (EECI 1997) of environment (Figure 1) now gaining acceptance. In this model people, their values and actions are placed at the centre because they, more than biophysical events, define environment; an environment that is perceptually different for each individual.

Linking environmental education and technology education through meaning-making

Environmental education is defined as the development of the learner’s knowledge and action competencies towards the resolution of environmental problems (EECI 1997). In South Africa what constitutes a problem and a solution varies considerably depending on the learner’s values and cultural context, consequently environmental education programmes should start with the learner’s self-perception, her understanding of herself in her world and her interpretation of what

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**Figure 1 Socio-economic model of environment (after Ekins 1993)**

- **SUSTAINABILITY**
  - Pollution, ecosystem and species destruction at such a rate and on such a scale that the fundamental biotic processes of organic regeneration are under threat.

- **POVERTY**
  - Systemic poverty of 30% of the world’s population.

- **RESOURCES**
  - Access and control of technological development.

- **PEACE**
  - Unequal production and consumption.

- **CONSERVATION**
  - Intensifying human repression.
  - Human rights abuses.

- **VIOLENCE**
  - Arms trade, weapons of mass destruction.
  - Militarisation.
  - Violence as entertainment.
  - Exploitation and inequality.

- **SOCIAL CONFLICT**
  - Pollution, ecosystem and species destruction at such a rate and on such a scale that the fundamental biotic processes of organic regeneration are under threat.

- **POLITICAL**
  - Unequal production and consumption.
  - Access and control of technological development.

- **ECONOMIC**
  - Systemic poverty of 30% of the world’s population.

- **SOCIETAL**
  - Intensifying human repression.
  - Human rights abuses.

- **PEOPLE**
  - Inability of increasing numbers of people to develop to their human potential. Social alienation.

- **RESOURCES**
  - Access and control of technological development.

- **PEACE**
  - Unequal production and consumption.

- **SUSTAINABILITY**
  - Pollution, ecosystem and species destruction at such a rate and on such a scale that the fundamental biotic processes of organic regeneration are under threat.

- **POVERTY**
  - Systemic poverty of 30% of the world’s population.

- **RESOURCES**
  - Access and control of technological development.

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- **SUSTAINABILITY**
  - Pollution, ecosystem and species destruction at such a rate and on such a scale that the fundamental biotic processes of organic regeneration are under threat.
actions are important. Arguably technology education could usefully adopt the same approach since technological action, being human action, is environmental action, and as such is couched in environmental meanings.

If we accept that a context of meaning for technology programmes can emerge from learners’ understandings of their environments, then it may be useful to look at how environmental educators approach their work. Di Chiro (1987:1) suggested, ‘we define our environment by the use of our individually and culturally imposed interpretative categories, and it exists at the moment we name it and imbue it with meaning’. Sharing that perspective many South African environmental educators view their role as facilitating ‘processes of co-operative meaning-making’ (O’Donoghue and Janse van Rensburg 1995:3), that can ‘accommodate the realities of how people come to socially construct and to change the way they see the world’ (O’Donoghue 1993:31).

The Research intervention
That environment can provide a context for technology education, is recognised in the OBE Foundation Phase Life Skills learning programme (Grades 1-3):

Learners should be able to participate effectively within their environment and develop scientific and technological process skills.

More concretely this research was located in Foundation Phase because ‘environment’ is provided as a Phase Organiser for technology (D of E 1997c:xi).

Methodology
This is an interpretative study limited to reporting three initial stages of a ‘work in progress’ focused on using environmental education approaches to organise a technology based intervention with teachers and their learners. The aim is to see if this combination of approaches can usefully elicit learners’ understandings of their life worlds, in order to contextualise and inform further technology and environment activity.

Data was recorded from participants’ written and verbal reports on the results of activities with their own learners in school. These activities had been previously developed with participants in researcher-resourced workshops.

The setting
Ten Grade 1 teachers from a small, rural town were selected by their Foundation Phase Advisor for participation in this project. The teachers were demographically representative, seven ‘Black’, two ‘Coloured’ and one ‘White’. The significance of which revolves around the quality of professional development they would have received under Apartheid, in turn linked to the material resources and class sizes in their respective schools. Most of these teachers still work in over crowded, under-resourced classes, where experiential, child-centred methods are not the norm. None of this group had previous contact with technology education.

Implementation of OBE was to start in January 1998. The group had received induction training which they felt did little to empower them. Consequently both advisor and teachers were happy for the researcher to bring appropriate activities to the workshops. Participants undertook to repeat them with their own pupils, record their impressions and report back to the next session.

Workshop one - Ubuntu ‘myself’
The session commenced with participants completing two questionnaires: ‘Brainstorm the ideas you have about technology’ and ‘Technology is coming into the Foundation Phase curriculum - what do you think about that?’

Within the Phase Organiser ‘environment’, the stated theme or Programme Organiser for the first term, was ‘Ubuntu’, which roughly translates as ‘myself in my community’. Curriculum outcomes for Ubuntu were that learners should demonstrate an understanding of: myself; my family and my home.

The researcher introduced a practical technology activity related to the sub-theme
‘myself’. No attempt was made to address outcomes for technology since the aim was to provide opportunities for learners to express through the activity, their understandings of themselves in their environment, and in so doing demonstrate where and how they see technology in their lives. It was discussed with participants that their learners should be helped but not directed in this activity.

The outcome was to create a personal ‘map’ of ‘myself and the favourite things I like to have around me’. Non-resistant materials were available such as large scrap cardboard boxes, paper and packaging containers. It was explained that by cross-sectioning the containers and gluing them onto a large sheet of card a pattern of 3D frames could be constructed. Into these frames 3D objects as well as pictures and words could be placed.

The advantage was that by placing ‘myself’ in the centre frame children could then spatially represent their favourite things around in order of importance, thus developing a personal environmental statement. These maps would then serve as a basis for building a basic idea of environment with learners, essential to stages 2 and 3.

Workshop two - Ubuntu ‘myself and my family’

After receiving participant reports, discussed below, this workshop continued, with the same approach as previously, to map out ‘Myself and My Family’. Participants, contributed suggestions on practical ways to represent people e.g. body shape tracings, faces made from paper plates and textile dolls. Many of these techniques they recalled learning in college but had not subsequently used.

Workshop three - Ubuntu ‘myself and my home’

Participants suggested that the earlier 3D map idea could be taken further by using house shapes in which to build up a representation of the home environment. For example boxes could be used with room dividers in which house artefacts could be placed.

Teacher reports

Results of the brainstorm questionnaire showed a predominant idea that technology is ‘problem solving with tools’. The second questionnaire indicated that most participants felt apprehensive and ill-equipped to teach technology. After showing apprehension and a lack of confidence in workshop one, reports of classroom activities based on that and subsequent workshops, were much more enthusiastic.

Most teachers reported high levels of learner enthusiasm and creativity:

“"It was a great success. The children took great pride in what they were doing and each child was anxious to show what their contribution was. It was amazing to see that they even thought about the electricity and water found in the house and it was displayed with cotton wool and wire.."

Not surprisingly some teachers were unable to leave their children free to express their life world meanings:

“"I grouped them and asked for them to think of a kind of home where they wish to live in .... I discovered that even those children who are living in one room houses also did well because they were talking about the homes they wish to live in."

In contrast one teacher’s excited observations, which elicited agreement from the group, is of particular significance:

“"I did never know anything like this in all my time teaching. When the children made pictures of their family, some of them had no men of any kind. I know many families are single but some children told me that the man would beat the mother and be cruel to them. I know this but never before could I ask. But now the child was talking about it and I know the child better and can talk to him. The same was when we did the houses. Some houses had only one room and when I asked where do you wash they said in the tap on the street. You see we teach them about cleanliness and I always thought
about homes with a bathroom and bedrooms. I know there are these one room shacks but I always thought about nice houses with many rooms. Now I can remember that some of my children have big problems, and they feel bad with the others."

And she continued:

"These children have problems with water and sleeping in one room with the women and men. They have no electricity and stay in the dark and at night may get harmed. We must teach ways to make this better and not only think about nice places where we live."

Discussion

It seems that the basic technology activities introduced had a significant effect on the teachers’ initially stated lack of confidence in having the skills and tools to do technology. Most reported success in their classrooms and brought numerous, varied examples of work that was clearly the learners’. In report back sessions nobody listed problems with tools or a lack of materials. In fact technology and problem solving was rarely mentioned. However environment was the adjective of choice. One teacher suggested that we should put all the children’s’ projects together on the school field and make one big environment.

The fact that these projects were introduced environmentally i.e. in a person centred rather than a technicist way, seems to have created an opportunity for the learners to ‘play’ unselfconsciously. The results as learners’ life world meanings, were interesting; on the one hand for their social candidness, and on the other for the technological understandings they contained.

In the final discussion teachers suggested several technological project areas arising from the context of meanings communicated by their children e.g. getting water and saving it; making light; making house structures; keeping things safe; presents for your family; beautifying the home with gardens; and making furniture.

The personal character of these suggestions would seem to support the value of further exploration of environmental approaches in meeting the requirements for OBE technology programmes that: learners must be encouraged from the earliest stages of education to arrive at solutions which are their own unique, creative and individual responses to real problems.

Note

1. For example Olsen quoted Barnett (1994:57) who drew attention to the limits in the concept of ‘fitness for purpose’ as a governing idea in technology education. The crux of the argument being that the values embodied in this concept are purely technical, reflecting the traditional stance of an engineer who meets technical challenges while leaving the broader value judgements to others.

2. Non-governmental organisations were influential in policy advocacy, and now in delivery. For example ORT-STEP which has close to 300 in-service teachers across its 6 branches studying accredited Further Diplomas in Technology.

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