Perception of Sustainable development and Education for Sustainable Development by African technology education academics

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Abstract

Sustainable development (SD) in technology education is considered to be among the important areas for research by the technology education (TE) community. International experts who took part in Martin and Ritz's Delphi study illustrated this point. TE teachers' perceptions of SD and their readiness to address these issues through their teaching are essential for effective learning. Research conducted by Elshof (2005), Pitt and Luben (2009) and Pavlova (2009a) highlight the differences in teachers' perceptions within the context of three countries. Although different methodologies were used in these studies, conclusions were similar: teachers' perceptions of what were important and readiness to address these issues were reflected in classroom practices.

This paper extends these earlier studies by examining the results of a study of African technology education academics' perception of SD and education for sustainable development (ESD). The paper is based on a survey conducted in January 2012. The paper highlights issues that are viewed as important by the African technology education academic community and that are relevant to a specific context. It uses a two-challenge framework (developed – developing countries SD challenges, UNDP, 2011) to interpret the results.

Introduction

University academics serve a critical role in developing a worldview that is sensitive towards the sustainable development agenda. More and more universities are signing Tailors Declaration to include a SD vision within their policies and practice. Education of future technology education teachers within a SD paradigm increases the probability of ESD implementation in school classrooms. These links between teaching and learning at different levels (including universities and schools) are well established in research. Rohaan, Taconis and Jochems (2008, 2009), for example, identified the links between teachers' understandings of technology and learners' concept of and attitude towards technology. Therefore, it is important for university academics to be aware of their own interpretations and beliefs about SD and the ways SD could be addressed through technology education.

Differences between teachers' perceptions of ESD are visible through research conducted across different contexts. Research conducted by Elshof (2005) Hill and Elshof (2007), Pitt and Luben (2009), Pavlova (2009a) highlight the differences in teachers' perceptions of ESD and in the level of readiness to address these issues through their teaching in the context of three countries (Canada, UK and Russia). Through the use of different methodologies these studies concluded

that teachers' perceptions of what were important and their readiness to address these issues were reflected in classroom practices. These differences are important to understand to support academics in developing their reflective practices that are aimed at the introduction and/or reinforcement of ESD in technology education.

This paper examines the results of research of African technology education academics' perception of SD and ESD. Academics' perceptions are examined through a framework of the ethics of weak anthropocentrism and the ways SD could be achieved argued elsewhere (e.g. Pavlova, 2009b). The second part of the paper focuses on interpreting the results obtained through a two-challenge framework (UNDP, 2011) that highlights the differences between developed and developing countries in addressing SD.

A framework and research design

A framework for this study is based on previous research (Pavlova, 2009a) on the nature of SD and the ways in which SD could be achieved. I have argued elsewhere (Pavlova, 2009a, b, 2011) that the differences in views about SD are based partly in different philosophical and moral conceptions of appropriate ways to conceive of the relationship between humanity and nature. On the opposite side of the debate are ecocentric environmental ethics (that attribute intrinsic value to nature and suggest that humans should live according to nature), and anthropocentric or technocratic environmental ethics (that attribute instrumental value to nature and suggest that humans should use and manage nature wisely). I have argued that a more balanced position based on the ethics of weak anthropocentrism/noosphere wisdom / 'frame of mind' paradigm (Pavlova, 2009a,b) provides a more appropriate basis for conceptualising SD within technology education for the development of approaches for ESD. This position promotes the mutual flourishing of human and non-human nature. It is well expressed through the principle of: *Respect and care for the community of life, meaning duty to care for other people and other forms of life now and in the future,* formulated as the basis for the ''Caring for the Earth'' strategy by the International Union for Conservation of Nature and Natural Resources and the World Wide Fund for Nature (IUCN, UNEP, WWF, 1991).

Other important categories used in this study are 'technical fix' and 'value change' as two major approaches for achieving sustainable development (Robinson, 2004). The importance of value change, in particular, the prioritising of 'moral values', and a conscious attitude towards the 'technical fix' as the major way of achieving SD have been argued elsewhere (e.g., Pavlova, 2006a, 2006b). A 'technical fix' approach analysed through the prism of a philosophy of technology that assumes that technological development is a subject of profitability: ''Enterprises invest not in order to benefit humanity or to protect it from problematic side-effects, but rather to open up markets and areas of expansion with promise to the future'' (Beck, 1997, p. 117). Technology might treat the symptoms not the disease. To achieve changes towards sustainability, a 'value change' is required. A fundamental transformation in underlying values and attitudes that would characterise a radical shift in our thinking is a condition for achieving sustainability.

These two arguments about the ethics of SD and the ways it could be achieved framed the approach used in this study that was aimed at examining academics' beliefs about SD and ESD and their attitude towards 'technical fix' and 'value change'.

Methodology

This study is a qualitative analysis of 4 surveys used with African technology educators during a workshop on *How to Re-Orient technology teacher training programs towards ESD* that took place prior to the international conference of the South African Association for Research in Mathematics, Science and Technology Education (SAARMSTE) 12-19 January 2012. The workshop attracted the attention of mathematics and science educators as well as technology educators, therefore out of 12 surveys only 4 were analysed for this study (although these other surveys provided valuable data). Three participants were from South Africa and one person from Malawi. Participants had between 15 and 22 years experience in education. There was one female and three males.

The survey used for this study was developed on the basis of the framework presented above. 15 concepts that describe SD (that were drawn from UNESCO/UN interpretations of SD) and a number of statements that describe eco-centric, anthropocentric and a balanced position, as well as a 'technical' fix and a value change belief were used in a survey. Previously this survey was used for another large scale study in China with more than 6000 respondents and was found to be reliable and valid.

For example, an eco-centric position was assessed through statements such as *Rather than seeking a balance across the economic, social and environmental areas, the crucial factor is the ecological integrity of the biosphere; Plans and animals have as much right as humans to live; Nature is very delicate and easily harmed*. An anthropocentric – 'humans as rulers over nature' – view were examined through such statements as *Rather than seeking a balance across the economic, social and environmental areas, the crucial aim is* to *alleviate human suffering and provide basic material well-being for all humankind; Nature is strong enough to handle the bad effects of modern developed countries; Humans were meant to rule over the rest of nature*.

The survey consists of four parts and an introductory section on personal data:

- Level of familiarity with the concept; what SD issues are important and what is addressed through teaching (part A)?
- Interpretation of SD (part B);
- Interpretations of ESD in technology education (part C);
- NEP scale (the "New Ecological Paradigm" to investigate the ecological worldviews, Dunlap & Van Liere, 1978; Dunlap et al, 2000) (part D).

The scale has a six-point Likert-type scale, scaled as: strongly agree (6), agree (5), slightly agree (4), slightly disagree 93), disagree (2) and strongly disagree (1). This scale was used for parts B, C and D. Part A includes open ended questions, and free questions that use a percentage range from 0% (not at all important) to 50% (medium important) and 100% (most important). Informal conversations with participants were conducted during the course of four-days after the workshop to clarify any issues.

The qualitative analysis of the results presented in this paper is focused on a limited number of questions:

1. Level of familiarity with the concept.
2. What are the emphases (on economic, environment, social, cultural aspects)?
3. What issues are important for technology education academics in terms of ESD in TE?
4. Composition of SD interpretation (eco-centric, anthropocentric, balanced).
5. What are the beliefs in terms of technological fix – value change?

Results

The responses reveal that participants are well aware of the SD agenda. Two of them heard for the first time about SD more than 10 years ago, and they perceive their level of familiarity with the concept as 4 out 5 (5 was max). The other two participants judged their level of familiarity as 3 out of 5 and they had heard about SD in 2008 and thus less than 10 years ago. They all heard about SD for the first time from different sources: institution where they worked, media, a conference and the State of the Nation address. These results highlight the importance of using different means to increase awareness of SD issues in society.

Aspects of SD that were most familiar for the participants include such areas as food; health, clean water; education; sustainable livelihoods, care for the environment; consideration of impact on society and environment; teaching how to use locally available resources and how to continuously apply survival skills using knowledge as a commodity. Aspects of SD that the participants would like to explore more included: the ways technological skills could be used to solve problems

and address poverty; impact and biases of technology on the environment; education for SD, issues related to food technologies.

They all viewed SD as an issue important for them and their students, as well as for the provinces where they live. In responding to the open-ended question two participants expressed wishes to learn two opposite aspects of SD in relation to technology – one is how to use technology to address poverty (social aspects of SD), another – how to learn and understand environmental impacts of technology (environmental aspects of SD), highlighting that for TE academics learning needs are diverse.

Their descriptions of what SD is included:

- "Addressing any need or want of my community for a longer time with assessment and improvement after a certain periods in between"
- "Being critical of one's actions in a particular environment and keen to develop long-lasting solutions cooperatively"
- "Using the available resources without disadvantaging the coming generation"
- "Using knowledge and skills to survive"

These definitions present the goals for action in a different timeframe: from immediate goal to survive now to considering the rights of the future generations and long term planning. They also believe in the need for cooperation and of constant monitoring of community developments.

When participants identified the issues that need to be addressed in their provinces now, they strongly agree that the three below are the priorities:

- Poverty alleviation;
- Renewable energy;
- Sustainable use of natural resources.

The next set of issues in terms of their importance was: Biodiversity loss; Clean water and sanitation; Infectious diseases; Illiteracy; Wasteful consumption; Population growth, and Health (air and water pollution, exposure to toxic and hazardous materials, HIV/AIDs). Other issues, added by participants were indigenous contexts and the need to attend to all issues above (Malawi).

In relation to teaching, the three key issues that participants are addressing **now** through the courses they teach were:

- Sustainable use of natural resources;
- Health (air and water pollution, exposure to toxic and hazardous materials, HIV/AIDs);
- Illiteracy.

To a smaller extent the participants also address rural development and renewable energy issues followed by **clean water and sanitation**, poverty alleviation, human rights; gender inequality, and then wasteful consumption and **infectious diseases** (they wanted to expand on two highlighted issues). One participant also addresses indigenous technologies through teaching.

In answering the question on 'what issues could be possible to address through the courses you teach', the participants prioritised the following:

- illiteracy,
- poverty alleviation, and
- renewable energy,

followed by clean water and sanitation, infectious diseases, biodiversity loss, and sustainable use of natural resources. They see a role for technology education in addressing the above issues through

development of sensitivity towards nature and developing an understanding that technological growth should be balanced; through applying design principles, critical and creative thinking skills to bring a human aspect to technology; through utilisation of locally available resources in a way that would not disadvantaging the incoming generations; and through the use of technological knowledge and skills.

All participants agreed that SD should be addressed through TE and a majority of them believe that the 'Economic aspect of SD should be addressed more than other aspects of SD (social and environmental) through TE". They do not agree that social, cultural or ecological aspects should be addressed more than other aspects of SD through TE. Two participants strongly agree that all aspects of SD should be addressed equally in TE. They also agreed that there is a need to support and promote cultural diversity through TE as a component of ESD.

Participants agree or slightly agree that development of social responsibility is an important aim for TE. They also believe (agree and strongly agree) that the following principles should be addressed through ESD in technology education:

- improve the quality of human life (enable people to realize their potential, lead lives of dignity and fulfilment)
- conserve the earth's vitality and diversity; minimize depletion of non renewable resources (use less, re-use, recycle, switch to renewables where possible);
- keep within the earth's carrying capacity (including human population and level of consumption).

They agree (although with different levels of enthusiasm) that a balanced view of the relationships between human-centred and nature-centred worldviews should be the basis for ESD in TE. They believe that extreme views of eco-centric and anthropocentric beliefs should not underpin ESD in TE.

Their perception of the nature of SD varies. Two participants, C and D have a balanced view of SD. Participant A has a very strong eco-centric view, although she agrees with some balanced view statements:

- SD should seek the balance across the economic, social and environmental issues
- SD should improve the quality of human life while living within the carrying capacity of the eco-system
- There is a need for humans and non-humans to co-exist through a process of co-development.

Participant B does not have strong views about either eco-centric or anthropocentric underpinnings of SD, his position is undecided.

In terms of the ways SD could be achieved, two participants, C and D believe that value change is the main means for achieving sustainability. Participants A and B believe that a mixture of responses was required that include both value change and technical fix.

Analysis

As argued by Pavlova (2011), while the rationale for technology education for all countries needs to be framed by concern for the human condition, due to contextual differences the emphasis of technology education activities will vary. In a simplified way, for developed countries the major area of attention is related to environmental aspect of sustainable design. For developing countries, the social aspects of sustainable design need to be emphasised. These approaches are justified by the analysis conducted by UNEP (2011) that used each country's natural and human capital and its relative level of development as indicators to identify specific challenges. Two dimensions of this analysis are *Ecological footprint* as an instrument to measure the impact of our lifestyle on the

environment and the *Human Development Index* (HDI) as an indicator of health, education, and standard of living. Some countries have attained high levels of human development, although at the expense of the quality of their environment. Other countries, while maintaining relatively low per capita ecological footprints, need to improve levels of services and the material well-being to their citizens. Therefore these two groups of countries have different challenges. The first one needs to reduce their per capita ecological footprint without impairing their quality of life; the second one needs to improve the well-being of their citizens without drastically increasing their ecological footprints.

Do the results of this study support the above conclusions?

The relative emphasis that participants put on the issues that need to be addressed in their society, *poverty alleviation* (and survival skills) is strongly emphasised together with the need for renewable energy and sustainable use of natural resources. Together with illiteracy, clean water and sanitation, poverty alleviation is prioritised as a theme to be included in TE courses. Support and promotion of cultural diversity and addressing the issue of infectious diseases are also included. Therefore, a challenge to improve the human development index through TE is strongly presented in participants' views. However, participants have a high level of environmental awareness, understanding that social development could not be achieved without conserving the earth's vitality and diversity and without keeping development within earth's carrying capacity. Therefore such issues as renewable energy; sustainable use of natural resources; biodiversity loss are also viewed as important to be addressed through TE.

The results of this study demonstrate that African technology education academics understand the need to address SD through technology education, putting an emphasis on social development issues framed by environmental challenges. Participants believe that value change is the most important way to address SD issues followed by technical fix. They have different beliefs that underpin their interpretations of SD.

Conclusions

This paper examines the results of research of African technology education academics' perception of SD and ESD, based on a survey. The results highlights that all participants believe in the importance of addressing SD through technology education, and that the social aspects of sustainability have been prioritised by participants, although it was acknowledged that social development needs to be framed by environmental concerns. This confirms the applicability of a two-challenge framework (developed – developing countries SD challenges, UNDP, 2011) for the context of technology education. Participants also prioritised a value-change approach to SD, although acknowledged the appropriateness of a technical fix approach for the technology education classroom. In terms of individual interpretations of SD, responses varied, including an eco-centric, balanced and undecided views. This study highlights the role of technology education as perceived by university academics in terms of involving students in learning through designing and making products and systems within the framework of sustainable development.

These results should be interpreted within the limitations of this study which is small scale and it is possible the participants of the workshop where the study was conducted were more informed, interested and enthusiastic about SD that an 'average' technology education academic.

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