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Investigating an Ethical Approach to Genetically Modified Crops in Environmental Educational Processes

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Abstract

Genetically modified (GM) crops gained attention in southern Africa in the context of broader debates about the struggle for food security and poverty alleviation to achieve sustainable development. The prospects of GM crops as a technological innovation have provoked numerous debates and environmental concern groups have challenged their use. Environmental educators' concern for greater ethical practices regarding environmental issues can be applied to the subject of GM crops. This article focuses on the perceptions of environmental educators regarding the use of GM crops towards sustainable development. Interviews were conducted with a small group of environmental educators to gain some insight into their perceptions. The interviews reflected some contextual relevance of GM crops, understanding of the concepts 'GM crops' and 'sustainable development' as well as four unique themes. These emphasise the plurality of the GM crops issue and the importance thereof in working towards an ethical approach in environmental educational processes.

Introduction

Issues surrounding genetically modified (GM) crops have been the subject of a range of popular discussions in the media because of their complex and controversial nature. Dickson (2005) argues that this public debate has great value as long as the facts about GM crops are portrayed accurately. Biotechnology proponents promote GM crops as a solution to poverty and food security issues in southern Africa (Conko & Prakash, 2003:25). Articles distributed by *Green Clippings*[1] in the public media suggest that environmentalists question the benefits and emphasise the threats GM crops pose to the environment. *Green Clippings* distributed about 50 articles in South Africa, addressing issues related to GM crops during 2002 to 2005.

The controversy surrounding GM crops poses a challenge to its governance. Beck (1991, cited in Webster, 1999:414) states that political institutions find themselves unable to keep up with this new technological development. As a result, these institutions become disempowered and have to administer a development they neither planned nor are able to structure, but somehow have to justify. This has implications for environmental management legislation and information dissemination practices. Such practices should ultimately challenge people to adopt an ideal of human behaviour – an environmental ethic (UNESCO, 1991:1).

In 2002, the United Nations (UN) declared the period from 2005 to 2014 as the Decade of Education for Sustainable Development (ESD). Fien and Tilbury (2002:5) reiterate that

sustainable development has to promote a greater consideration for social justice in an ecologically sustainable way when dealing with environmental problems and issues, implying an environmental ethic. This environmental ethic should be integral to environmental educators' functions. The Environmental Education Association of Southern Africa (EEASA) calls for the promotion of interdisciplinary and multidisciplinary studies of the environment, and the dissemination of information regarding environmental education, as expressed in some of the aims of the *EEASA Constitution* (EEASA, 2001:1) that will be instrumental in achieving the goals of the Decade of ESD.

The use of GM crops has a potential environmental, social, political and economical impact on southern Africa. For this reason, GM crops should be addressed in environmental education. According to Lotz-Sisitka (2002:4), environmental education processes can establish opportunities for a new or stronger environmental ethic to emerge, thus contributing towards the establishment of practices, structures and institutions with stronger environmental values to achieve the goals of ESD. By determining the perceptions of environmental educators on the use of GM crops, a valuable starting point in the creation of frameworks towards such processes could be established. The perceptions of environmental educators regarding the use of GM crops can contribute to the role environmental education may play in future towards establishing an environmental ethic.

The study reported in this paper attempted to determine the perceptions of environmental educators regarding the use of GM crops towards sustainable development (Le Roux, 2004).

Interviews were conducted to determine these using open-ended semi-structured questions. The interviews were conducted during the EEASA annual conference in April 2004. A very small sample of environmental educators was interviewed and therefore the data cannot be extrapolated. The interviews did, however, yield a rich source of data sufficient to place the spotlight on the importance of an ethical approach to GM crops in environmental education. Only the unique themes revealed from the data and the interpretation of the concepts 'GM crops' and 'sustainable development' will be discussed in this paper.

The next section provides background information regarding GM crops. Other perception studies regarding GM crops carried out elsewhere in the world are discussed, as well as a few studies conducted in South Africa. The perceptions of southern African environmental educators could be used in conjunction with information from other perception studies. Together they may contribute towards the establishment of a stronger ethical approach to complex and controversial issues such as GM crops.

Background Relating to Perception Studies of GM Technology

Genetic modification (GM) entails the transfer of selected individual genes from one organism to another, including genes from unrelated species. This technology has been used to promote a desired crop character or to suppress an undesirable trait (Nuffield Council on Bioethics, 2004:3). GM foods are the products of GM crops that are processed for human or animal consumption.

Proponents of GM crops view GM crops as instrumental in poverty alleviation and as a means to increase food security. It is said that by addressing problems such as poor soil quality, and the production of insect-resistant crops and crops that are herbicide tolerant (Thompson, 2002:2, Conko & Prakash, 2003:25), the food production ability of rural farmers who are almost entirely dependent upon the land for their livelihood, can improve. It is argued that insect-resistant crops will reduce the use of insecticides, which will result in decreased environmental poisoning. Although proponents consider GM crops as part of a strategy to ensure food security, it is met with strong opposition from environmental and social justice groups like Biowatch[2] and SAFeAGE[3] who are active in southern Africa. Egziabher and Shiva (1998), Altieri and Rosset (1999:4) and the Nuffield Council on Bioethics (2004:60) all seem to agree on the environmental concerns regarding GM crops. These concerns include gene flow to other plants and organisms, and the possible effect of GM crops on insects and other herbivores. This especially applies where modified crops contain components that their wild relatives would not contain. Unanswered ecological questions that refer to the indirect effects GM crops may have on plants, soil and non-target organisms are also raised as a concern. Other issues, which raise more general concern, deal with intellectual property rights, monopoly by the gene giants and involvement of civil society in the decisions regarding GM legislation (Nuffield Council on Bioethics, 2004:44).

Five international regulations are concerned with research on the trade and use of GM crops (Nuffield Council on Bioethics, 2003:65). Of these, the Cartagena Protocol on Biosafety under the Convention of Biological Diversity (the Protocol) relates most to environmental concerns. The Protocol covers the movement across national boundaries of living modified organisms that may have an adverse effect on biological diversity. The Protocol also contains procedures relating to the provision of information and carrying out of tests to assess the safety of living modified organisms such as GM crops (Nuffield Council on Bioethics, 2003:65). In addition, it encourages governments to take a precautionary approach to the domestic regulation of transgenic organisms (Conko, 2003:1). The precautionary principle is open to a variety of interpretations and much disagreement exists over whether the precautionary approach is a useful tool for managing the risks of technologies and products like GM crops (Conko, 2003:8).

The precautionary principle as an information and risk management tool is particularly problematic in contemporary society (Conko, 2003:1). GM crops are perceived as a contemporary risk issue (Beck, 2000:218). Modern risk issues are different from conventional thinking about risk. Contemporary risks become de-linked from geophysical boundaries and are intrinsically about the politics of knowledge and expertise (Goldblatt, 1996:158). Weber, Hair and Fowler (2000:29) elicited that an individual's perceptions regarding environmental problems (risks) are socially constructed, especially when the risk is not experienced first hand. Perceptions are partially derived from information presented in the mass media and environmental curricula rather than from immediate sensory contact with the issue. As a result, many perception studies regarding GM crops have been conducted around the world in an attempt to determine how to address the controversy and complexities of GM crops.

There have been numerous efforts to understand the public's perceptions with regards to GM crops and foods around the world (see Table 1). Only a few such surveys have been conducted recently in southern Africa by organisations like Public Understanding of Biotechnology (PUB),[4] Africabio (2002) and the National Consumer Forum (NCF, 2003) of South Africa. These were primarily done to ascertain public opinion, attitude and knowledge of GM issues. Some objectives in the PUB Business Plan (Joubert, 2003:7,10) express the need for perception (knowledge and opinion) studies of key audiences. A Human Sciences Research Council client survey on controversial topics in biotechnology (including GM crops) was conducted in 2004 and the report made public in 2005 (Rule & Ianga, 2005). It is hoped that the results will provide guidance in developing an optimum communication strategy for the PUB programme.

Table 1. Summary of previous perception studies and the resulting perception indicators

Indicators of Perceptions	References to Perceptions Studies
1. Knowledge	Murch (1976:277); Weber *et al.* (2000:29); AFIC & ISAAA (2001:9); Sittenfeld & Espinoza (2002:469); Kelley (1994); Morris & Adley 2001:47)
2. Values, culture, belief (ethical considerations)	Murch (1976:279); Cothern (1996:43); AFIC & ISAAA (2001:9); Kelley (1994); Gaskell *et al.* (2004:186)
3. Trust	Mucci *et al.* (2004:4); Gaskell *et al.* (2004:186); Chen Ng *et al.* (2000:110)
4. Scientific world-view (knowledge system)	Kelley (1994); Gaskell *et al.* (2004:186); Chen Ng *et al.* (2000:107)
5. Uncertainty	Cothern (1996:43); Gaskell *et al.* (2004:186)
6. Information and information sources	Weber *et al.* (2000:29); Sittenfeld & Espinoza (2002:469); Morris & Adley (2001:47); Chen Ng *et al.* (2000:112)
7. Benefit-risk analysis	AFIC & ISAAA (2001:9); Sittenfeld & Espinoza (2002:469); Mucci *et al.* (2004:4); Kelley (1994); Gaskell *et al.* (2004:186); Chen Ng *et al.* (2000:109)

AFIC – Asia Food Information Centre
ISAAA – (AFIC) and International Services for Acquisition of Agri-biotech Applications

The indicators of perceptions, which the various studies revealed, appear in Table 1. Knowledge, unawareness and uncertainty, normative belief systems, culture and trust can be regarded as dimensions of an ethical approach to environmental issues. This will be discussed with regard to GM crops in the subsequent paragraphs.

Knowledge, unawareness and uncertainty

As indicated in Table 1, knowledge, knowledge systems, information and benefit-risk analysis of a perceived risk, are integral to the perceptions thereof. Goldblatt's (1996:158) analysis of Beck's *Risk Society* (1992) elaborates on this contention by claiming that modern risk is purported to be intrinsically associated with a politics of knowledge, expertise and counter-expertise. This means that risks are socially invisible and must clearly be brought to consciousness, only then can it be said that they constitute an actual threat.

Drawing on the work of Beck and Bauman, Ward (2002:28) discusses the theories of knowledge that may underpin expert decisions in risk analysis. Beck makes a distinction between linear and non-linear theories of knowledge (Ward, 2002:28). A linear theory of knowledge emphasises one coherent knowledge system that underpins assumptions of universality, foundation, homogeneity, monotony and clarity, whereas unknowns or conflicting knowns are played down. An application of this linear theory of knowledge is explained by Shiva (1993:9) who highlights the fact that local knowledge has disappeared through its interactions with the dominant Western knowledge at many levels and through many steps. She states that Western scientific knowledge has generally been viewed as universal. This has often led to the prefix of 'scientific' being given to modern knowledge systems, and 'unscientific' for the traditional knowledge systems. Through this, more power has been granted to modern scientific knowledge that encouraged the perception that science is given a specific epistemological status. The fact that modern science is determined through social mediation is ignored. Proponents of GM crops often invoke the power of scientific knowledge when they argue that concerns with the GM crop risks are fundamentally irrational and anti-scientific (Millstone & Van Zwanenberg, 2003:656).

The need for scientifically accurate knowledge (and information) has been emphasised by several perceptions studies. A lack of knowledge is seen as the main reason for negative public perception about GM crops. Joubert (2003:5) states that a lack of understanding about biotechnology (of which GM crops is part) is providing a vacuum for unbalanced and often non-factual information, which has led to the confusion of the general public. Cockburn (2002:79) is of the opinion that consumers need to be more informed and Uzogara (2000:179) argues that public awareness needs to be increased. Perceptions due to a lack of knowledge raise the issue of unawareness, which Beck (1999:127) defines as both an inability to know and unwillingness to know. Unawareness may also lead to a marginalisation of certain communities within populations, where access to relevant knowledge is a problem. This may also result in a new source of inequality and thus social injustice (Rivera-Lopez, 2002:11). An inability to bring balanced information to rural communities about modern technologies like GM crops is likely to widen the gap between the 'have's' and the 'have-nots' which Sharma (2004:10) describes as a knowledge divide.

Knowledge and unawareness are realised in conflicts of cognition (Beck, 2000:217). More and more accurate knowledge is required, but more knowledge is also becoming a new source of risk. As people learn more about GM crops, they can question the issue with greater insight. Unawareness on the other hand makes deciding, in a context where the outcomes are uncertain, very difficult. As Beck (2000:217) suggests, this scenario can be applied to GM

crops, where neither the optimism of the proponents nor the pessimism of their critics is based on certain knowledge. Beck continues that there is no better breeding ground for risks than denying them. In other words, by making a lack of knowledge the foundation for action against risk, gates of fear can be opened and everything would then be perceived as risk.

Closely linked to certainty is the absence of doubt about a universal grounding of knowledge (Ward, 2002:28). Anti-GM groups raise two key environmental concerns related to uncertainty regarding GM crops. The first is the fear of the unknown, like the possibility of deadly micro-organisms or super-plants that might be released. The unintentional effects of gene transfer, for example, unintentional gene transfer that may create hard-to-eradicate super-weeds, is the second concern (Uzogara, 2000:188). These uncertainties about what we may be doing to the planet have made the implementation of a regulatory framework, such as the precautionary approach under the Protocol, problematic. Conko (2003:1) argues that the precautionary approach is open to a variety of interpretations, and much disagreement exists over whether the precautionary approach is a useful tool for managing the risks of technologies and products like GM crops.

Debates amongst proponents and opponents of GM crops often fuel confusion and uncertainty among, for example, farmers and consumers of agricultural products (Russo, 2004:9). As a result, neither the layperson nor the expert can predict with any certainty what the consequences may be (Lacy, 2002:45). Uncertainty, or a threatening future, is a parameter of influence for current action that Beck (2000:214) views as '… believed risks used as whips to keep the present-day concerns moving along at a gallop'.

Consequently, both knowledge issues (lack of credible knowledge) and uncertainty lead to manufactured uncertainty, where not only the knowledge base is incomplete, but more and better knowledge often means more uncertainty (Beck, 1999). Manufactured uncertainty is expressed by Beck (2000:217) as control and lack of control. At the one pole of risk is the attempt to calculate unpredictable consequences through a repertoire of methods, i.e., more control. At the other pole, risk remains inherently undetermined and uncertain in its diagnosis. In other words, the more we try to confine and control risk, the more it broadens the uncertainties and dangers, giving rise to manufactured uncertainty, as is the case with GM crops. This could be described as the dilemma that would be created if the linear theory of knowledge underpins the understanding of knowledge issues in relation to perceptions of GM crops. From previous perception studies, a conclusion can be made that knowledge as an indicator of perception is mostly based upon a linear theory of knowledge.

According to Ward's (2002:29) explanation, 'non-linear theories of knowledge accept unknowns as well as plurality, dissent and conflicting knowledge claims as central and inevitable components to understanding knowledge construction, deconstruction and reconstruction processes'. These could have several implications to making decisions and knowledge claims in the application of the Protocol. Applying a non-linear theory of knowledge will have to involve processes that make provision for 'a plurality of interest groups, none powerful enough to claim an objective superiority for the knowledge it represents, and engage in coalition formations around contested certainties and unknowns' (Ward, 2002:29). Such applications of the non-linear theory of knowledge can be found in the systems thinking or systems analysis

approach associated with interdisciplinary environmental courses, as well as in the broader arena of environmental management (Ward, 2002:31). Ward (2002:31) argues that this is particularly useful to help reduce ambiguities and miscommunications when people talk about complex issues. This may offer great value to environmental educational processes that wish to address the controversial and complex issues surrounding GM crops, particularly with regards to implementation of environmental practices stemming from the Protocol.

Normative belief systems and culture

Priest (2003) argues that cultural differences and policy priorities are particularly relevant to complex issues like GM crops. Within South Africa's heterogeneous society, food and food preferences vary. In addition, risks presented by GM crops are perceived differently because of different values that underpin culture and belief systems. For example, the opposition to GM crop technology in India is buttressed by various aspects of Hindu culture that question any 'tampering' with what it sees as spiritual links between humans and nature (Toke, 2004:183). Vegetarianism's opposition is based on concerns about animal genes being spliced onto vegetables. In southern Africa, the use of GM crops is opposed because it is feared that GM crops will transform agricultural practices and that farmers will not be able to keep or exchange harvested grain for the next season (Nuffield Council on Bioethics, 2004:51).

Toke (2004:182) states that public interest lies in the normative beliefs that underpin controversial scientific issues like GM crops. Therefore public perceptions are often primarily determined by a normative belief system. Non-scientific actors such as environmental groups are important in shaping dominant normative belief systems (Toke, 2004:182). The normative belief systems that underpin the various scientific regulatory systems and the views of critics of those systems need to be examined.

The role values play needs to be recognised as values permeate and impact on environmental risk decisions. For example, an individual or group may have certain perceptions of GM crops in an attempt to preserve the organic farming sector. Values provide a different view of the current reality and contribute to an understanding of the big picture (Cothern, 1996:63). Risk is both a factual and a value statement (Beck, 2000:215). Toke (2002:161) stresses that the values that impel people to take a pro- or anti-GM position are heavily dictated by social science rather than natural science. This means that risk statements can only be deciphered in an interdisciplinary manner where an equal measure of insight into technical know-how and familiarity with cultural perceptions and norms are applied. Making provision for these differences and where they originate from should enhance an ethical approach to the GM crops issue.

Trust

Priest (2003) summarises the GM crop debate by stating that opposition to biotechnology can be understood as a crisis of trust. This raises the question as to whom can be trusted regarding an issue like GM crops – science, industry, regulations, credible critical voices or the media? Priest (2003) claims that more knowledge of genetic science does not mean better support for biotechnology, and that trust can be a more powerful predictor to support biotechnology than

knowledge. Priest further elucidates that trust in the institutions that provide biotechnology to the public, and who oversee activities through regulations and who point out issues from consumer and environmentalist points of view, is crucially important. She explains that wise individuals make decisions on the basis of the extent to which they trust those espousing different points of view. These individuals look for various forms of expert opinion rather than trying to process all the raw data themselves.

According to Beck (2000:213), risk begins where trust in our security and belief in progress ends. Risk ceases to apply when the potential catastrophe actually occurs. Therefore, perceptions of threatening risks determine how we think and act regarding the specific risk. As long as there is trust in the progress of GM technology, GM crops will not be perceived as a risk. This trust regarding GM crops can be extended to international regulatory bodies and governments' abilities to implement regulations. The public seems to show more trust in international regulatory bodies such as the United Nations and World Health Organisation, than in government agencies (Chen Ng, Takeda, Watanabe & Maier, 2000:112).

An ethical approach

This paper argues for a stronger ethical approach regarding complex and controversial issues such as GM crops. Lotz-Sisitka (2002:2) indicates that in mainstream literature, an ethic is often described as a code of moral conduct or a set of principles by which to live. When referring to environmental concerns, environmental ethics could be seen as codes of conduct or principles which guide ways of living. UNESCO (1991:1) describes an environmental ethic as ideal human behaviour with respect to the natural and built environment. As indicated previously, GM crop issues raise several environmental and social concerns. These concerns call for responsible behaviour towards the natural environment. This ethical responsibility of human beings for the natural environment constitutes an environmental ethic. Such an ethical approach has the task to explore and enrich the world and creates new knowledge and actions (Lotz-Sisitka, 2002:3) specifically applicable to GM crops issues.

A scientific ethic in turn can be described as the ethical responsibilities of human beings for the implications of scientific issues to society (and the environment). Durso (1996) discusses scientific ethics in a context where more scientists are becoming involved in politics of knowledge creation. Foster and Sharp (2002:849) highlight scientific issues (like GM crops) that need to be understood within the social organisation of populations. A scientific ethic would therefore constitute a greater involvement of social organisations in scientific issues such as GM crops and *vice versa*. The discussion of Durso (1996) and Foster and Sharp (2002) on a scientific ethic is supported by Lotz-Sisitka (2002:2) when she argues that ethics are embedded in a larger matrix of cultural, aesthetic, religious, scientific, economic and political considerations.

An ethical approach to GM crops can be applied to environmental education processes because of environmental concerns that GM crops raise as a scientific development. This ethical approach can be expressed as an environmental ethic or a scientific ethic that requires responsible behaviour. This ethical approach can be summarised in the words of Buchanan (2000:162):

> ...our principle priority must be in supporting people to improve their own capacity for practical autonomy. Instead of behavioural modification, it is time to start helping people become more mindful about their choices, become clearer about the value of a particular course of action, become more discerning and insightful about whether their initial inclinations might have been roused by misdirected motives, and become more conscious of collective responsibilities to create a just society.

Methodology

The methods that have been used in other perceptions studies on genetically modified foods are questionnaires (Kelley, 1994; AFIC & ISAAA, 2001:9; Joubert, 2001; Sittenfeld & Espinoza, 2002:469; Cole, 2003; Mucci, Hough & Ziliani, 2004:4), focus group interviews (Kempen, Scholtz & Jerling, 2003) and perception scales used by Weber *et al.* (2000:28) to determine environmental risk perceptions. This study made use of structured open-ended interviews. These interviews were conducted at the EEASA conference during April 2004 with nine selected environmental educators who attended the conference and a presentation entitled *GM crops in developing countries: possible implications for education towards sustainable development* (Le Roux, 2004).

The interviews were used to ascertain how interviewees perceive GM crops. Closed questions were used to record demographic information. The purpose of the interviews was to obtain rich and informative explanations as offered in open-ended queries. During the interviews it was ensured that each interviewee was at ease and that he/she could talk freely. The interviews were conducted in a quiet place.

Validity was ensured by using the same set of questions with each of the selected of interviewees. The interview questions were piloted prior to application. It was observed how the pilot interviewees responded to the questions and they were asked to comment on any ambiguities and suggest adjustments to be made. An external researcher was also asked to comment on the questions to improve the objectivity and validity. The original set of 13 questions was narrowed down to six main questions, some with probing questions (Table 2).

To ensure trustworthiness a sample of environmental educators, broadly representative of the target group (in this case environmental educators and, particularly, in southern Africa) was chosen. The EEASA annual conference in 2004 was attended by approximately 350 delegates, all environmental educators from a variety of fields within southern Africa. It would be difficult to get a more representative sample of environmental educators. The sample of environmental educators interviewed in this study was very small, and rather than trying to extrapolate the data to all environmental educators, the study provided in-depth insight and a critical spotlight on the GM crops issue within environmental education.

Reliability was further improved by addressing possible interviewer bias. By ensuring that the research questions did not favour any particular bias and by recording the interviews, the information was not processed or filtered by the interviewer.

Table 2. Interview questions

1. Which organisation/company do you work for?
2. What is the nature of your work?
3. What do you understand by the term genetically modified (GM) crops?
• What do you think is the link between GM crops and modern biotechnology?
• Does the quality of your work depend on your knowledge of GM crops or biotechnology?
4. What has been your main source of information about GM crops?
• Who do you think presents more reliable information on GM crops?
5. What do you think is meant by sustainable development?
• How high do GM crops feature on your list of issues of concern with regards to sustainable development? Why?
• Do you think that GM crops have any use in sustainable development? If so what?
• Do you think that GM crops pose a threat to sustainable development? If so what?
6. How do you feel about the authorities making decisions with regards to policies on GM crops?

The data generated from the interviews were transcribed. The transcripts of interviews were analysed by means of phenomenological analysis. In order for the interviewer to understand what each interviewee said, rather than what each person was supposed to have said, bracketing was used. Subsequently, the entire tape was replayed several times by the interviewer to make sense of the whole and to provide a context for the emergence of specific units of meanings and themes.

The information was scrutinised and units of general meaning delineated. These units were noted and reduced to units of meaning relevant to the research question. The lists of relevant meanings were checked and those previously mentioned were eliminated as redundant. Units of relevant meaning were clustered together according to the codes used. From the clusters, themes were determined by examining the meanings of the clusters. A theme expresses the essence of the cluster.

General and unique themes from all the interviews were determined, i.e., what is common to most interviews and what is unique to a single or minority of interviews. Themes were contextualised and a summary of all the interviews was compiled to capture the perceptions accurately. From this information conclusions were drawn.

In the analysis of the data, the validity of the research can be enhanced through actively searching for evidence that contradicts, as well as confirms, the explanations being developed (Clarke, 1999:533). Training external researchers to verify the units of relevant meaning will contribute to the validity of the data. Attempts were made to ensure that the meaning of what each interviewee said was interpreted correctly. After the interviews were transcribed, the transcripts were checked and compared to the recordings.

Results

The analysis of the interviews provided contextual information as well as general and unique themes. The context of the environmental educators interviewed can be described in terms of the variety of environmental and social sectors in which the interviewees are involved and

their roles in this capacity. Of particular importance were the issues the interviewees indicated as environmental concerns. The interviews also revealed the interviewees' understanding of the concepts 'GM crops' and 'sustainable development'.

The phenomenological analysis of the interview data showed several general themes and some unique themes. The general themes include the following: the seriousness of the GM crops issue; the urgency to address needs in terms of food insecurity and poverty; ignorance and the lack of information; the uncertainty that exists about GM crops; the effect of information sources; trust in rational frameworks; and the bias of, and responsibility of, authorities. Unique themes are those themes that are unique to a single or minority of interviewees. In this paper, only the unique themes will be discussed.

The context of the interviewees

The environmental educators that were interviewed came from a variety of government and non-government departments where they fulfil various functions. This information appears in Table 3.

Table 3. Sector and function of interviewees

Sector (Department)	Function(s)
Formal education – Ministry of Education	Home economics inspector
Non-governmental Organisations	Botanical Gardens – education officer
National Environmental Authority	Information officer
University Environmental Education Unit	Research, policy development, community work
National Social Development Authority	Biodiversity programme supporting implementation of Convention on Biological Diversity (CBD)
Provincial Department of Agriculture and Environment	Capacity building and environmental services
US Aid for Agriculture and Land Resources	Regional programme manager dealing with plant breeding

The environmental educators that were interviewed were involved in a variety of projects and programmes dealing with many environmental and social developmental issues. The programmes and projects consisted of the following: networking and coordination at national level; public awareness programmes; programmes that support vulnerable and orphaned children; implementation of the UNICEF world food programme in schools; teaching and research; policy development; community-based programmes; the implementation of the Convention of Biodiversity; research on biodiversity; food garden and agriculture training; environmental education in schools; community programmes that encourage environmental action projects in agriculture; regional plant breeding programmes; environmental education in a nature reserve; and devising financial incentives for biodiversity.

The environmental concerns and issues in which the interviewees were involved, consisted of the following: biodiversity and its conservation; waste management; food support for vulnerable

children; biotechnology; drought; HIV and AIDS; food security; seeds and seed quality; access to indigenous crops; value of indigenous crops; variety of food crop options; purchase of seed; sustainable utilisation of resources; and breeding of crops such as sorghum, millet and maize.

Interviewees' understanding of GM crops

The concept 'GM crops' seemed to be reasonably well understood by most of the environmental educators who were interviewed. Descriptions of GM crops ranged from conceptions like '… food crops that are changed through human intervention by technology' to more scientific definitions '… where certain genes either from the same species or from species or families outside of that have been brought in or incorporated into the genome to produce a different variety'. However, there were misconceptions such as '… food with some medically scientific (*sic)* working in them' and descriptions of GM crops as 'hybrid seeds' and 'products of cloning'. No link with biotechnology in general was revealed from the interviews.

Interviewees' understanding of sustainable development

Several initial responses like 'a loaded question', 'worrying that there are many different definitions' and 'that's a good question' confirmed that sustainable development is still an ambiguous and value laden concept. However, a much clearer understanding of sustainable development exists amongst the environmental educators interviewed than of GM crops. The general understanding can be based upon the *Brundtland Report's* (1987) definition that it is a kind of development that aims to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. Sustainable development can be defined contextually differently in that '… somebody's needs in a rural community can be different from somebody's needs in an urban area'. Referring to community-based natural resource management, sustainability is viewed as '… being based upon utilisation, not just preservation, not just locking up fauna and flora in a national park, but also allowing the consumption of those with the philosophy by doing that things become more sustainable because there is more control on it'.

Several interviewees stressed that sustainable development entails 'people being empowered in their own context' and that it is 'a development that doesn't compromise the quality of life'. Concerns were raised about the strong economic approach that drives sustainable development and that 'ethics need to be looked at very closely'. These concerns were raised in the context of poverty alleviation and food security issues.

Unique themes

Four unique themes were identified. These are issues associated with language and terminology, knowledge systems, change in societal structures in southern Africa, and interest and awareness. The identification of each theme was based on actual comments and concerns raised by interviewees. Each theme is provided with the relevant comments used for identification:

Language and terminology. Responses included:

- Expressions and terminology in genetically modified organisms that are used do not exist in indigenous languages or are alien to indigenous languages.

- We ourselves are grappling with the ideas that are involved.
- Awareness of these issues is zero because there is no way to explain it.
- Some terms and concepts need clarification. These include biotechnology, hydroponics, hybrid seeds, plant breeding, food gardens, indigenous crops, organic farming, genetically modified crops (GM crops), genetically modified organisms (GMOs), living modified organisms (LMOs), genetic engineering (GE), biodiversity, bio safety, Cartagena Protocol, Convention on Biological Diversity (CBD), tampered, naturally, naturally evolved.

Knowledge systems. Responses included:

- There are different forms of reliable information depending on what you mean by reliable information.
- Scientific researchers who are working on biotechnology research would document their findings' reliability based on the methodology that they are using.
- Activist information is also reliable information.
- It is a different form of information.
- It forms more of a socially critical orientation rather than a sort of scientific method orientation.
- The two types of knowledge systems are not seen as an either/or option but as equally valid and reliable.

Change in societal structure in southern Africa. Responses included:

- Situations are unique in southern Africa.
- Thirteen to fourteen million people are on the brink of starvation in southern Africa.
- The number of imports that have to be made to sustain people is vast.
- Humanitarian aid.
- There is some sort of disaster at all time, floods or droughts, wars, famine.
- The youngest are now taking care of the oldest.
- Households are headed by children.
- The labour force to do traditional farming is just not there.

Interest and awareness. Responses included:

- Media publicity and information available contributed to a change in interest in GM crops.
- I am currently very interested in GM work done in southern Africa therefore read a lot.
- I have heard about it but didn't take much notice of it.
- Attending an information and discussion session on GM crops has encouraged me to do more reading and research on it.
- It is one of the key issues we will have to deal with in this decade.
- There are signs that authorities take biotechnology safety issues seriously and are starting to make it a priority.
- There is an infiltration in policy makers that seems to favour proponents of GM crops.
- People's views might shift considering the threats and advantages of GM crops.

Discussion of Results

The contexts in which the interviewees find themselves and their understanding of the concepts 'GM crops' and 'sustainable development', as well as the unique themes that have been identified through the data analysis, namely language and terminology, knowledge systems, societal change in southern Africa and interest and awareness, are discussed.

The context of interviewees

The environmental educators that were interviewed came from a variety of government and non-government departments where they fulfil various roles mostly related to education. They were involved in a variety of projects and programmes dealing with many environmental and social developmental issues. GM crops, as a new technological innovation, featured in some of their functions, projects, programmes or concerns, and is especially relevant to their field.

The concepts 'GM crops' and 'sustainable development'

The concept 'GM crops' was relatively new and unfamiliar to a number of interviewees. The implication is that the concept requires clarification especially in the context that environmental educators can expect to encounter it. Consequently, environmental education programmes should address the concept to ensure that educators are familiar with it. 'Sustainable development' is clearly understood by the environmental educators that were interviewed, although it was recognised as being an ambiguous concept. It is worth noting that sustainable development is value laden depending on the interest served. Ideally, all interpretations of this concept should be shared to empower environmental educators and expose them to the various trains of thought.

The unique themes

Language and terminology: The lack of available information on GM crops is a need that will have to be addressed, particularly in southern Africa. An information expansion programme looking not only at clarifying complex terminology but also making it relevant to indigenous cultural and language groups should be developed. There are several concepts related to GM crops that need clarification that will enhance the understanding of GM crops. These concepts appear in the results (see above). Programmes that disseminate information should also ensure that all information is as unbiased as possible, or that multiple vantage points are presented. This would be the starting point for environmental educational processes that could foster an ethical approach to GM crops and improve comprehension of GM crops.

Knowledge systems: There are different ways to regard GM crops and this must be acknowledged in environmental educational programmes. This can be related to the non-linear theory of knowledge discussed earlier. By making provision for a plurality of interest groups and for a deliberative approach, objective superiority can be deconstructed. Engaging with knowledge should then contribute to the development of an ethical approach to GM crops.

Change in societal structure in southern Africa: The realities of the situation in southern Africa pose a constant challenge to any environmental education process. Issues highlighted from the

data are: frequent disasters that make the region more dependent upon humanitarian aid, the impact of HIV and AIDS on the labour force, and the solutions GM crops may provide in filling a niche. These realities are expressed in the United Nations (UN) Millennium Development Goals. The Millennium Development Goals focus the effort of the world community on achieving significant and measurable improvements in people's lives (World Bank, 2002:2) and could potentially be incorporated into environmental educational processes to help decision making and deliberation on issues such as GM crops.

Interest and awareness: After the discussions on GM crops and armed with a little more information on the issues surrounding GM crops (gained from the conference presentation), the interviewees expressed a change in interest and a need to raise awareness. Arousing their interest has apparently awakened a need to know more about GM crops and to understand the various complexities and arguments surrounding their use. This reiterates the need to make information on GM crops available and accessible. It is, however, important that the general public can easily comprehend this information and that all cultures and languages understand the risks and benefits. Environmental educators can play a key role in enabling communities to engage with such information to assist with the establishment of an environmental ethic.

Conclusion

Lotz-Sisitka (2004:57) suggests that environmental education processes in southern Africa have a key role to play in both investing in human development and in protecting environments to ensure sustainable livelihoods and safe environments for all. These processes should foster an ethical approach towards issues such as GM crops.

GM crops are only beginning to be raised as an issue amongst environmental concern groups within the region. The data shed light on this, as several environmental educators interviewed are dealing with biodiversity issues related in particular to the Protocol. The data also showed some of the complexities surrounding GM crops that emphasise the plurality of perspectives on the issue. Information about the plurality of GM crops should be integral to environmental educational processes that aim to address GM crops in programmes and projects. Environmental educators as social actors concerned for the environment can stimulate greater participation, reflexivity and criticality by becoming involved in the discussions on GM crops.

An ethical approach to GM crops in environmental education processes should create room for a new or stronger environmental ethic to emerge, thus contribute towards the establishment of practices, structures and institutions with stronger environmental values. This paper has illustrated that gaining a better understanding of environmental educators' perceptions may enable a more in-depth, critical and pluralist approach to engaging with knowledge associated with GM crops in a southern African context.

Notes on the Contributors

Stephan le Roux's qualification in genetics stimulated his interest in the concerns surrounding genetically modified crops. He completed his MEd dissertation entitled 'Implications of

environmental educators' perception regarding the use of genetically modified crops towards sustainable development' at the University of South Africa (UNISA) in 2004. Tragically, Stephan passed away in October 2006 as a result of brain cancer.

Johanna (Gherda) Ferreira has been involved in the development and tuition of environmental education programmes at UNISA for more than a decade. She is professor in the Department of Further Teacher Education at UNISA. Email: ferrejg@unisa.ac.za.

Endnotes

1 *Green Clippings* provides an environmental news analysis service which can be obtained online at http://www.greenclippings.co.za/gc_main.

2 Biowatch is a national NGO that publishes, monitors and researches issues on genetic engineering and promote biological diversity and sustainable livelihoods (available online at http://www.biowatch.org.za).

3 SAFeAGE (South African Freeze Alliance on Genetic Engineering) is committed to ensure a ban is imposed on genetic engineering in food and farming (available online at http://www.safeage.org).

4 PUB (Public Understanding of Biotechnology) was launched in 2003 by the South African Agency for Science and Technology. The overall aim of the PUB programme is to promote a clear understanding of biotechnology and to ensure broad public awareness, dialogue and debate (www.pub.ac.za).

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