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Drivers and Barriers for Implementing Sustainable Development in Higher Education

Edited by J. Holmberg & B. E. Samuelsson

Education for Sustainable Development in Action
Technical Paper N° 3 - 2006
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Drivers and Barriers for Implementing Sustainable Development in Higher Education

Göteborg Workshop
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Edited by J. Holmberg & B. E. Samuelsson

U N E S C O

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Preface

The Chalmers University of Technology and the Göteborg University both have a rich profile in research, and a long tradition of collaboration in education for sustainable development. The Centre for Environment and Sustainability, which started in 1989, is a concrete example of the strategic partnership between the two institutions.

At the World Summit for Sustainable Development (Johannesburg, 2002) the UN Secretary General Kofi Annan emphasized the need to make the abstract concept of sustainable development "a reality." When recommendations for a decade on education for sustainable development emerged from this gathering, Sweden made a commitment to host an international conference on learning for sustainable development. This project was entitled "Learning to change our world – the Göteborg consultation on learning for sustainable development" and was the collaborative effort of our two universities in May 2004.

The success of the Göteborg consultation on "learning for sustainable development" led to a pledge by our two universities to host a follow-up conference of similar stature within the next three years. The workshop held in Göteborg 7-9 December 2005 on "Drivers and barriers for implementing sustainable development in higher education" is the first of three preparatory workshops *en route* to the next international conference in 2008. This publication captures the rich exchange of experience and strategies employed by institutions of higher education from a variety of countries.

We are convinced that this collection of papers emanating from the Göteborg consultation (December 2005) will serve as an important input to the International Conference on learning for sustainable development foreseen in 2008.

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Executive Summary

Background

In 2001, just before the European Unions (EU) top meeting in Göteborg under the leadership of Göran Persson, Prime Minister of Sweden, and at the time chairman of EU, Göteborg University and Chalmers University of Technology arranged a conference entitled "Knowledge and learning for a sustainable society". The conference was a success, but two things are especially worth remembering in this context. *"All for one, but none for all. Universities need drastic reorganisation to cooperate in addressing global problems"*. The citation comes from Sheldon Rothblatt one of the invited lecturers who was cited in the Times Higher Education in 2001 after the conference. The other citation: *"There is urgent need for a new type of learning"* comes from Roland Scholz, Zürich, also an invited speaker. The two citations touched upon something that later became the lead theme for our efforts.

In Johannesburg in 2002, Göran Persson, offered Sweden as host to a conference on learning for sustainable development. The conference later took place in Göteborg, May 2004 under the title "Learning to change our world – the Göteborg consultation on learning for sustainable development" and Chalmers University of Technology and Göteborg University were again among the organizers. 350 participants from more than 70 countries took part, all with an interest and engagement in learning for sustainable development. The most striking result that came out was that there was no common view on either sustainable development or learning for sustainable development. The consultation ended by the vice-chancellors of the two universities vowing to organize another conference within 3 years on the same subject.

In preparation for the international conference in 2008, we have planned 3 workshops with the purpose of focusing on drivers and barriers to implement sustainable development in higher education, in school and in learning environments outside the traditional school and university systems. The titles are: "Drivers and Barriers for implementing sustainable development in higher education", "Drivers and Barriers for implementing sustainable development in schools" and "The right to learn". By inviting experts from all over the world to define and elaborate on the problems as well as successes experienced we wanted to deliver an input and some recommendations for the 2008 event.

The Göteborg Workshop

The narrative below is a summary of the discussions that took place during the workshop "Drivers and Barriers for implementing sustainable development in higher education" in Göteborg December 7-9, and ends with a series of recommendations.

The procedure used was as follows: Before hand we defined four themes to be discussed at the workshop -

1. *How can sustainable development be understood and what new challenges does it bring to the universities?*
2. *How does the traditional discipline-based structuring of knowledge and research effect the implementation of learning for sustainable development in higher education?*
3. *Separate courses and programs or/and an integrated perspective throughout the whole education?*
4. *What role does research for sustainable development have in the process of crossing barriers and creating drivers for education for sustainable development at a university level?*

All participants were invited to write a chapter on one or several of the themes cited above. The papers were then distributed before the workshop to provide a background for the discussions. This publication is a collection of the workshop papers and related discussions.

The discussions at the workshop were organized in smaller groups covering each theme at a time followed by presentations in the plenary session. The concluding session included a discussion resulting in a list of recommendations and actions for the 2008 conference.

We have together tried to summarize the discussions under the different themes as well as the concluding list of recommendations, which try to take everything and everybody into account. As the organizers and principal editors of this publication, we are solely responsible for the summary of the discussion content presented below.

The four themes discussed at the workshop

1. How can sustainable development be understood and what new challenges does it bring to the universities?

The concept of SD has been around for many years. The most cited definition was published almost 20 years ago in the report from the World Commission on Environment and Development (WCED 1987): "meeting the needs of the present without compromising the ability of future generations to meet their own needs". Even if there have been several attempts to make the concept more operational it is clear that it cannot be exactly defined — and it should not! It is an ever-evolving concept. It can be compared with the concept of health – as health cannot be defined in precise terms either, and yet, everyone has an idea about what health is and health is important for everyone. When we meet each other we often ask: how are you? Sustainable Development can be seen as the health of societies and the planet. If we are concerned about the present development and whether it is sustainable we instead ask each other: how are we?

The fact that the present trends are far from sustainable makes it much easier to define unsustainable trends than sustainability. There have been many attempts to formulate principles based on this idea, see for instance (Daly, 1990 and Holmberg, 1995). Such principles and other conceptual models as the IPAT equation (Ehrlich & Holdren, 1971, 1972) can be helpful when trying to understand the challenges of sustainable development. Education for sustainable development (ESD) is about dealing with complex systems, systems thinking and learning about core concepts. ESD is a learning process not a product!

Sustainable development brings many challenges to the universities. Universities, with their core values of scepticism, curiosity and freedom of speech, have a profound role to play in developing students' qualities to cope with uncertainty, poorly defined situations, diverging norms, values, interests and reality constructions. Wals & Blaze Corcoran (2006) further state that sustainability is about systemic change within our institutions that allow for transformative learning to take place. This means looking at sustainability issues from a range of disciplinary angles, cultural perspectives (see Lotz-Sisitka & Lupele 2006), different time perspectives and a range of spatial perspectives. Universities cannot in an instrumental fashion teach *now* for sustainable development *in the future* (Scott & Gough 2006). Lundholm (2006) shows that dealing with attitudes and values (which are largely hidden) are as important a challenge for the university as achieving knowledge and understanding.

2. How does the traditional discipline-based structuring of knowledge and research effect the implementation of learning for sustainable development in higher education?

It must be hard to find something more multi- and transdisciplinary than sustainable development. It is also quite clear that the traditional discipline-based structuring of knowledge and research are here to stay. This combination constitutes a major challenge for the universities when implementing learning for sustainable development in higher education (Dam-Mieras 2006).

This several fold challenge must be dealt with from different angles: the university culture, in which depth is perceived as better than breadth; the merit system; the publication tradition; the award system; the peer review system; the evaluation of job applications; the funding system etc.

There are many positive multi- and transdisciplinary examples to be found, for instance in relation to the problem based learning method and case studies. The co-teaching activity at Monterrey institute of technology is one positive example (Lozano et al. 2006).

A common experience from proactive universities is that some kind of organisation with overview and responsibility outside and across the traditional disciplines is essential for making multi- and transdiciplinary ESD activities become a successful and lasting activity. Such an organisation works, as an engine for the issues that otherwise often becomes everyone's interest but nobody's responsibility. It therefore acts as an incubator for change, and hence a norm supporting structure (Wickenberg 2006). Examples of such organisations can be found at Delft University of Technology (Mulder & Jansen 2006); Monterrey Institute of Technology (Lozano et al. 2006); UPC, Barcelona (Ferrer-Balas et al. 2006) and at Chalmers University of Technology and Göteborg University.

3. Separate courses and programs or/and an integrated perspective throughout the whole education?

The answer is simple: both are needed! The separate course is needed to give the basic understanding of the challenges associated with sustainable development; to deliver tools and conceptual models for dealing with dynamic and complex systems; and to attain a feeling of how things are interconnected. The separated basic courses on sustainable development delivered at universities today have often an environmental focus. This needs to be balanced with more integration of social and economic aspects of sustainability. There is also a need for education for professional sustainability management competences outside the university (Rydén 2006).

As mentioned above: ESD is a process rather than a product. In this context a relevant question is: What makes higher education higher than other education? Ironically, the "lower" we go in education the more open, self-determined and participatory it becomes (Wals & Blaze Corcoran 2006). This kind of education is often more challenging for the teacher and it cannot only be evaluated with traditional quantitative methods. The seven level scale suggested in the Bologna process will make it even more difficult.

Since ESD is about continuous learning it is also essential to integrate sustainable development aspects into existing traditional courses. Turpin-Marion et al. (2006) point at some difficulties to achieve this integration. However, Delft University has implemented a successful program (Mulder & Jansen 2006).

4. What role does research for sustainable development have in the process of crossing barriers and creating drivers for education for sustainable development at a university level?

SD involves a profound transformation of the societal metabolism. It is essential that this transformation be done on a firm knowledge base. Therefore, existing knowledge must be structured/restructured in a relevant way and new knowledge must be developed. Knowledge must be widely shared in order to increase awareness and to provide a basis for decision-making. This is all a large societal learning process (Holmberg 1995). It is therefore difficult to separate research for sustainable development from research for ESD and both are needed. The Halifax Consultation 2005 identified several research priorities in this area for the future (Wright 2006).

Since the research often determines the structuring of knowledge and are organised in traditional disciplines "drainpipes, ESD calls for "gutters", and therefore new structuring of knowledge. ESD also calls for dissemination of findings. It therefore points at the importance of communicating for a new audience — re-writing. The present academic merit system is focusing on publishing in high-ranking deep disciplinary journals. This trend will eventually lead to that everybody is writing for nobody (Because everybody is busy writing).

Eriksson (2006) writes: "practical and empathetic understanding of the existential situation of fellow human beings must be viewed as a form of knowledge in its own right. This knowledge should be a valid field of higher education and research and a challenging area for intellectual discourse and debate".

Final Discussion and Recommendations

Ensure continuity

During the United Nations Decade on Education for Sustainable Development, a number of conferences will be arranged. From the workshop in December 2005 in Göteborg it was considered important to carry over knowledge and experiences from one big event to the other. One way would be to leave a message or a report that will feed into the next conference. It was also considered important to recommend that UNESCO put information on and from conferences on their website including through involvement of UNESCO National Commissions. Coordination and knowledge management were mentioned as important actions. This publication on Drivers and Barriers for Learning for Sustainable Development in Higher Education is one part of the platform for the next international conference on *Education for Sustainable Development* foreseen in Göteborg in 2008. In the interim, there will be two more workshops, one with a focus on Drivers and Barriers for Learning for Sustainable Development in Pre-School, School and Teacher Education in March 2006 and the last one with a focus on Drivers and Barriers for Learning for Sustainable Development in learning environments outside the traditional school and university systems in December 2006.

Highlights

- The role of universities should be discussed and education outside universities should not be forgotten. Transdisciplinary thinking should penetrate all planning, and new educational partnerships should be encouraged. “Redefine transdisciplinary, multidisciplinary and interdisciplinary science and society – words and definitions are important for better understanding and communication.”
- Organise a session on “experimental university structures” with participation of NGOs and companies. It should be noted that NGOs are an important source to learn from. There is a need to open up for creativity.
- Technical universities are often in the forefront in education for sustainable development. Networking between technical universities and universities could be a profitable approach.
- World Social Forum and World Business Council were discussed as dialogue partners.
- Cases from Education for Sustainable Development should be incorporated in the 2008 consultation in Göteborg. Different aspects of the North-South issue (maybe also the East-West?) could be introduced in some cases. Links with the Asia-Pacific region.
- “Focus on good experienced learning.” What has happened in different countries? In the search for good projects why not look at Eco-schools.
- Social and economic dimensions in Education for Sustainable Development need to be focused as well as ecological questions. These give many opportunities for knowledge integration and for transformative learning. “ESD is a huge mission in the search for meaning. Research on ESD rather than on SD!”
- School Development Through Environmental Education and Criteria for ESD-schools - a document for international debate from SEED and ENSI networks by Søren Breiting, Michaela Mayer and Finn Mogensen can be found on www.seed-eu.net
- Religious and cultural issues should be incorporated. Dialogue is essential and departments or faculties of religion and culture should be consulted.
- It was considered important to learn from corporate training.
- There is a need to know more about the relations between *to be aware*, *to have knowledge* and *to behave* in Education for Sustainable Development.
- *Research on Environmental Education* is one of many scientific journals with a lot of important information that is not read by many teachers or people in common. They should not just report the field but shape the field. Maybe electronic publishing could reach more readers. “**How** we do research is as important as **what** we do research on”.

- The role of media in learning should be accounted for. Popular Science is one way to go. "People are seeking information – e.g. the whole private sector."
- Refugee education and integration are issues not to be forgotten.
- "There is a capability approach to deal with in the shortage of teachers in the world." This affects higher education as well as schools.
- The role of music, art and theatre must be discussed. "Penguins are melting" was just one example of many in the discussions of "the balancing act".
- Young people are worried that our generation is working too slowly in the many critical aspects of a sustainable future.

Consultation on ESD 2008 as a process

- The voice of the youth must be incorporated in the 2008 consultation.
- VIP persons must be invited for the 2008 consultation. Ministers have to be reached and also senior civil servants at the ministries.
- Invite trade unions as a "pushing factor" as well as Schools of Business.
- Schedule the program optimizing "meeting people". Communication and coordination and not too much of top down.
- Music and media are powerful forces – use them to reach people.
- The democratic process during Learning2004 was successful. Develop or copy?
- Why not use "open space" at an early stage for the 2008 consultation in Göteborg to connect with different arrangements that have happened and are happening at both national and international levels.
- Arrange a pre-conference on emerging issues in research on sustainable development and education for sustainable development.

Award or prize

- A European (and/or national) prize for innovations and creative Education for Sustainable Development with an award ceremony connected to the 2008 consultation in Göteborg was discussed.

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1. Learning for Sustainable Development: Is it Possible Within the Established Higher Education Structures?

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Abstract: In this paper learning for sustainable development is first put in the context of the great challenge for our global society to bring about a more sustainable development trajectory than the present one. Then a description of learning and education is given, followed by a historical perspective on their development in Western society and some reflections on the design of modern learning environments. Subsequently the way learning for sustainable development is dealt with in the Bachelor and Master programmes of the School of Natural Sciences at the Open University of the Netherlands is described. Finally, a description of the Regional Centre of Expertise (RCE) on learning for sustainable development in the context of UN DESD is given.

Introduction

Learning for sustainable development could be described as learning to deal with dilemma's in a complex societal context in which ecological, economic and socio-cultural aspects are at stake and in which links between the local and the global level are made. In the UNESCO Higher Education Information Brief[1] published in the context of the UN DESD, the following can be read: *the challenge for higher education in the context of DESD is to innovate traditional learning environments and learning processes in such a way that they not only support the learning process of children and young adults in formal education, but life long learning, training and informal learning as well. Higher education institutes are challenged to co-operate together in networks that constitute a supportive infrastructure for life long learners*.

Co-operation between universities is not enough, however. In order to fulfil their outreach/service function at regional, national and international levels as well, universities and higher educational institutes will have to be active nodes in international/national/regional networks with other partners such as primary and secondary schools, vocational education, science centres, small and medium sized companies, chambers of commerce, NGOs, national and regional governments, etc.

The challenges for higher education in the context of the Decade are thus enormous, but the opportunities as well. New media and ICT offer many possibilities to enhance human activities in the field of education by providing flexible access to educational resources, assisting in information management and facilitating active discussions.

Challenges for a global society

Our present society could be characterized as a society in which continuous change seems to be a most stable factor. A major reason for that is the process of globalisation going on for centuries already with transport technology and international trade as important driving forces. It has been boosted during the last decades by the development of ICT and by a policy of trade liberalisation. In that globalizing world human activities increasingly are geographically spread, production chains cross national borders, and virtual space becomes a space for activities complementary to physical space (Castells 1996; Beck 1997; Brooks 2003).

The emerging global space connects all places on earth and relates the human activities in different societies. The reach of choices made is not restricted to the direct personal environment, the consequences for fellow world citizens in other parts of our global society should be taken into account as well. Governments, organisations operating in the private domain, NGO's and world citizens have a joint responsibility for the developments in the global

1 Available at http://portal.unesco.org/education/en/file_download.php/21a5450c515bab552176c98215fffaf8brief+Higher+Education.pdf

space. Probably many will agree with these abstract statements but how to learn to take responsibility in practical situations?

Policy-making and responsibility

For most people it will not be easy to understand the complex societal problems that are characteristic for sustainable development. It will be difficult for governments to get acceptance for the drastic policy measures needed (WRR 2003) because the expected problems:

- may only become evident in the future
- will become manifest at remote places and thus ask for international solidarity
- may not happen at all

Government is not the only party responsible for the quality of society, however, organisations operating in the private domain, NGO's and world citizens are responsible as well.

For companies this responsibility is expressed in concepts such as corporate social responsibility (CSR), which is dealing with concepts such as integrity, good governance and a series of objectives desirable from the societal perspective (OECD 2000).

NGO's play an important role in the globalisation of civil society. The effectiveness of socially active NGO's lies in their flexibility and the dynamics of the network structures in which they operate. They form horizontal and vertical coalitions and use the internet effectively for processing and spreading of information, for exchanging experience, for communication and for activating the public (Arquilla and Ronfield 2001; Warkentin 2001; de Wilde et al. 2003; Breton, 2003).

World citizens can influence developments in the global space in at least three ways: as a citizen, as a consumer and as a producer. As a citizen that influence runs on the one hand via democratic institutions in the home country and on the other hand via civil society. As a consumer that influence runs via consumer behaviour. As a producer that influence runs via governance structures and employees participation.

Education and learning for sustainable development

Individuals and organisations will have to learn, by and while doing, to realise a more sustainable development trajectory for Planet Earth. How can that learning be organised and/or facilitated?

Learning

A rather pragmatic description of learning is: learning is the result of the process of continuous interaction of an individual or a group with its physical and social environment. The learning environment can be formal (the educational system), non-formal (e.g. training on the job) and informal (family life, leisure time, visit to a museum or a zoo), and the learning process continues life long. It can be calculated that on the average only about 5 – 10 per cent of the life long learning process of an individual takes place in the formal learning environment (van Dam-Mieras, to be published).

Education

Education could be described as an institutionalised process aimed at realising defined learning objectives for defined target groups. The learning objectives comprise disciplinary, social, cultural, and economic items. The target groups can be divided according to age and the level of prior education or development. The educational system tries to provide contexts that support the learning of individuals. Starting from theoretical concepts of learning it has tried to create a set of conditions favouring the individual learning processes. The learning environment is designed, the content is structured, the learning process is supervised and the results are tested. As the educational system has the ambition to prepare children and young adults for functioning in society and on the labour market both the socio-cultural and the economic aspects are important (Eurelings et al. 2002).

Disciplines and a fragmented reality

The prominent place of disciplines as organisation principle in science and education in Western culture can be understood from a historical development that took place in the 17th century. Before that time the practices of knowledge generation were based on observations using human senses, construction of mental models based on those observations, and on reasoning and discussions with others. In the 17th century a 'scientific revolution' took place with important consequences for scientific methodology in the Western world. Observations using human senses were complemented with observations using instruments and systematically organised experiments. The discussion of mental models was institutionalised in academies of sciences, the peer review system for quality control of scientific knowledge was developed and scientific journals were founded. It was tried to understand the complex physical and social environment by using simplified models and schemes that allowed for a simplified pattern of reasoning. The development of this scientific methodology resulted in the organisation of research in disciplinary domains. A disciplinary domain is thus the working domain of a community of peers that speak and understand the common 'disciplinary language' and develop together the knowledge in that specific domain. With the emergence of disciplines a system for quality assessment and control based on the judgement of peers co-emerged.

The scientific methodology developed resulted in a pattern of reasoning with an inescapable order of conclusions and produced a 'verified truth'. Subsequently that 'verified truth' could be instrumental for exerting power (Dijstelbloem en Schuyt 2002; Marres en de Vries 2002; Allee 2003). The results of those developments are found back in many aspects in Western society, for instance in the system of laws and regulations and in the organisation of research and education. The knowledge model of the 19th century describing knowledge as the result of a rational process with universal validity can be seen as a result as well.

The disciplinary organisation principle is a good organisation principle for research as it enables researchers to get to know the part of the world described by the disciplinary model - a subsystem of the real and much more complex world - with a certain degree of certitude. As disciplinary research constitutes a source of knowledge for innovations and new societal practices a certain amount of disciplinary oriented teaching will remain useful in the future as well, but for dealing with societal complexity that will not be sufficient. As a model is only a simplified part of the complex real world, disciplinary oriented education by no means guarantees readiness for society. In addition to (a certain amount of) disciplinary knowledge individuals also need competencies. Examples of the latter are competences to look further than the borders of the own field of specialization or culture, to work together with people of different beliefs, to communicate (orally, in writing and via new media), and to reflect on the own personal dedication, involvement and performance.

Learning environments

Learning must prepare individuals for functioning in professional and societal settings in which they will be confronted with complex problems and will have to work together with experts from different disciplinary domains and societal stakeholders. Most probably acquiring knowledge will remain an important objective, but the ability to actively apply knowledge within a practical context becomes more and more important as well. For the design of learning environments this means more emphasis on an active, individualised learning process in a rich, contextualized and open learning environment. In comparison with traditional education, mainly focussed on the acquisition of knowledge, competences oriented education gives much more attention to role-playing, tasks and problem solving (Kerka 1997; Lynch 1997; van Loo en Semeijn 200; Kreijns et al 2002; Westera et al. 2000; Kreijns 2004).

What the optimal learning environment looks like will of course depend on the specific learning objectives and the specific target group. Generally speaking in many Western countries a shift from a behaviouristic to a cognistivistic-oriented approach of learning is observed in the literature on learning theory (Eurelings et al. 2002). In parallel a shift from a teacher oriented to a learner oriented approach is found in the literature on teaching. In agreement with these shifts an increasing interest in the development of competencies and in working and learning in

multidisciplinary teams is found. The latter can be seen as a parallel to the shift from mode 1 to mode 2 knowledge as described by Gibbons (Gibbons 1994, 1998, 2003) and from normal to post normal science in policy practise (Funtowicz and Ravetz, 1991, 1993, 1994).

Learning for sustainable development at the Open University of the Netherlands

The Open University of the Netherlands is a university for adults organizing its learning processes and environments according to distance education methodology. The latter implies a great degree of freedom as to time, place and pace of learning. The School of Natural Sciences has given sustainable development a place in both the Bachelor and the Masters programmes.

The Bachelors programme has a natural sciences basis. Students are first introduced to 'System Earth' and the disturbances in the system brought about by human activities. With societal complexity as the starting point for the learning process disciplinary relevant knowledge and tools from the domains geology, biology, chemistry, physics and mathematics are offered. Graduates should be able to actively contribute (as a partner in a multidisciplinary team) to problem solving and dealing with dilemmas in the domain of environmental sciences and sustainable development. Therefore in addition to a sound natural sciences base a certain amount of knowledge of policy development and management are needed as well. Disciplinary knowledge alone is not sufficient, however, attention has to be paid to the interaction between disciplines as well. The competences to work as a member of multidisciplinary teams on complex societal problems are very diverse and therefore there is ample opportunity for students to develop such competences at both a national and an international scale (see below). Students can – to a certain extent – choose a personal profile.

The Master programme is a tailor made programme that gives students the opportunity to develop their knowledge and competences according to a personalised trajectory. The programme is designed by staff in interaction with the student and matches the personal interest and professional activities of students on the one hand and relevant developments in environmental sciences and sustainable development on the other.

It will be evident that both the student profiles (adults active on the labour market) and the objectives described above (graduates that are able to deal with dilemma's in complex societal settings at scale levels from local to global) ask for innovative learning environments.

Examples of innovative learning opportunities are the introductory module 'Earth, people and environment' (an introduction to natural sciences starting from societal complexity and not from abstract disciplines), the Virtual Environmental Consulting Agency (an agency run by students working on real world problems), the Global Virtual Seminar and the European Virtual Environmental Seminar (students working in international teams on case studies relevant in the context of sustainable development), and the Virtual Master Class (scientific writing within a ICT-facilitated master community). The design and development of such innovative learning opportunities and environments asks for creativity, collaboration with stakeholders and international collaboration. For that reason 'Learning for sustainable development' has been chosen as the joint research topic within the School of Natural Sciences (Ivens et al. 2002; van Dam-Mieras, to be published).

A Regional Centre of Expertise (RCE) in the context of UN DESD

In the context of UN DESD United Nations University (UNU) launched the idea to create a worldwide network of Regional Centres of Expertise for Education for Sustainable Development (EfSD) (van Ginkel 2004; Fadeeva et al. 2005). Characteristics of RCE's are that they:

a) Enhance collaboration between different levels of formal education, i.e. between primary, secondary and higher education
b) Facilitate relations between formal education and local actors relevant for ESD, such as research centres, local businesses, museums, local governments, etc.

RCE's develop their activities locally and choose the organisational form that best fits the local needs. The objective is to have created towards the end of UN DESD a global learning space for Sustainable Development with these RCE's as nodes at the regional level.

Starting form this conceptual idea for an RCE initiative was developed in the region Eindhoven (Netherlands), Cologne (Germany), Leuven (Belgium) (van Dam-Mieras et al. 2005). In the region there are 7 research universities, 15 universities for applied science, several multinationals, a large number of SME's among which also very innovative SME's, and regional governments with policy plans in the field of sustainable development. In interaction with these knowledge institutes, governments, companies and NGO's active in the region, the RCE wants to function as a connection point for knowledge interactions on sustainable development issues among stakeholders in society. Deliberately the somewhat vague term knowledge interactions is used here because the classical concept of knowledge generation in universities and research centres and subsequent dissemination of knowledge to society is too limited for the generation of knowledge relevant for sustainable development in our present society. All actors in society can – or even have to – contribute to the participatory process of context embedded knowledge generation for sustainable development. By formulating our activities in this way we do not mean to say that the generation of scientific knowledge according to an agreed upon scientific methodology would not be relevant for sustainable development, on the contrary, it remains very important as well and it belongs to the core activities of some of the RCE partners. However, the focus of the RCE is on knowledge embedded in the regional societal context.

Conclusions

Learning for sustainable development can be described as a joint search of individuals and organisations for knowledge and competences that enable them to deal with dilemmas in complex societal settings. That type of learning asks for authentic and open learning environments in which encounters with a diversity of disciplinary and stakeholder perspectives can take place. Most learning environments in traditional formal education do not optimally support that type of learning. Learning for sustainable development therefore constitutes a trigger for innovations in education.

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2. Empathetic Understanding Of the Existential Situation of Fellow Human Beings As a Field of Knowledge

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Abstract: This paper was written in late November 2005, at the University of Cape Coast, Ghana, as a letter to the Workshop. From my experience in Ghana with university activities and rural development[1], I consider the insight into the conditions of fellow human beings, especially of those who are underprivileged. This is a kind of understanding, a form of knowledge, rather than a state of emotion that has to be valued in its own right, beside such knowledge as social and economic overviews and statistics.

Human freedom and knowledge

As human beings we are conditioned to freedom, not only as individual persons, but also as belonging to interindividual or transindividual actors or processes: family, work teams, committees, meetings, local communities, economic agents, cultural and political discourses. We take part in decisions that form our lives, our societies, and our common future world.

The existential situation and the available knowledge are largely determining the extent of the freedom and of the associated responsibility. (Jean-Paul Sartre: L'existence précéde l'essence.) There are very wide variations in the existential situation, the available knowledge and the freedom of choice, from those who are powerful in the world, economically and/or politically, to those who are fully occupied by the day-to-day survival.

Knowledge is essential for understanding and accepting those limitations that are a precondition for freedom (like keeping one's vehicle in the road) and also for identifying and realizing those development potentials that are actually available.

Tomorrow (22 November), I shall participate in a meeting of the Community Council of Edumafa, a poor fishing community on the Atlantic shore, in the Ekumfi District in the Central Region of Ghana. I was adopted from the outside by the community as Nkosuahene (chief of development). The existential situation of Ekumfi-Edumafa is very limiting. Large fishing vessels from Europe and Asia take most of the fish along the coast of West Africa. Low rainfall and poor soil quality make a transition to agriculture difficult. The discussion to-morrow will deal mainly with the school and the young generation, and with Edumafa's diaspora and their possibilities to contribute to development with knowledge and financial means. The situation of Edumafa is characterized by limiting necessity rather than by freedom. However, the citizens of Edumafa have gradually come to understand the importance of knowledge and they have acted accordingly. In little more than ten years they have gone from a situation with 15 children in a school building beginning to fall down, to a situation with Kindergarten, Primary School (classes 1 to 6), Junior Secondary School (classes 7 to 9) and almost all children in school. Their determination has attracted a foreign non-governmental organization which is now supporting the community and which has set up the building for the Junior Secondary School. There is now an interest in the community to start a Senior Secondary School that would also be open to children from the neighbouring villages.

Existence is not granted

To Sartre, the existence was the beginning of everything. His *L'existentialisme est un Humanisme* appeared in 1946, the year after the nuclear bombs exploded over Hiroshima and Nagasaki. Those bombs marked the beginning of an arms race that threatened the existence of humankind and of all higher forms of life on Earth, a threat that we have not yet come to grips

1 My learning and observation position is i) that I am involved with my Ghanaian colleague, Professor Francis Allotey, in organizing annually a Regional College in applied mathematics, for West-African graduate students in physics and mathematics, and ii) that I am Nkosuahene (chief of development, part of the traditional organization) of a fishing village, Ekumfi-Edumafa in the Central Region of Ghana, on the ocean shore.

with. The technical-economic development, taking place after 1945 has created dangers for humankind and for those geophysical and ecological systems that form the basis for human existence.

To secure this basis is one of the main ingredients in sustainable development. The point of departure for Sartre was the personal existence of the individual; the goal of sustainable development is continued collective human existence.

Human understanding as a field of knowledge

To destroy is much easier than to build. Sustainable development needs a global participation and collaboration. Such participation must be based on freedom and a common will to contribute.

In the world of today, a large part of humankind do not possess the freedom. They are caught in the struggle of day-to-day existence, deprived of basic economic means and of the necessary knowledge.

Today, the lack of will among the privileged people of the world to understand the situation of the deprived, to share with them and to join them in their efforts for a better life, is the greatest obstacle to sustainable development. Apartheid had to be abandoned in South Africa; the economic apartheid of the global system will also have to be abandoned.

No part of humankind is isolated from the rest. With the fast transport systems and instant communication, all human problems are close. The present situation is not only an obstacle to sustainable development; it also involves immediate dangers. An infectious disease that spreads in a poor environment can grow into a global pandemic. Young people finding themselves caught in a hopeless situation, can be recruited by extremist movements or warlords and cause a lot of destruction and suffering.

This has been one of the mechanisms behind the recent civil wars in West Africa, making the whole region appear unstable.

This picture can be turned around. If a standpoint of empathy and understanding were globally spread to underlie all decision-making, also very difficult local problems could be handled by the world community. Then a basis would exist for attacking common global problems.

The danger of abstracting from the human context

To continue, I have to say a few words about *abstraction*, a well-known activity for me as a theoretical physicist. The ability to generalize and to abstract from unessential details is important in all formation of knowledge. This makes the purely abstract science of mathematics very useful. Abstraction is a necessary method not only in science but also in technology and administration.

However, abstract schemes are by themselves empty. The real world is concrete. Concrete experience is needed for forming mental images and concepts. Science is learnt through observations and experiments with physical, chemical and biological systems and processes.

If abstractions are allowed to dominate in the human sphere, they may be extremely dangerous and destructive. For Paul Tibbets and his crew who bombed Hiroshima, the bomb was an explosive device and the city centre was the target; the people had no place in the military order. For a while, the physicists of Los Alamos were enthusiastic when they heard the news of the successful bombings of Hiroshima and Nagasaki, but when the understanding of the human implications hit them, their enthusiasm faded.

Categorization of peoples with respect to various external forms of otherness was a recognized academic discipline in Europe. When I studied theoretical physics at Uppsala University in the 1950s, I passed every day a door with a sign Institute of racial biology. To abstract from the shared humanity of peoples living under different external conditions, one was using an arbitrary scheme to systemize irrelevant anatomical details.

Europeans and their descendents have dominated the globe since the grand days of Spanish and Portuguese seafarers, 500 years ago.

The coast of Ghana has a row of castles and fortresses from European military and trade activities. Within close reach from my desk I have a number of historical sites: Elmina Castle, Cape Coast Castle (once under Swedish flag), Anomabu Castle, Fort Amsterdam at Abandze. At Elmina Castle and Cape Coast Castle, a visitor can get a clear image of the physical situation for the war captives who were kept there, destined to become transatlantic cargo.

The pseudoanthropology of Uppsala University was a late activity in a long series of academic efforts to rationalize and justify European dominance. Today such attempts are more subtle and can be hidden in cultural comparisons and in economic rationality. The effects in terms of inhuman social policies and immigration policies are still strongly felt by those who suffer from them. At times their tensions can lead to violent eruptions as in several French cities recently.

Joseph Stiglitz, Nobel laureate in economics and now an outspoken critic of the international economic system, describes distance and abstraction in economic policies as similar to that in terror bombing, as described above:

The unemployed are people, with families, whose lives are affected — sometimes devastated — by the economic policies that outsiders recommend, and, in the case of IMF, effectively impose. Modern high-tech warfare is designed to remove physical contact: dropping bombs from 50,000 feet ensures that one does not "feel" what one does. Modern economic management is similar: from one's luxury hotel, one can callously impose policies about which one would think twice if one knew the people whose lives one was destroying. [Globalization and its discontents, 2002]

Empathetic understanding as a field of knowledge

My thesis here is that empathetic understanding of the existential situation of fellow human beings has to be recognized as a form of knowledge. Such knowledge transcends statistical knowledge and theoretical knowledge and it transcends barriers between groups of humans.

Médecins Sans Frontières is an example of developing the professional knowledge of physicians in this direction.

At the University of Dhaka, Professor Muhammad Yunus found his economic science irrelevant to the situation of the people in the city, but he brought it into practical use. He started the Grameen Bank that gives micro credits (www.grameen-info.org) to very poor people, mostly women, for their investments in small-scale economic activities. Worldwide, now hundreds of millions of people are involved in micro credit schemes.

In economics, the ‘economic man’ is a perfectly legitimate model for illustrating certain theoretical ideas. But to consider the ‘economic man’ as a good approximation of a human economic actor is asocial ideology rather than science, and even more so to view the ‘economic man’ as a norm. To consider humans as equal and equity as an ideal is also ideological but it is not arbitrary, and it does not leave to a postulated ‘invisible hand’ to put everything together. In the perspective of sustainable development, empathetic understanding, like that of Yunus, is rational but the autistic self-interest, preached in standard economics, is to be regarded as emotional and irrational.

A serious problem is that competition between individuals and between companies has been institutionalized in such a way, economically and practically, that exploitive behaviour rather than empathetic understanding have become the norm. Already John Maynard Keynes in 1931, expressed this economic philosophy of selfishness and greed:

For at least another hundred years, we must pretend to ourselves that fair is foul and foul is fair, for foul is useful and fair is not. Avarice and usury and precaution must be our gods for a little longer still. For only they can lead us out of the tunnel of economic necessity, into daylight.

Important human-oriented descriptions of the world of today can be found in the Human Development Report, issued by United Nations Development Programme, in World watch's The State of the World and in monitoring reports on the United Nations millennium goals.

But poverty, hunger and illness occur in very concrete situations. Behind the figures and tables of UNDP, UN and World watch, there are local communities, families and individuals with aspirations and hopes for a good life. Constructive dialogues and cooperation with people at the local grassroots level across economic, social and cultural barriers are necessary.

Exploring ways of collaboration based on understanding

A truly human empathetic and collaborative perspective would require a more direct exchange and collaboration with the underprivileged people of the world. Universities and other learned institutions could use their intellectual and moral freedom for opening such dialogues and getting involved in development cooperation.

In the process, one could learn how priorities and practices of the privileged influence everyday life of poor people. Joint efforts to solve practical problems and improve life in some localities would also help to spread a combined structural and empathetic knowledge of the present situation.

The world is one and development everywhere is everybody's responsibility. Taking sustainable development as a common task and justice as a common goal, one could find new and innovative institutional forms of academic links and cooperation. Studies and courses should be organized as symmetrically as possible between North and South.

This could move the general academic interest in a more humane direction. The connected changes in academic interest and institutional forms could also help to counteract the massive loss of competence from the South known as 'brain drain'.

Conclusion

My conclusion is that practical and empathetic understanding of the existential situation of fellow human beings must be viewed as a form of knowledge in its own right. This knowledge should be a valid field of higher education and research and a challenging area for intellectual discourse and debate. This could be an important step for breaking down some of the worst barriers for sustainable development. Viewing development as a common task, new, more symmetric, institutional forms and programs of South-North cooperation could be set up and practiced, as a more efficient way to sustainability.

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3. Lessons learned from our particular "Decade" of Education for Sustainable Development (1996-2005) At UPC

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Abstract: UPC's current vision of its contribution to sustainable development (SD) is the following: "By 2015, the Technical University of Catalonia will become a technological point of reference in sustainable development at the regional, national, European and global levels, as a result of its contribution to education, research, development and innovation. This will be achieved by defining an effective, cooperative, long-term strategy drawn up by the University and its stakeholders". This vision is the result of ten years of institutional maturation of the internal process, from an initial "greening" perspective towards a progressively proactive institution that aims to contribute decisively and effectively to SD and use SD as an opportunity. Particular attention has been paid to drivers and barriers in the university structures according to personal and specific experience.

This paper is a result of a participatory internal and external evaluation process at the end of the Second Environmental Plan (2002-2005). In it we describe in chronological order the relevant steps in this process (some planned and others circumstantial), identifying strategic decisions, specific key activities and initiatives. We also attempt to place them in the particular context of the University and to extrapolate them when possible.

Furthermore, we present UPC's current capacities and activities concerning learning for sustainable development in HE, and future expectations. In particular, we describe the activities and outputs of two key units for the transition: the centre called CITIES, which aims to implement EfS in the real context of UPC, and the research group on Education for Sustainability, linked to the UNESCO Chair in Sustainability, which aims to act as a think-tank within UPC. Additionally, we present some collaborative educational projects in which UPC is involved, such as the Regional Centre of Expertise in Barcelona, in the context of the UN DESD.

Introduction

UPC's vision and commitment to sustainable development (SD)

UPC's institutional maturity, which makes the university more "sustainable", has evolved positively in the last decade. Like all transformations, it is a complex process in which there are several contradictions, but an overall positive trend. The institution has incorporated sustainable development in the objectives of all main strategic and political documents. Since 1996, the institution has developed and implemented two environmental plans, which have integrated research, education and operations in a comprehensive strategy. These plans are based on the model described in Figure 1, which underlines the outputs that come from these three areas (SD trained education professionals, SD solutions for research, and a SD role model for campus operations) together with the flows that cross between them, which are synergetic effects that also have to be promoted. The balanced progress in the three areas provides mutual reinforcement for achieving the overall objectives of sustainable development in the University.

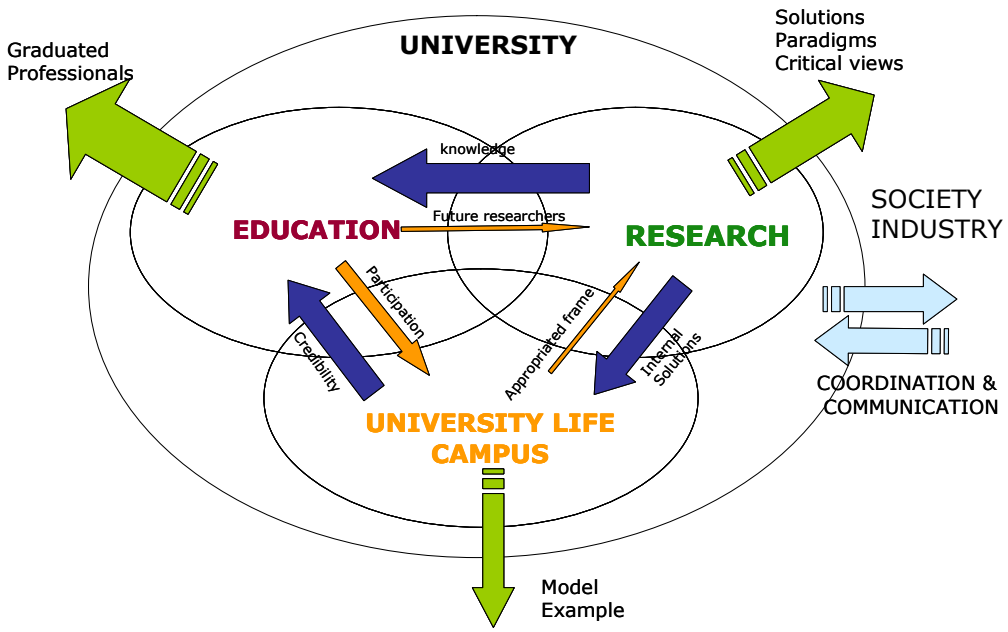

Figure 1. The role of UPC with respect to the environment and SD

Strategic approach

The framework for the environmental and sustainability policy took the form of strategic multiyear plans (the periods of these plans were 1996-2001 and 2002-2005), that covered all the university's areas of activity (education, research, operations and coordination/communication) and included indicators for monitoring their progress [1-3]. As an example, Figure 2 shows an indicator for education: the percentage of greened subjects (those subjects that include environmental topics in the course description and objectives).

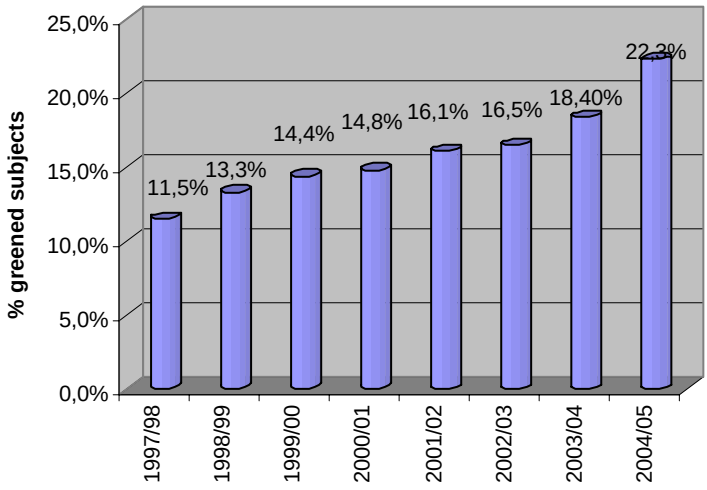

Figure 2. Evolution of the percentage of "greened" courses at UPC

After evaluating the first Environment Plan in 2001 we saw that **mainstreaming the plan objectives into key university processes was essential** in order to successfully channel education and research towards SD. Many efforts were made during the second plan's implementation phase in order to include and integrate the environmental indicators related to the curriculum into the different strategic planning levels that guide university decision-makers [4].

Organizational structure

The institutional activities aimed at SD have been coordinated by a particular unit in charge of implementing the environmental policy. This unit is currently called CITIES (Interdisciplinary

Centre for Technology, Innovation and Education for Sustainability) and was formerly the "Environment Plan Coordination Office". It was formed by a single person in 1997, and has grown considerably since then: today it hosts 6 staff members and 6 students. A vice-rector, appointed by the Rector, has always had political responsibility for environmental policy. A significant change is that CITIES, which is still part of the General Services of the university, now belongs to the Research Area in the administrative chart. This is a strategic option so that the centre is present where the "seeds" of transformation are planted, that is, in research. The structure of CITIES is shown in Figure 3. It can be seen that the three areas (Research, Education and Management) are "crossed" by a few thematic priority programmes that aim to concentrate efforts on certain issues with regard to which there is a social demand, and generate specific alliances with the corresponding stakeholders.

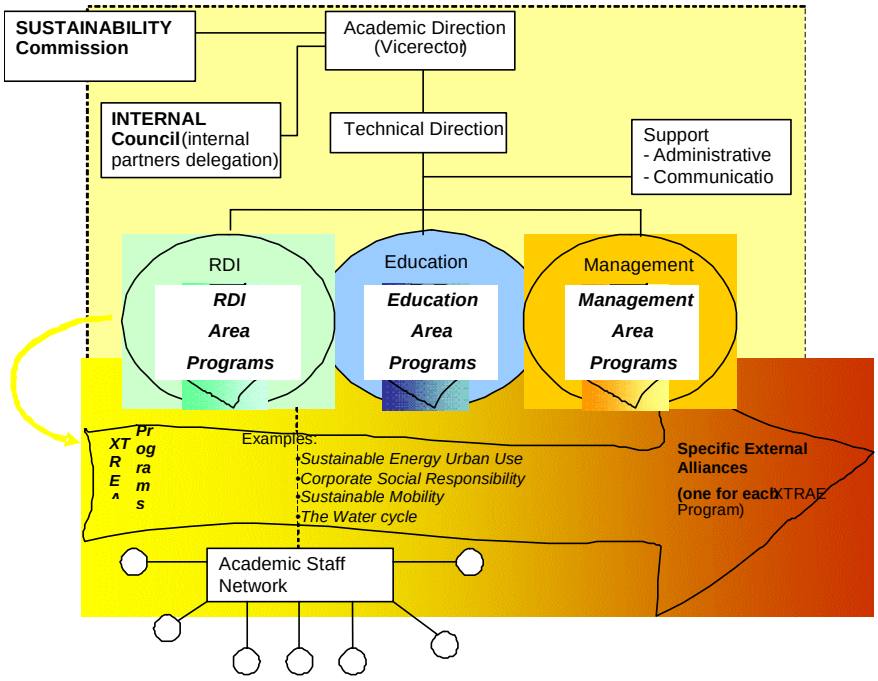

Figure 3. Structure and strategic approach of CITIES

It was mentioned above that at UPC there has been a UNESCO Chair in Sustainability since 1997. This is formed by around 30 academic professionals from different disciplines, and concentrates on research and education in sustainability and its relation to technology. The chair has a research group focusing on education for sustainability (EfS), which conducts **specific research on EfS in Higher Education (HE)**. Currently, 2 PhD theses are being carried out on this particular theme, one on "Efficient learning methods to teach SD in technological HE" and one on "Sustainability integration in HE policies as a quality requirement". UPC is part of the "laboratory" for this research.

Education for Sustainability at UPC

The approach

In 1996, when UPC's first Environment Plan was approved, it was decided that UPC would not offer a new degree in environmental studies (e.g. environmental engineering, environmental sciences), but **would "green" all the curricula** of existing disciplines. Since then, several actions aimed at achieving this objective have been carried out. The specific actions can be seen in *UPC's Annual Environment Reports* [5], which present indicators and describe the actions carried out. Transforming current education is based on three goals: (a) disseminating environmental concepts through the curriculum; (b) reinforcing research into environmental issues as the driving force for transforming education; (c) making the university more sustainable to ensure a coherence between the message and the reality at the campus (practice what you preach). Due to the great "impermeability" of the curriculum, it has not been possible

to revise the courses thoroughly from a sustainability perspective, but only from an environmental one. Basically, the approach for transforming the curriculum has been based on "adding" contents to it; in general these contents are environmental concepts and practices. Some of the actions that have been carried out for this purpose are the following: writing manuals and guides; using indicators, benchmarking and strategic planning tools; seminars and conferences on curriculum greening and EfS.

Main results in education

General dissemination of environmental concepts through the curriculum

One of the ways to monitor the dissemination of environmental and sustainable concepts in the curriculum is to count the courses that include environmental and sustainability concepts in the "official" course description using a key-words search. Looking at the overall results, there has been a positive trend towards greening the curricula, which has doubled the number of greened courses in 8 years (Figure 1). Additionally, efforts have been made to encourage an environmental considerations section in final theses, which are compulsory in all degrees. The level to which this requirement is fulfilled varies greatly according to the disciplines, but on average it is around 30 per cent [5].

Specific "concentrated" activities

Although there are no specific environmental/sustainability degrees at UPC, the degrees in Civil Engineering, Chemical Engineering, Industrial Engineering and Architecture offer the possibility of specializing in environmental studies.

A particular example: learning from the campus in building engineering

In the school of building engineering (EPSEB, UPC), a specific final thesis option has been developed by CITIES and the School on energy efficiency in buildings. About 10 to 20 students are involved in it every year. The outstanding feature of this option is that students work on a real case of a UPC building together with technical staff in order to analyze and propose solutions and improvements. It is an interesting case of applying the outputs of academic work directly. The results of this experience show that the curriculum needs great modifications in order to provide graduates with the appropriate skills in energy efficiency, but also that the staff need to refresh their knowledge on these issues.

Among many optional subjects on sustainability at UPC, many of which have little impact, the UNESCO Chair in Sustainability has developed an e-learning course of 6 ECTS on "Technology and Sustainability". This course considers the SD perspective in depth and is particularly influential because around 1000 students per year take it. There are many other optional subjects on environment and sustainability concepts, but none of them has this level of impact (they only have 17 students on average). There are around 70 related optional subjects, approximately 20 per cent of all optional subjects.

UPC currently offers 5 PhD programs related to environmental and sustainability concepts. This offer is not very rational, as there is considerable overlapping between the programs. Though there have been various attempts to rationalize and upgrade this offer (the 2nd Environment Plan planned to concentrate its efforts on a single reference program in environmental issues), this situation has not been corrected. It seems that the "Bologna" process will provide the opportunity to tackle this problem effectively.

In October 2004, UPC hosted the second international conference on Engineering Education in Sustainable Development (EESD), organized by CITIES. UPC considered it a strategic goal to (a) "normalize" research and educational innovation in this field, (b) catalyze changes in the institution, and (c) establish strong international partnerships and promote UPC's leadership. One year later, it can be seen that all three objectives are progressing correctly. The most specific result of the EESD 2004 conference was the Barcelona Declaration, the first ever international declaration on EfS in a specific professional field [6].

Discussion: drivers, barriers and lessons learnt

Staff level with regard to SD, skills and motivation

A considerable number of staff are quite competent in environmental issues (considering the significant percentage of researchers working in this field), even if there are still improvements to be made. However, there is a great lack of a comprehensive SD perspective and interdisciplinary skills. Is it possible to train the teachers? The effort to train them "directly" failed when it was attempted at UPC from 1998 to 2000. Only motivated teachers (those that did not need it) attended the courses, but obviously those that most needed it never came. A training possibility could be to offer something for new young lecturers and PhD students. Training for the general lecturers should probably be mostly linked to and performed through research activities.

It is possible to find ways to encourage the tremendous efforts and motivation of those who are open to change (in general through involvement in research and innovation projects). However, it is almost impossible to motivate those who resist change.

University culture and resistance to change

The biggest handicaps are the traditional resistance to change in HE institutions and the high level of "irrationality" of the decision-making process in discussions on curriculum (re)design, based ultimately on the curriculum as a tool of power in the university structure. The experience of mainstreaming environmental goals in UPC's overall strategic planning has increased the "greening" level but not reformulated the programs from a SD perspective. Hence, windows of opportunity for significant change such as "Bologna" should be taken up.

The level at which changes occur

Our perception is that each individual change is a key element in the overall change. Institutional plans and decisions are nice on paper, but do not "happen" if there are no believers and actors. *Bottom-up* is as important as *Top-down*, complemented with middle-level staff who keep the change process going; hence the need for new SD specific structures such as CITIES and the UNESCO Chair in Sustainability. Therefore, personalized approaches can also be much more effective than impersonal ones (e.g. the DRAIA method in TUDelft [7]).

Concentration vs. dissemination

All our current approaches combine concentration and dissemination, and try to find a balance between them. The problem is that although concentration has the benefit of showing examples (thus motivating), creating critical mass effects and producing rapid changes, it only affects a few actors, and often creates "*SD ghettos"*. On the other hand, diffusion affects the majority, but is rather more complex to manage, much slower in becoming visibly effective, and sometimes hard to keep going.

Lack of pressure & external recognition

Another important issue is the lack of pressure in Spain to make these kinds of changes. UPC has been a forerunner in all the issues of curriculum greening, although the university has never been "asked" to do so or "recognized" for doing so. National platforms such as those in the UK, Netherlands and Sweden are clearly needed. In fact, UPC is urging the Spanish Rectors' Conference to create such a working group. Additionally, the lack of SD criteria in the accreditation phases of the programs is clearly a barrier.

The near future

The window of opportunity provided by the European Higher Education Area (EHEA)

The EHEA is seen as the challenge that will make a significant change possible, though many people doubt whether this is really going to be achieved in Spain due to the lack of funding for HE. The two main levels at which transformation is expected are the bachelor and master's degrees. Bachelor degrees, according to "Bologna", are going to be implemented progressively from autumn 2007 onwards. They may coexist with current programs until 2010, when all programs will need to follow EHEA guidelines (ECTS, etc.). In this process, there are some possibilities of embedding SD in the curriculum, such as the importance of transversal

knowledge, skills such as interdisciplinary and social/relational competences, and problem/project-based learning. It can be seen as an opportunity for redesigning the curricula from a sustainability perspective. UPC is going to offer new master's degree programmes on sustainability topics such as energy systems, the water cycle, environmental engineering, leadership for sustainability and sustainable architecture, thus revising its initial position of not offering specific courses in environmental and SD issues. This is indeed an opportunity to work towards achieving a critical mass that can be used to introduce the sustainable perspective in all the education provided by UPC.

Increasing social interaction

In the future, one of UPC's clearest goals is to improve its interaction with all stakeholders. Therefore, UPC will benefit from the outside worlds' interest in SD by developing a clear and efficient interface for stakeholders who clearly express their interest in collaborating with UPC in greater depth. The model in Figure 1 is embedded in the societal context as a mutual learning and innovative framework, as represented in Figure 4.

One project that aims to fulfill this goal is the recently created Regional Centre of Expertise (RCE) in Barcelona in the context of the UN DESD. Partnerships between universities were asked to act as seeds for the creation of RCEs. In collaboration with ESADE, a Spanish business school that is a leader in Corporate Social Responsibility, the proposal that was presented has been recognized as RCE-Barcelona[1] [8].

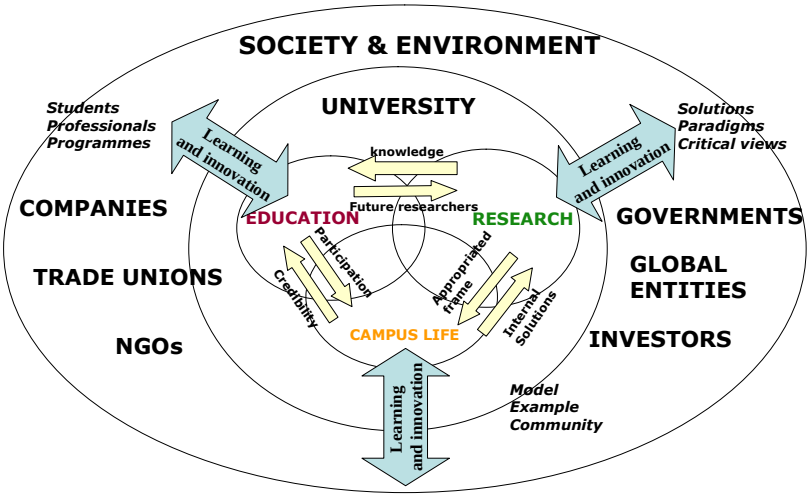

Figure 4. Proposal for the renewed role of UPC with respect to SD

Conclusions

For 10 years, UPC has been developing strategic plans in order to green its whole system, and particularly its education. Following this experience, an international evaluation was carried out in order to start a new strategy oriented towards sustainability.

The conclusions of the evaluators were as follows:

1. Clear leadership and vision are necessary for UPC to harvest its great potential to become a forerunner in the field of sustainability;
2. Sustainability is a very broad and complex issue, which will be too fragmented, in the different departments if it is not correlated at the top level. This was a significant result of the interviews and is also the experience, for instance, of Chalmers University of Technology. It is necessary to:
   - *Build further on the qualities in Sustainable Development (SD) that have been achieved at UPC. Turn the mindset of the UPC community towards SD.*

[1] http://www.ias.unu.edu/news/details.cfm/articleID/686

- *Benefit from the interest of the outside world in sustainable development by developing a clear and efficient interface for the different stakeholders (who clearly express their interest in collaborating with UPC in greater depth). Intensify relations with external parties, i.e. governments, businesses and societies (NGOs), to strengthen demand orientation.*
- *Use the Bologna process as a window of opportunity to introduce compulsory courses based on sustainable development for all students, to green courses and to create the possibility of specializing in SD in all regular master's schools.*
- *Develop conceptual initiatives in research, in particular in radical innovations for SD.*
- *Start up a plan for change as part of the UPC declaration by the end of 2005.*

These conclusions provide the inspiration for the new sustainability plan that will be carried out in the period 2006-2015.

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4. Excepts from Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability

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Background

In 1998, the Commission on Sustainable Development called for UNESCO to develop guidelines for reorienting teacher training to address sustainability. In turn, UNESCO created a UNITWIN / UNESCO Chair on Reorienting Teacher Education to Address Sustainability at York University in Toronto, Canada. The Chair established an International Network of 30 teacher-education institutions in 28 countries to address this issue. The International Network met in October 2000 and began planning strategies and methods for moving forward. Over the next four years the network members continued to try to reorient their practices within their own institutions. This paper reports on the result of their efforts. It is born of practice informed by theory, not the musings of people who simply imagine how to proceed.

The international network undertook many types of initiatives in their efforts to reorient teacher education to address sustainability, such as curricular development, programmatic change, faculty development, networking, publishing, and forming partnerships. The members met with success and obstacles.

Guidelines for Reorienting Teacher Education to Address Sustainable Development

In order to reorient teacher education to address sustainability, we needed to examine the major tenets of sustainable development and apply them to education and teacher education. As we examined the ideals that currently underlie sustainable development, we identified societal goals – environmental stewardship; social equity, justice and tolerance; and quality of life for all people in this generation and the next - that ESD would most likely address. And in democratic societies, ESD is created through a process of public participation and addresses community-based decision-making.

To begin the process of reorienting teacher education to address sustainability, faculties of education around the world must draw their own thematic guidelines based on descriptions and ideals of sustainability. Although many idealistic and wholesome descriptions of the conceptual underpinning of sustainability and sustainability education exist, faculties of education must decide which themes to emphasize within their curricula, programs, practices, and policies to ensure that teacher-education programs fit the environmental, social, and economic conditions and goals of their communities, regions, and nations.

Initiatives Taken by the International Network

Members of the International Network undertook many types of initiatives in their efforts to reorient teacher education to address sustainability in their home institutions, provinces, nations, and internationally. Their efforts affected curricula, programs, practices, and policies within their institutions in locally relevant and culturally appropriate ways. Their activities stimulated the growth of regional, national, and international networks. They used a wide variety of forums available to teacher educators (e.g., conferences and journals) to advocate for ESD. Members kept track of their efforts in journals, chronicling their efforts, successes, and failures. Members of the International Network created and implemented the following activities related to ESD:

Curricular / Program Development

- Developed graduate level programs at Masters' and PhD levels in ESD.
- Developed a compulsory ESD course for Masters' programs in Geography and Environmental Education.
- Established Advanced Certificate programs in ESD.

[1] This paper is extracted from the research report to UNESCO on The Reorienting Teacher Education Project.

- Established distance education courses in ESD.
- Established an Environmental Education concentration in the College of Education's Masters' Degree in Curriculum and Instruction.
- Established short in-service courses for teachers.
- Reviewed and revised existing courses to address sustainability.
- Infused ESD into all Math, Science, Geography, and Technology courses.
- Infused ESD into other disciplines at undergraduate and graduate level programs such as agriculture, population education, and consumer education.
- Initiated programs with Women's Studies, Women in Society, Women in Agriculture, and Women's Literacy.
- Devised an ESD project using literature and language arts at the secondary school level to address male youth violence and to deliver skills in conflict resolution.
- Launched an Aboriginal Studies programme with a focus on ESD and traditional ecological knowledge.
- Assisted in infusing the concepts of sustainability into dissertations and graduate research as an option.
- Pursued research projects in ESD

Institutional Change

- Formed Institutes and Centres for Sustainability Education.
- Formed institution-wide ESD committees and discussion groups.
- Launched a Cyber-Environment Education Institute.
- Developed ESD internships for students from other countries.
- Established an interfaculty Research Institute on Innovation and Sustainability.

Faculty Professional Development

- Pursued European Union funding for faculty training in ESD.
- Developed interfaculty exchanges related to ESD among universities.
- Established a national ESD professional development consortium.
- Held institution-wide, national, and international conferences and workshops on ESD.

Launched an international peer reviewed journal on ESD

- Formed four international regional networks of faculties of education related to ESD and reorienting teacher education, which involved approximately 70 faculties.
- Established an ESD link with schools in another country.
- Developed a regional strategy for ESD.
- Established a language-based ESD network in Europe and the Americas in English, Portuguese, and Spanish.

Partnerships/Community Service

- Formed partnerships with local / regional government and nongovernmental organizations (NGOs).
- Developed recognition programs for schools and institutions that promote ESD (e.g., green school movement).
- Formed Sustainable Business Partnerships to promote ESD.
- Undertook research on infusing ESD into teacher education on a national level.
- Engaged geographic information systems and other information technology approaches to monitor community sustainability issues.
- Developed community-based off-campus teacher education projects within the innercity to improve the delivery of schooling to undereducated youth.

- Formed regional ESD curriculum-writing teams.
- Developed link between the faculty of education and the school of business to co-develop professional development programs on ESD for senior level education administrators.
- Produced manuals, texts, and other sustainability teaching resources for elementary and secondary schools.
- Translated key ESD materials, including the *Education for Sustainable Development Toolkit* Web site, into local languages.

Promotion of ESD

- Raised the level of awareness of ESD through many activities by writing journal articles and popular press materials; giving media interviews, lectures, and presentations at conferences; contacting academics and educators in many disciplines; and speaking with higher-education administrators around the world.
- Delivered copies of Agenda 21 to all faculty members in the six largest regional universities.
- Designed programs to model ESD practices within an institution.
- Produced sustainability demonstration sites that address energy conservation, organic agriculture, wastewater treatment, etc.
- Participated in a national committee to rewrite teacher education certification requirements.
- Use the Earth Charter as a framework for the development of presentations and workshops.

Challenges to ESD and Enablers

While many nations around the world have embraced the need for education to build capacity to achieve sustainability, only limited progress has been made on any level. This lack of progress stems from many sources. In some cases, a lack of vision or awareness of the role education could play in achieving sustainability has impeded progress. In others, it is a lack of policy or resources such as funding. None of this surprises anyone who works in an institution of higher education (IHE) and who has been involved in the change process. Everyone, who has somehow shaped change at an IHE knows, change *is* possible, and it *does* happen.

Challenges to teacher education reorientation

Some of the more prevalent challenges reported by members of the International Network for reorienting teacher education to address sustainability fell into the following categories.

Institutional Awareness, Support, and Resources

- Official national and provincial curriculum rarely mandate sustainability;
- Teacher certification guidelines do not mention sustainability;
- Lack of trained professionals who are knowledgeable about ESD;
- Lack of funding and material resources;
- Lack of national, provincial, and local policy to support ESD;
- Lack of an institutional climate that supports creativity, innovation, and risk-taking, which are necessary to support transformative efforts to reorient education to address sustainability;
- Lack of reward for institutions or faculty members who undertake ESD programs.

Prioritizing Sustainability in the Educational Community

- Lack of awareness of importance of ESD;
- Lack of knowledge of ESD complicated by the lack of access to inservice training related to ESD;
- Lack of support from the ministries of education.

Reforming Education Systems and Structures

- ESD is not part of ongoing educational reform;

- Prevalence of traditional disciplinary curriculum frameworks makes incorporating sustainability, which is transdisciplinary, arduous.

Establishing and Sustaining Partnerships

- ESD programs are often developed without local community participation or involvement of other stakeholders leaving the program without local context or relevance;
- Lack of coordination of effort between ministries of environment, education, health, agriculture, etc.

Lessons Learned: Communicating about sustainable development and ESD

1. Use the vocabulary of your audience to promote ESD
2. Link the strengths and passions of others to sustainability
3. Describe ESD as a solution to an existing educational issue
4. Use all three strands of sustainability to promote ESD
5. Promoting ESD: a priority for years to come

Recommendations Relating to Institutions of Teacher Education:

1. Recommendations Regarding Ministerial and National Level Involvement

Because many curriculums - primary, elementary, secondary, and teacher-education - are mandated at the provincial / state or national level, those who promote reorienting teacher education to address sustainability often find themselves talking to and working with officials of ministries of education.

Recommendations:

1.1 Work with ministries of education to make ESD a mandatory part of elementary and secondary education at national and provincial levels.

1.2 Work with ministries of education to revise teacher education and certification requirements to include ESD and to align these revisions to correspond to the ESD components of elementary and secondary education.

1.3 Work with the ministries of education to create policy to support ESD.

1.4 Work with the ministries of education to create professional development programs related to ESD for teacher educators.

1.5 Engage teacher unions and national certification boards in the conceptual development and implementation of ESD.

1.6 Develop a strong national coordination team for ESD that includes professional organizations and issue-related educational organizations (e.g., consumer education, environmental education, and equity education) to integrate their work with institutional ESD initiatives through cooperation, collaboration, and sharing of ideas.

1.7 Work with national publishers and textbook committees to infuse sustainability into textbooks at all levels.

The report went on in this same way to address recommendations in the following spheres: Community and Regional/Provincial Involvement, Institutions of Higher Education, Faculties of Education, Engaging Pre-service and Inservice Teachers, Individual Faculty Members, Funding and Other Resources, Partnerships, Research, Communications, and finally Information Technology Opportunities

Conclusions

Many survey respondents repeatedly mentioned the urgency to act and the need for profound change. Bringing quality education to the schools of the developing world competed for importance with the larger question of "what kind of education would best serve humanity in the future?" This led to the general agreement that reorienting our current education systems—especially in the North—was an essential task. At the heart of this task is reorienting teacher education. An International Network member stated, "For the fulfillment of the objectives of

ESD and effective teaching of the subject, a complete transformation in our teacher training programmes is needed." Another claimed:

> *There is an urgent need to re-examine the nature and structure of schooling in a more critical way to address [ESD] in its broadest context (i.e., school organizational principles, operational practices, school grounds management, and curriculum content). We are faced with a paradox: Is education the problem or the solution in working toward a sustainable future? At current levels of unsustainable practice and overconsumption it could be concluded that education is part of the problem. If education is the solution then it requires a deeper critique and a broader vision for the future. Thus, whole systems redesign needs to be considered to challenge existing frameworks and shift our thinking beyond current practice and toward a sustainable future.*

While many spoke of the enormity of the task at hand, all who participated were able to make significant and positive inroads. Interested individuals operating within their own spheres of control (e.g., weaving sustainability themes into their own classroom curricula) made great headway reorienting their programs. Also, many institutions were able to develop new courses at both the undergraduate and graduate levels.

Problems arose when the Network members advocated for change beyond the sphere of direct control. The lack of mandate from institution and ministry policies relegated the initiative to an optional realm where already busy faculty members were hard to recruit. Furthermore, the lack of resources, such as an existing research agenda for ESD, also hindered the development of ESD within the institutional setting.

As expected, ESD within teacher-education institutions is currently endorsed by early-adopters. However, it will take concerted effort and resources to institutionalize ESD into programs, practices, and policies as well as the entire teacher-education curriculum.

As teacher educators, the challenge is ours to accept or ignore. Success or failure, however, will also depend on attention from provincial and national governments that set and fund educational priorities.

5. An Integrated, Interconnected, Multi-disciplinary Approach for Fostering Sustainable Development at the Monterrey Institute of Technology, Monterrey Campus

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Abstract: An ongoing effort to use an integrated, multidisciplinary approach to foster and consolidate Sustainable Development (SD) efforts at the Monterrey Institute of Technology, Monterrey Campus is presented. The six primary focal points of the Sustainable Campus Programme are presented. They include academic issues, physical plant operations, research, societal outreach and diffusion. The activities in each focal point are interlinked with the efforts of the others in order to provide a strong, campus-wide "sustainability fabric" that is helping us to deepen and broaden our sustainability efforts. Clustering separate activities and enhancing them through this overarching effort has been found to provide synergistic results. Drivers and barriers are presented and discussed in order to serve as another example of campus engagement of administrators, faculty, staff, students and society-at-large in the global journey to sustainability.

The journey towards SD started some time ago in Monterrey Institute of Technology's thirty-three-campus system. The system's 2005 Mission statement, originally developed in 1995 stated explicitly: *"….. Carrying out research and extension relevant to Mexico's sustainable development is also part of the Institute's mission."* And important actions have been carried out throughout these last ten years, promoting in many ways SD.

However, at the beginning of 2005 new Mission and Vision statements were announced, wherein a substantially deeper and more explicit commitment to SD was clarified (Tec de Monterrey 2005). The statements include several Principles, among which number five is the Principle of Sustainable Development that is stated as follows:

> *"Tecnológico de Monterrey is committed to sustainable development, and manifests this commitment in all of its activities by promoting a balance between economic, social and environmental factors, over time. It also promotes this commitment in the preparation students receive."*

In this context, Tec's deliberate commitment towards sustainability is clarified and put in context with the following statement:

Monterrey Tec, being a private, higher educational institution demands a link with enterprises and the community to ensure that our education, research and outreach always have societal relevance. Curricular updates are necessary, in order to educate future professionals with appropriate attitudes, values, knowledge and skills, that will be needed as they engage in more sustainable occupations throughout the country and world.

As in any other human organization, from time-to-time, ideas and concepts appear and start resonating within the system; some fade away and others gain momentum. Also "champions" grasp the relevant concepts and promote them with zeal and hope the others will also become engaged in the near future. This is the case in Monterrey Campus; several persons have been committed to SD; among them some members of top management, academic directors, educators, professionals, as well as students and members of Tec's Governing board.

A thorough discussion regarding Sustainable Development was done about five years ago. At that time the then recently appointed Campus President, Dr. Alberto Bustani, decided to support what came to be known as the *"Sustainable Campus Programme,"* (SCP). As a result of this support, a programme was developed that was designed to encompass a wider, more inclusive view of Sustainable Development in Tec's educational, research, outreach and campus operational activities.

The programme was designed to underscore and act upon the fact that most contemporary institutions of higher education are formed by the interactions with and in response to diverse stakeholders. In order to make progress on the journey toward SD, these stakeholders and the universities must work in harmony and unison.

Tec's SCP has the following six main objectives:

1. Weave SD concepts, as the "Golden Thread," throughout all courses and curricula at the undergraduate and graduate levels.
2. Perform campus operations in ways that are based upon Sustainability criteria.
3. Ensure that Sustainability is incorporated, as the contextual framework, for disciplinary and multidisciplinary research.
4. Coordinate and integrate Tec's Societal Outreach, among stakeholders that play important roles in Mexican and Latin American Societies.
5. Prepare and disseminate, internally and externally, regular reports of Tec's SD, plans, programs and progress.
6. Support, plan and hold "High Level Conferences" on "Conservation and Sustainable Development," twice a year, in coordination with the Mexican, National Secretary of Environment and Natural Resources.

Of course such broad and all-encompassing goals needed specific actions for each one considering also their interconnections and hoped for synergies. At the same time, the Monterrey Campus is related to thirty-three other Tec System Campuses; hence those activities are to be integrated and applied throughout the entire network. This is underscored at the beginning of Tec's new Mission and Vision statement for 2015, which serves as a general frame of reference that supports the implementation of SD throughout the entire thirty-three campus network. However, since each of the campuses has a vast degree of freedom, each campus team may select its own ways of implementing SD on their campus. This process will be promoted and supported throughout the Decade of Education for SD. Tec's new Mission and Vision are already proving to be an excellent catalyst and guide for promotion of SD.

But as usual not everything is as easy as expected. In any organization, barriers to change are present for each specific goal that is proposed and tried. In this context, we describe for each goal, the strategic choices, as well as the barriers and how we are seeking to overcome them.

1. Weave SD concepts, as the "Golden Thread," throughout all courses and curricula at the undergraduate and graduate levels

In our process of seeking to increase SD throughout the curricula, we began by reflecting upon the lessons learned by our first efforts to do so that occurred several years prior to the SC Programme. At that time, a mandatory course for all students in all careers was given. The title of this course was "Ecology and Sustainable Development." Of course, every Campus has a students' feedback structure that is used to guide course changes. Feedback for this course revealed that it was too biased towards ecology. Unfortunately, the educators in charge of giving the course did not take proper and prompt action to change the course accordingly. Consequently, when the course was changed from mandatory to voluntary, enrolment in the course diminished dramatically. This was a clear signal that it did not have the supposed general appeal to all students in all curricula.

Hence a different approach was taken; we invited educators who wanted to learn more about SD to participate in a two and a half-day course designed to provide materials and experiences in introducing SD into their courses and curricula. Those who volunteered and who are now working to introduce SD into their courses are called the Tec. SD "champions." They did not need to be convinced of SD's importance, but they benefited from being provided the opportunity to participate in lectures, debates, discussions and to work together with other colleagues to plan how they will further enhance the weaving of SD as a golden thread throughout their teaching efforts.

Thus, a two pronged program evolved: a. the SD "champions" were educated and empowered to move forward. b. the top management of Tec officially supported their efforts and encouraged others to do so too. (This is also reflected in the new mission, vision and strategy statements for the entire thirty-three campus network of Monterrey Tec.)

Giving the status of compulsory or mandatory to the latter actions was deemed to be inappropriate because it might backfire and result in increased resistance to change courses and curricula. Therefore, it was and continues to be totally voluntary for faculty to become engaged in SD in their teaching.

A two and a half day course on SD was designed and provided to those educators who wanted to take the lead as SD "champions." The two main goals of the course were:

a) To establish a common ground for the faculty about SD concepts, by clarifying and expanding upon the three dimensions of SD and by ensuring that all understood the crucial fourth dimension, **time** in SD.

b) To provide educational materials and collegial support to the educators during and after the course so as to help them complete the SD course and workshop with specific actions they planned to implement within their own courses.

As the result of a team of experts in various SD aspects, offering this course on SD four times during three years, approximately 100 educators have taken the course and are progressing in weaving SD as a golden thread into their courses and curricula.

But providing education and capacity building in sustainability for the educators was found to be insufficient. We realised we needed to assess how much weaving of SD was actually accomplished within their courses after they took the short course.. For this, working in close cooperation with the Campus Academic Development Division, an assessment tool was designed and utilised that gave us the opportunity to work with the new SD "champions" to track and assess their progress in infusing SD into their courses. (See Appendix 1)

Additionally, the SCP team visited all academic divisions to promote the SD efforts and to encourage additional faculty members, in all divisions, to incorporate SD into their curricula.

The faculty members of all divisions listened attentively but not very many of them accepted the invitation to also become SD "champions." These faculty members perceived this invitation as an additional academic load that did not address details of implementation; consequently, because they did not deem it to be important they gave it low priority. (This was due, in part, because they did not have a good understanding of the relevance and urgency to learn about and to teach SD concepts, approaches and values to their students.)

However, since early 2005 when the new Mission and Vision for 2015 was announced; it is acting as a promoter of interest in SD because people now perceive that the issue is relevant for the whole institution and that they also need to become involved in teaching SD.

Monterrey Tec's future professionals are strongly linked with enterprises in diverse economic sectors, some of them will soon be working in decision making positions. Also, Monterrey Tec's board members in the various campuses come from successful regional enterprises. Being a private higher educational institution, it has been standard practice to assess the probable labour market for our graduates, responding according to the findings by modifying and rendering the curricula up to date for existing and new careers. Additionally, there is a strong social and community commitment in Monterrey Tec. For these reasons we reinforced our links with the new corporate vision on SD as will be described following.

Additionally, Tec hosted the Business Council for Sustainable Development-Latin America Chapter of the WBCSD for a number of years. Through this partnership many excellent working relations have been established with Latin-American enterprises for promoting eco-efficiency, discussing and assessing global climate change and many other, relevant issues.

Based upon this partnership with WBCSD many SD efforts are increasingly resonating in a dynamic manner throughout the campus. An example of a subsequent step in the partnership is

the strategic action that was taken in planning the use of the on-line *'Chronos'* course, developed between the WBCSD and the University of Cambridge, to bolster SD awareness and commitment among people in companies. Although the course was designed for those already working in businesses, a pilot study was done to ascertain its possible use in the Campus. Among the various reasons to use *'Chronos'* are the fact that it has been designed to foster individual and organizational value's clarification towards SD, and that there are important international businesses in the WBCSD, who state that their journey towards sustainability is important to them.

For implementing *'Chronos'* in the Campus the mandatory "seal" courses were used. These courses are given for all careers in all academic divisions, as well as they are given at different stages within the 9 semesters that most student majors require. That allows the faculty to cover a very wide array of issues. Overlapping was minimised, in that different "seal" courses used different parts of *'Chronos'*.

To date, we have 83 educators who have incorporated SD concepts into their courses. Further, approximately 10,000 students have taken *'Chronos'* in various courses throughout several academic divisions.

2. Perform campus operations in ways that are based upon Sustainability criteria

Improving campus operations was also very urgently needed, because "we needed to practice what we were preaching", undergraduate and graduate students very quickly detect any lack of congruence in Campus projects or programmes with the SD concepts that some educators have woven into their courses.

For the physical plant operations, a set of indicators was generated based upon the basic principles of Eco-efficiency. These indicators were used to monitor the trends and quantities of water and energy usage as well as those of paper, cardboard, aluminium and PET plastic recycled.

The time course data for five years of Tec's per person energy and water usage as well as paper collected for recycling are plotted in Figures 1 to 5. The results indicate that progress has been made but we also used the data to identify additional places and ways that further improvements could be made.

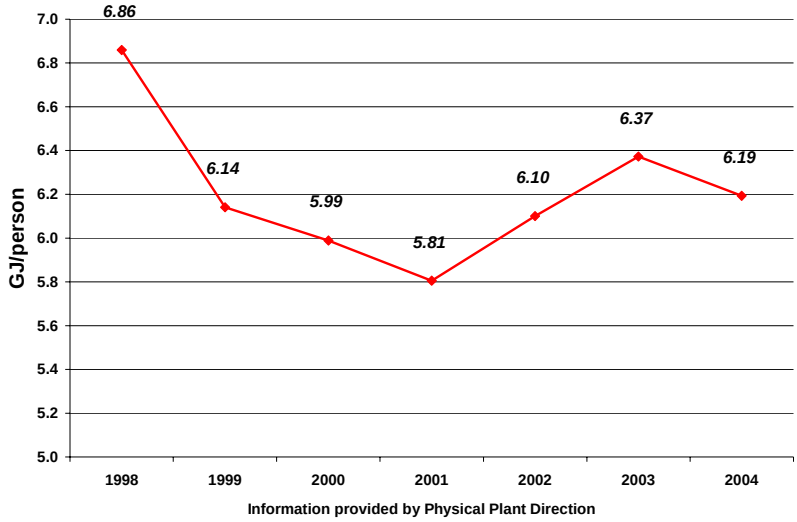

Figure 1. Electrical energy consumption per person at the Monterrey Campus

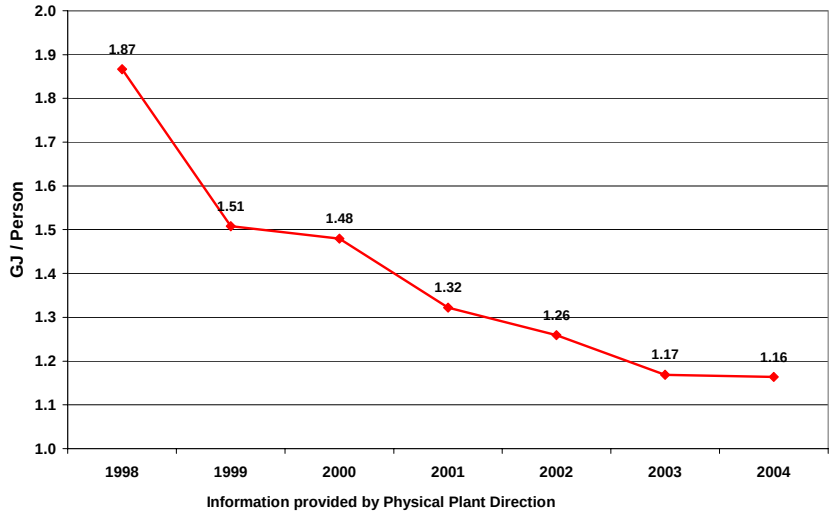

Figure 2. Natural gas consumption per person at the Monterrey Campus

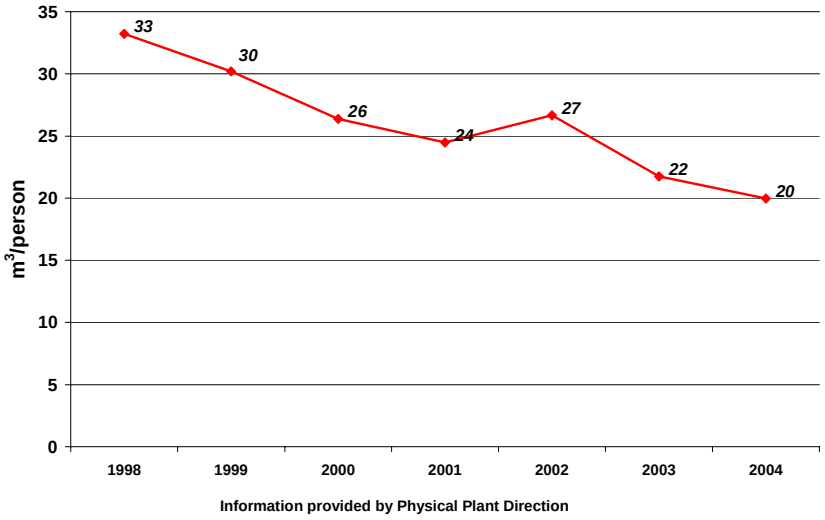

Figure 3. Water consumption per person at the Monterrey Campus

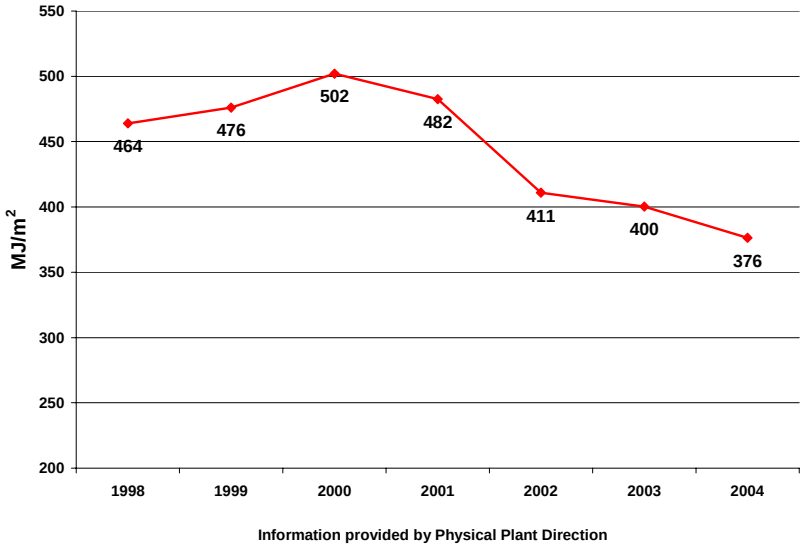

Figure 4. Electrical energy used per square meter at the Monterrey Campus

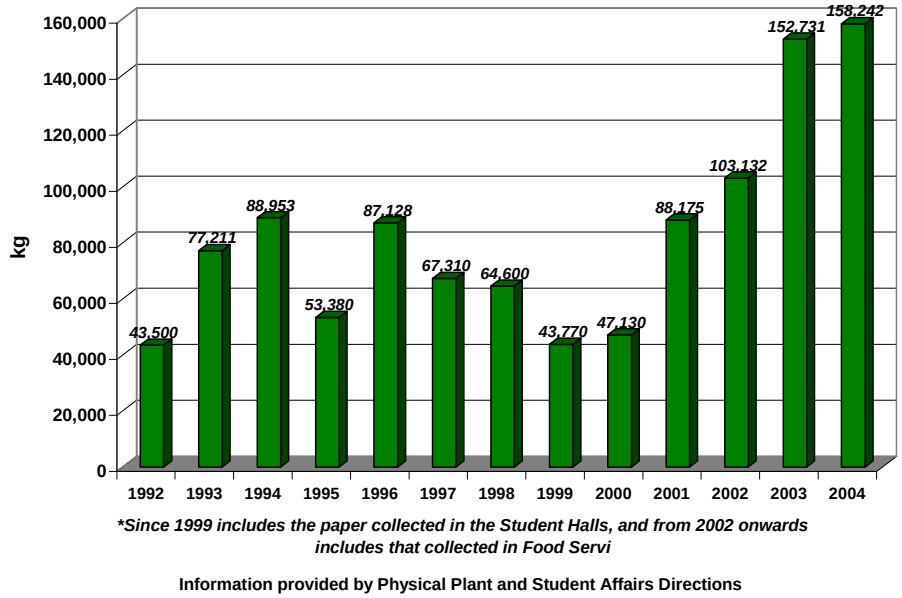

Figure 5. Paper Collected for Recycling on the Monterrey Campus

Electricity, natural gas and water use **on a per capita basis** have been decreasing in the Campus, due to many specific actions, in spite a slight increase in the total number of students and personnel.

Also the built campus area has increased in the time period shown. Nevertheless, the per capita and per square meter trend has been decreasing. This provides evidence of a more efficient resource use.

Also recycling awareness, as well as a proper and sustained collection campaign has improved paper, aluminium and PET plastic recovery.

It is important to state that collected used PET plastic could not be sold a few years ago, due to a lack of market value, but fortunately an association was recently formed, that is promoted and fostered by the main bottling companies in Mexico. This has generated a market demand for recycled PET bottles.

Furthermore capacity building in SD for union and administrative personnel has been provided.

Wastewater treatment is provided by a new facility, where treated water is used for watering Campus landscaping.

Life appreciation through Campus landscaping

Appreciating life in urban societies is relevant for our student's future. Mexico has been transforming from a society that was predominantly agrarian with small cities and towns into a mainly urban one, with most of the people living in large cities. As a result, more and more people are disconnected from forests, jungles and living animals. Campus gardens and landscaping therefore can offer an opportunity to re-appreciate life in some of its manifestations and to educate students about the beauty of bio-diversity. With these concepts in mind, the campus leadership has made a complete census of the trees of the campus gardens. The data are now integrated into a GIS database (Kermath, 2006).

It was found that of the 1,878 trees on campus 74% are introduced species, alien to the region. Some of these species do not withstand the climatic conditions of Monterrey. As a matter of policy, when they die, they are replaced with local species, resilient to the local climate. Additionally name plaques that include the scientific names and the common names have been placed on most of the trees. A future project to link tree growth with carbon fixation is underway.

Public Recognition for Campus Operations efforts

Public recognition is needed for those activities within every Campus that are taken for granted, the lack of which generates a barrier for collaboration in sustainability issues, while the opposite lays the foundation for interaction and cooperation between academia and physical plant.

The main barriers we encountered for cooperation was lack of recognition for achievements made in improving the physical plant operations and the lack of time for interactions and sharing due to work overload. This resulted in little or no time for general discussion, meetings, planning and acting. Trust among different Campus parties is another issue of concern regarding barriers, which was linked to lack of recognition.

Although trust is a strong cultural and societal issue in Mexico, it also generates a certain drag, as well as it makes any project advance at a slow pace. However recognising that "lack of trust" is a potential barrier, encourages one to keep the process proceeding by strategically improving and maintaining the lines of communication among the various stakeholders.

This is, however a tiresome, slow task, but it is also essential; in the sense that one can turn a barrier into a promoter if it is managed properly.

Having a Campus that serves approximately 17,000 students, requires efficiently designed and implemented physical plant facilities. Some of the eco-efficiency efforts on energy and water use efficiency improvements can be used for academic purposes. But this issue has a double edge to it. Physical plant operators and the management are reluctant to provide the academic service because what they want is to provide Campus services, no matter what; but academicians would sometimes like to experiment with certain parts of the Campus utilities for pedagogical purposes. Such experiments might bring about dramatic improvements but also may cause a certain utility to temporarily provide a less than optimal service for the Campus. As can be inferred from this illustration, by not achieving trust and reaching a compromise and commitment from both parties, a huge barrier for cooperation can appear. Understanding from the academicians that the physical plant needs to provide a flawless service and that there are certain facets of the utilities that can be used for pedagogical purposes can increase interest on the part of the physical plant personnel to co-work with the educators in such experiments. This is the strategy we have adopted and are still testing as we continue to build bridges among the educators and the physical plant personnel.

One such example is a "biodiesel" production experiment based upon used cooking oil from the cafeterias. This is a project between academia and the area that co-ordinates bus transportation for students. The "biodiesel" produced is used as fuel for the buses.

3. Ensure that Sustainability is incorporated, as the contextual framework, for disciplinary and multidisciplinary research

Research has been an important issue in Monterrey Campus for quite some time, but has been mainly organised along the typical disciplines and was usually performed by single researchers. Because Tec's top management is committed to SD, it was clear to them that multidisciplinary research had to be promoted from the top down. The need for this type of research was clear from a sustainability frame of reference, that no single discipline was capable of carrying out meaningful SD research. As a result Tec's System obtained and utilized seed funds to establish and support twenty-four multidisciplinary research chairs.

A powerful barrier to fostering and performing multidisciplinary research is due to the fact that recognition, at various levels, comes from within the disciplines, hence establishing research groups with researchers from different disciplines is difficult and is often considered to be an academically improper way for universities to organize their research activities. Hence to lower the hurdle and to promote multidisciplinary research on SD was a "raison d'etre" for initiating these interdisciplinary SD chairs.

The following are examples for some of the multidisciplinary research chairs relevant to SD that were established.

Environment

Nature Services: Economical and Ecological assessment as a key factor for sustainable development
Ecosystems services values in the hydrological cycle
Carbon capture in north-eastern Mexican ecosystems

Life Cycle

Management of products' life cycles and their relationship with businesses' sustainable competitiveness in international environments.

Water

Sustainable use of water in north-eastern Mexico.

Energy

Modernisation of Mexico's energy sector: A sustainable approach.

Housing

Development and innovation of housing processes and technologies.

4. Coordinate and integrate Tec's Societal Outreach, among stakeholders that play important roles in Mexican and Latin American Society

Another important strategy to foster SD has been interacting with the Community Social Service; this is a unique opportunity to provide awareness to our students, regarding the social needs for Mexican society. Poverty is an important issue in today's Mexico.

Every undergraduate student in the Tec system has to contribute 480 hours of social service, half of which (280 hours) must be done in the Community social service structure of the Campus. Normally, young people used to work in low-income communities near the Campus; thereby, providing inputs on different ideas, projects or services, but once they had finished their required time, the projects and ideas were usually left adrift.

Therefore, Tec's top management considered ways to provide a well-structured programme to render each community with an effort that would continue in spite of the fact that individual students had finished their individual social service time.

To accomplish such longer term, SD focussed project opportunities for the students and for the community, the SCP provided capacity building in SD to several institutions that help the Monterrey Campus in the Community social service programme. This medium term goal is a way of promoting the weaving of SD into Tec's community outreach. It is anticipated that this will have significant SD reverberations on the campus and within the community outside the Campus.

An effort that has been carried out for more than a decade is the link with FOMCEC (an NGO that fosters environmental consciousness), which has been working closely with the State department of education with kindergarten, primary and secondary schools to certify them as "green schools". Amplify upon this as it is very important. Further, what else is planned in co-working with FOMCEC?

Analysis and Conclusions

To discuss and analyse the drivers and barriers one needs a certain type of structure, otherwise addressing sustainability fostering in higher education institutions might result in a non-comprehensive scheme or one that is extremely simple. Nevertheless, all persons, who are engaged in weaving sustainable development within this HEI, need this structure.

McKeown 2002, Lozano 2003 and Lidgren 2004, as well as Shriberg 2002 discuss assessment tools for, ways to foster implementation and ways to characterise and overcome the barriers that often impede the incorporation of SD into HEI. They also highlight the importance of using good monitoring, feedback as well as reporting mechanisms so that the university community is kept informed, involved and motivated.

As presented in the preceding sections of this paper, faculty, staff and students are using a multi-tiered approach to diffuse SD throughout the campus and in the surrounding communities. This is focussed primarily on a two-pronged approach:

Firstly, it is important to underline that each individual contributes to the Institution's viability in accordance with the institutional Vision and Mission. We are fortunate to have a number of visionaries that have provided breakthrough guidelines for future actions.

Secondly, we need and have increased numbers of educators who are seeking to implement SD visions into action within Tec. Part of our future efforts are focussed upon disseminating and helping to infuse that vision to a second echelon of educators that are convinced that these concepts should be incorporated into their courses, research and outreach. This is part of our capacity building effort. This is an on-going effort that must be supported, monitored and reported upon within and beyond the campus community.

Establishing a common ground to understand, discuss and launch SD is part of that capacity building, first through three-day courses that laid the SD educational foundations for participating educators. We are now developing an *'in-depth,'* integrated, multi-disciplinary course on SD for educators, where the complexity of SD is developed more fully within the three dimensions of sustainability and also integrating the time dimension as the fourth element.

We are also using the Chronos course to make our students, educators, staff and directors more fully aware of SD's importance.

It is essential for us to underscore the crucial role of top management commitment and support for SD. This is clearly stated in Tec's new Vision and Mission statements, which provide a solid frame of reference for supporting and endorsing SD implementation activities.

Although good progress has been made, as in any human organization, barriers have appeared.

From the individual stance there are two main barriers. First those persons that listen attentively seem to be interested and then they return to their base state of lack of efforts on SD. There might be two explanations for this type of action/inaction. One is personal time over-commitment. This is partially due to the fact that since Tec is a private institution that is largely supported by student tuition, consequently much is demanded of all educators to provide extensive educational services. Thus, they have little time to make course changes to incorporate new ideas and concepts such as SD.

A second barrier is based upon the fact that humans do not usually like to make changes. A third one is represented by "small feuds" within the institution guarding their responsibilities as their own personal impregnable turf.

Additionally, from the Tec organization, as a whole, we have detected several barriers. For example lack of proper communication within the organization, connected with people's time overload is a barrier to achieve progress towards SD.

The number of students has increased 60% during the last decade, but internal management and administrative structures have lagged behind in adapting to this increase.

Secondly, being such a large organization, Tec administration has failed to properly gauge the amount of time that is required to make changes. Some can be done in a semester but others require a substantially longer time to be successful (Downey 2004).

For example, although SD concepts have been incorporated in a number of courses, there is a periodic curriculum and course revision, hence that would be an especially good time to challenge the educators to weave SD's "golden thread" into their course(s), just as they engage in the normal course revision. This is an example of proper timing to achieve a wider impact.

In conclusion, we are optimistic that the Tec is on the SD journey. It must continue on the journey. It must also share and learn from other academic systems as they too continue on the SD journey. We invite your feedback and assistance as we move together into a more Sustainable Future!

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Appendix 1

	Assessment Criteria to integrate Sustainable Development concepts in Courses and Academic Programmes for Monterrey Campus	Date: 21 May 2003. Version: 1.0

VARIABLE	BASIC	INTERMEDIATE	ADVANCED
GOALS AND CONTENT	A theme or sub-theme is included regarding the study of Sustainable Development aspect. The course requires, at a certain stage, that students acquire basic information regarding SD.	Sustainable Development aspects are included in several course modules or thematic units. The course requires that students systematically incorporate the SD perspective in their main subject area.	Sustainable Development constitutes an integral course aspect, which reflects its various components (intentions, goals, content, activities, evaluation, etc.). The course provides to the student a wide conceptual basis about SD, from the profession or main subject perspective; developing complex skills for planning, decision making, etc; prepares to handle tools for SD planning and assessment indexes; foster that students adopt a leadership role in SD, as well as active participation in SD projects or local problems.
APPROACH	SD is approached from a partial perspective. (For instance: only environmental aspects).	SD is approached from a multidisciplinary perspective (several disciplines contributions)	SD is approached from an inter and trans-disciplinary perspective, taking into account in an integral manner the environmental, economical and social aspects.
DIDACTIC STRATEGY	The course includes learning activities inside or outside the classroom, oriented in such a way that the students obtain basic information about SD themes or problems (reading material, information acquisition, etc.).	The course includes learning activities inside or outside the classroom, oriented in such a way that knowledge and skill development are acquired about SD themes or problems (discussions, debates, essays, etc.).	The course includes application or integrative activities inside or outside the classroom, requiring knowledge, skills and attitude learning on SD aspects based in problem, case or project solving.
INFORMATION RESOURCES	In some course theme or sub-theme bibliographic references related to SD are included; that are optional reading material for the student.	In various course modules or didactical units bibliographic references related to SD are included; that are mandatory reading material for the student.	An ample list including information sources is provided; in various formats (books, articles, and peer reviewed journal articles); preferably recently published (2000-2005); which should be related to SD from the discipline perspective, and mandatory reading for the student.
EVALUATION	Information knowledge and basic concepts are evaluated through written exams.	Concepts comprehension, as well as some skills are evaluated in relation to SD.	Knowledge, skills, attitudes and values learning are evaluated in a continuous and integrated with other course contents. Projects, field work and other final deliverables, including assessment criteria related with sustainability.

6. Curriculum Transformation in Higher Education Institutions: Some Perspectives from Africa

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Abstract: This paper draws on experience gained in the Southern African Development Community (SADC) Regional Environmental Education Programme (REEP) Course Development Network (CDN): a participatory support programme for course curriculum development in the southern African region, involving 12 institutions. The paper outlines some of the contemporary epistemological and pedagogical challenges facing African Higher Education Institutions (HEIs), as these relate to 'sustainable development'. The paper examines four case studies of curriculum change in 4 Universities, arguing that African Universities, like HEIs elsewhere, may need to take more careful account of the interplay between structure and agency, to understand how different factors enable and constrain agency and how this interplay may result in morphogenesis (change).

Africa's Development Path

Southern Africa, together with the African continent as a whole, holds a marginal economic position in the global context. Reduction in poverty achieved so far is not 'in pace' with the minimum standards set by the Millennium Development Goals. The regional growth rate of 3.2% achieved in 2002 is far from the target growth rate of 7% required to halve poverty by the year 2015 (SADC, 2003:3). A close relationship exists between poverty and environmental degradation, particularly when high levels of dependency on natural resources occur. 75% of the population in southern Africa live in rural areas, and are heavily dependant on natural resources for livelihoods. Southern Africa is also heavily affected by the HIV/AIDS pandemic with infection rates ranging between 25-40% of the adult population in many countries, presenting the region with an extreme humanitarian disaster that will affect social, economic, health and education systems in devastating ways in the next twenty-thirty years (Barnett & Whiteside, 2002). The SADC Integrated Committee of Ministers emphasise the need to urgently address resource *and capacity constraints* (SADC, 2003: 3), highlighting an important role for HEIs. The New Partnerships for Africa's Development (NEPAD) (2003) indicates that an *interdisciplinary response* is required to address development issues in Africa, which would seem to imply that all lecturers in HEIs need to become engaged in curriculum change processes.

Challenges for African Higher Education Institutions

On the face of it, this would simply require HEIs to change their curricula and their research priorities. However, the complex nature of environmental and sustainability issues produces a more complex epistemological challenge. African societies are faced with a 'double risk' factor, namely environment and sustainability risks associated with production (e.g. pollution, migrant labour etc.) as described by Beck (1992) *and* the risks and vulnerabilities associated with poverty (Le Grange, 2002; Fakir, 2002). Epistemological challenges result as the consequences of risks can only be partially known and many 'solutions' remain open ended, and fallible, as scientific certainty remains elusive. An added complexity in an African context is the relatively poorly documented nature of African epistemology. The contemporary globalising discourse of 'internationally acceptable standards' is, in many ways, retarding opportunities for deliberating African epistemologies as most HEIs attempt to compete according to these 'international standards'. The influence of globalising discourses is also felt in the arena of sustainable development. In their assessment of the World Summit on Sustainable Development outcomes, African authors Bond and Guliwe (2003) together with other activist groups from southern countries (Bissio, 2002; Fisher & Ponniah, 2003) question whether *genuine* sustainable development can emerge from Washington-centred geo-political power relations, Northern

corporate privilege and Southern leadership 'compradorism', and neo-liberal orthodoxy, indicating a need for policy critique as well as policy implementation.

Commenting on the influence of neo-liberal orthodoxy in society, Bourdieu (2003) remarks that there is a real danger that an abasement of culture and minds can result from a narrowing of education and curricula according to neo-liberal doxa (which some argue has appropriated sustainable development discourse). Bourdieu (2003) argues that academics have a responsibility to engage critically and pro-actively within an increasingly complex epistemological environment, and a failure to do so may leave social scientists with an objectivity that appears to be little more than a form of censorship. Bourdieu (2003) and Touraine (2000) are among some of the influential European sociologists that argue for a 'new role' for Higher Education in society. They argue against a 'fake universalism' which results from standards-based thinking, universal definitions of a global development path (i.e. sustainable development thinking) and the universalist path set by neo-liberal orthodoxy.

Creating the Organisational Means for Change

Bourdieu (2003) argues for a 'scholarship of commitment' in which an *organisational means* is created for competent researchers to unite their efforts with those of responsible activists in ways that allow for a collective discussion and elaboration of a set of analyses and proposals for progress that do not exist only in the 'virtual state of private and isolated thoughts or circulate in fringe publications, confidential reports or esoteric journals' (pg. 16). He asks whether intellectuals / research scholars can interject themselves into the various social movements (e.g. the environmental and health movements) that are active at the national and international levels. Both Bourdieu (2003) and Touraine (2000) argue that HEIs have an important role to play in inventing a new manner of doing politics. At a more practical level, they argue that academics (HEIs) should '… organise or orchestrate joint research on novel forms of political action, on new manners of mobilizing and of making mobilized people work together, on new ways of elaborating projects and bringing them to fruition together' (pg. 21). Curriculum change in Higher Education, when designed to address socio-ecological and other development challenges reflexively, can be viewed as a 'novel form of political action' in the sense that it has the potential to lead changes in thinking and practice.

In 2001 the Southern African Development Community Regional Environmental Education Programme (SADC REEP) established a formal Course Development Network, to provide the *organisational means* for 12 partner institutions to work together to bring about such change. This network is linked to a more informal network consisting of over 28 course development initiatives. The formal network involves six Universities (University of Botswana, University of Malawi, University of South Africa, University of Swaziland, Rhodes University in South Africa and the National University of Lesotho). A key outcome of this network was the development and reflexive implementation of at least 12 new courses in environmental and sustainability education in southern Africa, some of which are documented in a monograph entitled '*Cases of Course Development in Environmental and Sustainability Education in southern Africa'* (Lupele, 2005). A selection of these cases provides the empirical basis for further discussions in this paper.

Curriculum Change and Agency (A re-structuring process)

This section of the paper comments on some of the key dynamics that have enabled and constrained the agency of four of the course developers working within the auspices of the network. The four cases of environmental education and sustainability course development examined here include:

- ***Case 1: University of Botswana*** (Kelhoeilwe, 2005): A new participatory in-service course for teachers, developed to support implementation of environmental education policy in Botswana.
- ***Case 2: University of South Africa*** (Le Roux, 2005): A new course, based on a new qualification in environmental education, developed as a distance education course module.

- ***Case 3: Rhodes University, South Africa*** (Timmermans, 2005): A new course, based on a new qualification, developed as a semi-distance, modular course for in-service and mid career professionals.
- ***Case 4: University of Swaziland*** (Mlipha, 2005): A new short course for industry practitioners, developed and offered in partnership with key national stakeholders.

The cases are examined through analytical 'lenses' provided by Archer's morphogenetic theoretical framework (Archer, 1995), which allows for a more in-depth deliberation on social change processes, one which is not couched in rational choice discourse of 'drivers' and 'barriers' to change. The basic theorems in Archer's morphogenetic approach are that i) structure necessarily pre-dates action(s) which transform it and that ii) structural elaboration necessarily post-dates those actions which have transformed it. She proposes a basic morphogenetic /static cycle with three phases: structural conditioning (the conditions under which agency operates); socio-cultural interaction; and structural elaboration (morphogenesis) / structural reproduction (morphostasis). These are discussed in more detail in the analysis below.

Structural Conditioning

Broader contextual influences: In all cases, it was evident that the courses were developed in response to the complex array of environment and development issues facing southern African society (as briefly outlined above). Various new policies and laws have been developed in SADC countries to address these challenges, and this provides implementation challenges for local institutions (such as HEI's). Implementation of new policy formed the primary motivation for all of the courses listed above, and other courses developed in the CDN (Lupele, 2005).

Institutional structuring, hierarchy, power relations and procedures: Curriculum development in most universities in southern Africa is done by specially constituted curriculum development teams which are either constituted by senior professors or external consultants (or both) (Namafe, 2005; Nhamo, 2005; Le Roux, 2005). This system is generally hierarchical, and individual lecturers have little freedom to change curricula, without a protracted procedure which requires approval of more senior academics. This explains why two of the four cases under scrutiny here were conceptualised as 'external courses' (Ketlhoeilwe, 2005; Mlipha, 2005). Capturing some of the power dynamics at play, one lecturer describes the issue as follows "… some academic players in certain universities may assume that the task of developing a course … should be the preserve of people holding the rank of professor only" (Namafe, 2005: 18).

Agent's interests and positions: Most participants in the CDN were influenced by the institutional interests to respond to national policy and national needs as expressed by Mlipha (2005:58) "… the course attempts to facilitate the process of compliance with existing national environmental legislation and standards …". Other interests included professional academic and ethical interests such as broadening own experience and knowledge in a regional context and developing a course that engenders respect for and responsibility towards the environment (Le Roux, 2005). Others expressed an interest in quality and application of curriculum in context (Timmermans, 2005).

Evidence of rewarding or penalising experience: Most of the members of the CDN indicated that the process of interaction with other colleagues in a similar position has been a rewarding experience. Some reflected on the value of personal professional enhancement of skills and knowledge of course development (Le Roux, 2005; Ketlhoeilwe, 2005). Institutional difficulties were also noted, particularly university bureaucracy (Ketlhoeilwe, 2005). Other rewarding experiences were found in the outcomes of the courses which, for example "… enabled participants to develop relevant contextualised teaching and learning materials and learning activities" (Timmermans 2005:51).

Agent's articulation of the prevailing conditions: Agent's developing the courses were responding to diverse needs i.e. national policy, institutional procedure and regional networking experiences. Course developers commented on the challenges associated with developing a course for a wide-ranging practitioner base including teachers, conservation officers, industry

practitioners and others (Timmermans, 2005) This required course developers to introduce multi-disciplinary perspectives into the course, while at the same time addressing specific disciplinary and contextual needs of each learner group (Timmermans, 2005; Mlipha, 2005).

Socio-Cultural Interactions

Reasons for pursuing or maintenance of change: Agents involved in the course development processes all indicated that the main reason for pursuing change in curriculum was in response to national priorities as influenced by structural and cultural demands (e.g. policies, learner needs) described above. A second reason, less clearly articulated, was agent's interest in networked professional interactions at a sub-regional (international) level, and the associated possibilities for professional development.

Evidence of sacrifice for altruistic reasons: The CDN activities was said to have been time consuming as members had to meet twice a year over a period of three years, and they were all involved in developing and implementing their 'innovation' in their work contexts at the same time. Members were prepared to sacrifice their time because of the importance they attached to the process (Lupele, 2005).

Evidence of recognition by promotive interest groups*:* The CDN created opportunities for network members to present their initiatives at two southern African conferences, and at one international conference. Course developers also published aspects of their work in the *Southern African Journal of Environmental Education* (Mlipha, 2003; Ketlhoeilwe, 2003; Frölich & Le Roux, 2004; Mokuku *et al*., 2004), which has contributed to personal professional academic rewards recognised within the University system. The network was also invited to the founding meeting of an African Environmental Academics Network, and was reported as an 'exemplary case' of sub-regional co-operation in a study on HEI innovations (SAIDE, 2004). Through this visibility, the CDN has been requested to participate in an Africa-wide course development initiative, providing opportunities for further individual and collective reward and recognition.

Group interactions leading to a manipulation of knowledge*:* The scope of interactions included bi-annual discussions on the process of course development, and a sharing of experience, skills and materials relevant to course development. Regional workshops provided a forum for peer review, monitoring progress and for discussing emerging structural and other constraints, and provided a platform for further refinement of the courses. A listserve was established to maintain communication between bi-annual meetings. Sector-specific interest groups (e.g. industry course groups) were established to discuss sector-specific issues, which fed into course development processes.

Structural Elaborations/Structural Reproduction

Resultant morphostasis / morphogenesis: Within the supportive framework provided by the CDN, lecturers (actors) were able to deploy their agency in the interests of social transformation. This allowed these actors to effect curriculum changes in response to some of Africa's environment and development challenges. In all cases, there is evidence of morphogenesis (structural elaborations). In the Rhodes University, UNISA and Botswana University cases, there is evidence of pedagogical transformations as shown by the participatory and reflexive orientations of the courses developed (Timmermans, 2005; Ketlhoeilwe, 2005; Le Roux, 2005). In the case of the Swaziland course, new university-government-civil society partnerships were established and multi-disciplinary approaches were established (Mlipha, 2005).

Overt compromises and concessions of the outcome*:* Despite evidence of morphogenesis in all four cases, two of the initiatives (Ketlhoeilwe, 2005; Mlipha, 2005) were developed as 'extra-ordinary' initiatives, due mainly to the difficulties of embedding new curricula within the structural constraints of accredited curriculum development processes, reflecting morphostasis in so far as the actual 'formal / normal' curriculum offerings in the two institutions were not changed or elaborated. The two other initiatives (Le Roux, 2005; Timmermans, 2005) were both the result of new qualifications and were therefore 'institutionally required'. It would seem therefore, that while broader national policy is a key influencing factor in stimulating changes in

HEIs, curriculum development structures in University settings may constrain integration of new policy-responsive initiatives into the systems and structures that exist in HEIs. The structural functionalism and the hierarchical nature of institutional curriculum decision making procedures appears to be a key constraining factor affecting agency. The cases all show evidence of policy implementation, but there is little evidence of policy critique. As discussed above, epistemological challenges facing HEIs would seem to require not only policy implementation, but critical and reflexive review of policy.

***Evidence of unintended consequences of action**:* Evidence of unintended consequences of action appear to be mostly associated with the power of the network for creating opportunities for professional development and growth and for professional recognition and broader opportunities. Unintended consequences may also be evident in the somewhat uncritical approach to policy implementation favoured by most of the CDN courses, which may be reductive of potential epistemological and pedagogical transformations.

***Evidence of elaboration of agency, and how it is likely to influence further elaborations of agency**:* Most of the agents involved in the CDN have shown evidence of improved course development competence, and most have published at least one paper and all have contributed to the CDN publications. In recognising these skills, the CDN are now involved in an Africa-wide course development initiative to bring about curriculum and institutional changes towards sustainable development.

Conclusion

Archer (1995) argues that it is through examining the *interplay between structure and agency* that a better understanding of social change processes (and thus change in HEIs) can be gained. As outlined above, the broader context of policy change, and the institutional structures and power relations associated with curriculum development have emerged as both: enabling and constraining factors. Sub-regional, multi-disciplinary and multi-institutional networked interaction has emerged as an enabling factor in supporting curriculum change, although it too has associated constraining factors (e.g. it is time consuming). These factors have shaped agents action(s), and in all cases structural elaborations were evident, but in some these were not institutionally embedded as 'normal' curriculum development initiatives, nor were they necessarily epistemologically transformative, although there is evidence of pedagogical transformation. Personal professional rewards as well as collective rewards and recognition have also emerged as enabling factors.

As shown in this analysis, this interplay of enabling and constraining factors cannot simply be described or identified as 'drivers' or 'barriers' to change. In proposing a more nuanced perspective on change processes Archer (1995) argues for a study of socio-cultural interactions, and for an analysis of how social relations between people are capable of changing or maintaining the relations between ideas and between material structures. She argues that "… neither the structuring of society, nor the social interaction responsible for it can be discussed in isolation from one another" (pg. 246). In her analysis, Archer (1995) proposes that a 'double morphogenesis' is involved in re-structuring (change processes) namely that: agency leads to structural and cultural elaboration (e.g. curriculum / course changes in HEIs), but is itself elaborated in the process (i.e. the agency potential of the person / group is changed), as was evident in the increased confidence and competence of the course developers participating in the CDN, and the broader recognition that the CDN has received. Archer argues that, in effecting change,

> *… agents need their wits about them to decide how to perpetuate rewarding situations and to eradicate frustrating ones … many situations can only occur within certain structural and cultural limits, and these [often] unacknowledged conditions of situated action lie beyond the ken of time-and-space bound agents (pg. 247).*

In responding to the challenges facing African Higher Education Institutions outlined in the opening section of the paper, agents in African HEIs will no doubt need 'their wits about them' to navigate the structural and cultural factors influencing Africa's development path, and their own institutional contexts. A deeper understanding of change processes may provide the

means for educators in HEIs to engage realistically and critically with the change processes required. As shown by the outcomes of the CDN, networked interactions, and the establishment of the *organisational means* for enabling and supporting change processes would seem to be important in African HEIs.

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7. The Challenges Facing Learners in EE and ESD

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Abstract: This paper explores students' learning experiences in environmental education (EE). Recent reviews in the field of environmental education research have made clear that insufficient attention has been paid to question of learning. In particular, there have been very few empirical investigations into the process (as opposed to the outcomes) of students' learning experiences. In the light of this situation, this paper will report findings from two studies that focused specifically on learners' experiences of and responses to environmental curricula.

The two studies were undertaken independently but drew on similar theoretical perspectives and methodological approaches. The first focused on students' responses to environmental geography lessons within three English secondary schools. The other looked at Swedish university students' learning about environmental issues as part of undergraduate programmes. Drawing on data, the paper presents detailed empirical illustrations of learning challenges experienced by students during environmental education courses. The experiences are (i) emotional responses to the content, (ii) different values/beliefs from the teacher and (iii) ideas about what is and is not appropriate and helpful to study in different curriculum contexts.

The paper discusses important messages from this work for teachers and lecturers seeking to facilitate environmental learning amongst their students. The key point is that teachers/lecturers need to recognise that students' difficulties with environmental learning activities can be as much due to issues of attitudes and values as to challenges of knowledge and understanding.

Introduction

For much of the last decade, there have been few investigations into environmental learning, that is, 'learning which accrues from an engagement with the environment or environmental ideas' (Scott and Gough, 2003, p. 14). In particular, there has been a tendency to overlook the process aspects of environmental education so that there is 'a marked predominance of evidence on learning outcomes, but very little about learning processes' (Rickinson, 2001, p. 216).

This paper reports on empirical studies on students' learning and learning experiences within EE and ESD, and the challenges these pose for learning. The studies were conducted by Lundholm (2003; 2004a; 2004b; 2004c; 2005) with undergraduate students and by Rickinson (1999a; 1999b) with secondary school students and have been jointly presented in a paper by Lundholm & Rickinson (2005).

In this paper several challenges facing learners are outlined using short excerpts as examples. First, the challenge of dealing with emotional responses to the content, secondly, the way opinions are played out in the classroom and dealt with by students and thirdly, how students deal with a content that they don't find relevant for future profession or appropriate for other reasons. The paper ends by discussing implications for practice and presents current and future research on learning and sustainable development.

Students' Emotional Responses to the Content

The first area of challenge is when students have to grapple with their own emotional responses to the subject matter they are studying. Two examples are presented here, different as they are, showing disengagement as well as engagement, both leading to difficulties in learning. An example of disengagement was seen very clearly with Melanie, a 13-year-old student in Rickinson's (1999) study. Her response after a lesson that involved watching two short pieces of film about rainforest destruction in Amazonia, was that of strong emotions (*'I don't like cutting down trees, I don't like animals being hurt or moved')* and had lead to disengagement (*'I was just paying a little bit of attention'*) as a result of her emotional reaction.

For a group of Swedish undergraduate biologists (Lundholm, 2005), the difficulty was the extent to which they should allow their personal values and emotions to shape the way they carried out the task about the companies' environmental reports mentioned earlier. This is well illustrated by the following interchange within a small group shortly after they had set the task of examining the series of company environmental reports:

Karin: *We can't get too emotionally involved, that's the problem!*

Hans: *No*

Karin: *We can't actually include what we* ***think***

Nina: *But yes, we can include what we* ***think***

Karin: *No, not what we think about these companies and their-*

Lena: *We can't say "I think they're crap!*

Nina: *No, exactly "MoDo is a hell of a company, cutting down the forest" – no!*

Hans: *We share a common view of the companies –*

[All the students are talking at the same time. Difficult to hear the different voices.]

Nina: *Yes, yes, but I think the same way – companies suck! [She laughs]*. ***That*** *judgement we should not include*

Karin and Lena: *No*

In the extract above, the group seems to reach some kind of consensus that getting 'too emotionally involved' would not be helpful and what is really needed is an impartial engagement with the task. What is interesting, though, is that this issue of impartiality remained an ongoing tension throughout the process of the group carrying out this piece of work. Even in their last group meeting, they were still debating what was and what was not 'relevant to the focus of our work'.

While there are differences between the minimal engagement of Melanie and the impartial engagement of the engineering students, what they all have in common is students having to deal with their own individual emotional responses to environmental subject matter.

Students' Different Opinions from the Teacher/Lecturer about the Content

This second category of challenge brings the teacher or lecturer into the picture alongside the students. Research on teachers' thinking in environmental education has made clear that teachers can hold strong views on the issues that they are teaching (see, for example, Fien, 1992; Corney, 2000). It is therefore possible for students and teachers/lecturers to hold strong and diverging views about the topics with which they are dealing. Negotiating such differences in viewpoint can present real difficulties for students, especially when they are only too aware that it is the teacher/lecturer who will be grading their work. This type of situation was clearly seen amongst the engineering students in the Swedish study. In the interviews about their ecology course, several students brought up the issue of the lecturer's perspective. Ola, for example, stated that *'our dear ecology lecturer's viewpoint that man was God's biggest mistake'*, and as a consequence avoided *'going into discussion* [for fear of] *becoming an enemy of someone who is going to correct your exam'*.

Another example, from Rickinson's study, shows how a student, Lisa, had developed a strategy for dealing with her teacher's requests for her to express an opinion about issues that she did not see as particularly interesting or controversial. In her words, '*I didn't really feel sorry for the trees, it was just something to write because that was what miss was trying to make us look at the effects the trees had from the acid rain'*.

The examples above present different challenges facing the students connected to the aspect of opinions in the teaching-learning situation. There is an important difference, though: for the university students, the difficulty was with having an opinion that conflicted with that of the lecturer; for the school students, the challenge was not having a strong view either way on an issue about which the teacher felt they ought to have an opinion.

Students' Views of What Should be Studied in a Subject

This final category of learning challenges stems from students holding strong views about the type of content that should be included within a particular school subject or university course. One example of this came from a 13-year-old school student in England, Aiden, who felt that learning about the peoples of the rainforest was *'not really geography'*. So, far from being geography, Aiden felt that *'You probably would have learnt about the Kayapo in history as history is about things that happened and people in many ways'*.

In Lundholm's study (2004b), there was also evidence of students experiencing difficulties with the nature and structure of their environmental curricula. An issue for the engineering students for example, was whether the course content was helpful to them in terms of working as an engineer in the future. Their complaints were that the content of their ecology course was:

(i) Too focused on problems as opposed to solutions – One student, for example, argued that *'I think ecology, it should relate to cases and actual examples instead of just saying how very bad everything is. For example, if you are building a road in the jungle you have to cut down the trees. Okay, that's easy to understand, but what should you do?… The course ought to give solutions to problems and not only the problems. So that it is more adapted to construction. I think that would make the course more interesting for the students as well. And I think that more students would feel more involved and concerned. Some students did not prioritise the course because they felt it was just so much mumbo jumbo.'*

(ii) Overly concerned with the big picture - *'Ecology, I don't know, let's say the 'water cycle … You don't really need the big picture. It's enough to know that in this place, water runs from here and on, sort of … It is rather extensive, it's not absolute, sort of. And then the fact that it doesn't relate to what you want or to what you are here for. It is kind of on the side or how to say. So it becomes . it feels, I don't think you have to take the ecology course to become a good engineer. It is only a thing you have to do to get through'*.

The common theme here is of students expressing personal evaluations of the content and they way it is organised within an environmental course or series of lessons. This suggests that another challenge associated with environmental curricula is that students can attach low priority to environmental content if they see it as inappropriate to the subject and/or unhelpful to a future professional training.

Conclusions

The studies reported in this paper suggest that learning about environmental issues within settings such as schools and universities is far from straightforward. Three areas of difficulty that can present challenges for students involved in environmental education have been presented. These occur where:

- Students' learning experiences are shaped by an emotional reaction to an aspect of the topic being studied
- There is some kind of conflict between the beliefs or views of a student and the beliefs or views of the teacher/lecturer
- Students feel that a certain type of task or content is not appropriate for them to be studying within a particular subject.

The challenges of emotional responses and student-teacher conflicts seem to be more closely related to the values-rich nature of environmental subject matter. These challenges all have a strong affective (and in some cases, normative) dimension, and in this sense, seem more particular to learning within environmental education. In the words of Ola, one of the Swedish engineering students, '*There are a lot of values in a subject like this. I mean, just think about environmental issues!'* The way in which such values play out in school or university classrooms is an important issue for consideration by practitioners and researchers within environmental education.

Implications for Practice

From this work important messages stem for teachers and lecturers seeking to facilitate environmental learning amongst their students. Perhaps the most important message is that environmental education can present a number of quite particular kinds of learning challenges for students.

Environmental subject matter can evoke strong emotional responses amongst learners, which can influence the nature and depth of their engagement with any learning activities set up by the teacher/lecturer. As we saw earlier, Melanie's dislike of *'cutting down trees and animals being hurt'* resulted in her *'just paying a little bit of attention'* to a video about deforestation. This idea of students choosing how and when to engage with emotive issues is supported by Watts and Alsop's (1997) work on school students' learning about radiation and radioactivity. One of their key findings was that 'where issues are unpalatable or unsavoury there is a tendency for people to ignore them, to undergo "conceptual avoidance"' (*ibid.* 361). The key point here is that teachers/lecturers need to recognise that students' difficulties with environmental learning activities can be as much due to issues of attitudes and values as to challenges of knowledge and understanding.

Finally, there is the important point that it cannot be assumed that students will share teachers'/lecturers' belief in the importance of dealing with environmental/sustainability issues within particular curriculum subjects. The engineering undergraduates in Lundholm's study were far from convinced that their ecology course was helpful to them in terms of working as an engineer in the future, while one of the school students in Rickinson's work felt strongly that learning about the indigenous peoples of the rainforest was *'not really geography'*. These examples suggest that curriculum developers and practitioners need to think much more carefully about the ideas that students bring to the learning situation about what is and is not appropriate and helpful to study in different curriculum contexts.

A further point relating to all of the above challenges is that their occurrence in school and university classrooms may well be *largely hidden*. Students may well have very good reasons for wishing to keep their differences of opinion or views about the subject matter hidden from their teacher or lecturer. This highlights the importance of renewed efforts to improve our understanding of environmental learning from the perspective of the learners.

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8. Embedding Education for Sustainable Development In Higher Education in the UK

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Abstract: This paper outlines research designed to assess current approaches to teaching and learning in sustainable development across the higher education sector in England. Hence this work represents an important step forward because a) it is the first interdisciplinary and integrated investigation into Education for Sustainable Development (ESD) and its implications for Higher Education Institutions in the UK; b) it is a sector wide attempt to examine the potential and actual links between different disciplinary traditions and perceptions about different teaching approaches to ESD; c) it focuses on what practitioners in the sector are currently doing.

The paper outlines the results of this study and identifies examples of emerging good practice in curricula (design and teaching and learning approaches) as well as identifying barriers and solutions to embedding ESD in higher education.

Introduction

The Higher Education Funding Council for England (HEFCE) is the major funder of higher education (HE) in England, providing £6 billion per annum, which is a third of the sector's income from all sources. As part of its strategy for the future development of higher education, HEFCE has publicly committed to the following vision:

> *"Within the next 10 years, the higher education sector in England will be recognized as a major contributor to society's efforts to achieve sustainability, through the skills and knowledge that its graduates learn and put into practice and through its own strategies and operations."*

This vision is based on the belief that HE has a pivotal role in enacting sustainable development because of its core activities, teaching and research. Yet few students currently graduate with an understanding of how to make specific contributions to future economic and social development in a sustainable manner (Jucker, 2002; Martin & Jucker, 2005).

In research, higher education can play a significant role in finding solutions to some critical social and environmental problems, like poverty alleviation and climate change. In the UK, the oil and gas industries have a significant influence on academic research priorities, including receiving substantial public funding in support of research for the extraction of fossil fuels. Yet only 2 percent of the total funding goes towards researching the environmental impacts of the industry (NEF, 2003).

The buildings that make up the vast 24.6 million square metres estate of the English higher education sector also have a massive impact on the sustainability of the natural environment. Taken together, the 130 universities and colleges of HE are responsible for:

- Consuming 5.2 billion kWh of energy/annum at a cost of over £200 million
- Consuming over 16 million cubic metres/annum of water
- Spending £3 billion/year on goods and services
- Over 1 million people travelling to work and study every day
- Producing hundreds of thousands of tonnes of waste to landfill and incineration every year

The mismatch between the HEFCE vision and the reality of the unsustainability of the university sector is a major challenge to all of its stakeholders.

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In recognition of this challenge the HEFCE has developed an ambitious strategy and action plan for sustainable development in HE (www.hefce.ac.uk). The action plan in support of universities is organised around four broad themes:

- Engaging with stakeholders to bring about policy synergies on sustainable development
- Building the capacity of people to manage sustainable development
- Sharing good practice or supporting the development of good practice where none exists
- Rewarding more sustainable behaviour

HEFCE has also funded the establishment of two Centres of Excellence in Teaching and Learning (CETL); one aimed at developing sustainable communities through professional education for the built environment professions, and the other aims to develop and transform the *whole* university into a centre of excellence in education for sustainable development.

In response to the HEFCE action plan the Higher Education Academy[3] (HEA) commissioned the authors to undertake base-line research to investigate the most appropriate ways in which Higher Education Institutions can be supported to embed ESD into their curriculum and teaching and learning.

Key Objectives and Approaches to the Research

Few attempts have been made to assess current teaching and learning practice in ESD across a sector of education in the UK. Hence, this research represents an important step forward. Its purpose was to identify different approaches to teaching and learning in ESD; emerging best practice models and barriers and solutions in embedding ESD into the curriculum. The approach throughout the research was non-prescriptive, open and participatory which reflects the underlying philosophy of sustainability, the 'embryonic' state of sustainability in some of the subject areas and the need to encourage and foster its development in the sector. The results presented here are based on a survey questionnaire sent to 24 subject centres and eight subject centre focus group meetings.

Research Outputs

Definitions

Whilst the major focus of the research was on teaching, learning and curriculum, the HEA encouraged the team to seek some response to the question, *"What is sustainable development?"* In particular we wished to assess whether a subject discipline had adopted a specific definition as a starting point in their approach to teaching ESD. It is important to stress that the contemporary view is that focusing on definitions is a potentially serious barrier to an objective and active discourse on the sustainability agenda (Martin et al, 2005). In general, the subject disciplines were reluctant to adopt any particular definition because they felt that it compromised important aspects of how they approached the subject. Within the humanities field there was a strong reluctance to apply any of the existing definitions, because they arose mainly from the environmental, social and political sciences and gave limited emphasis to the concept of 'equity' and 'empowerment'. Other disciplines argued that definitions could mask diversity and stifle debate because broad definitions can cover up differences and give an illusion of consensus. Some subject disciplines were content to use the Brundtland definition, whereas more applied fields preferred more utilitarian definitions. A significant minority did not apply any definition whatsoever.

Teaching and Learning

The majority of respondents to the survey use the conventional range of teaching techniques for ESD: lectures, seminars and tutorials. A few mentioned extending these to personal perspectives and reflections, experiential work and more holistic (interdisciplinary) approaches. Some were not sure whether ESD was taught within their subject area at all.

[3] The HE Academy is an independent organisation funded by HEFCE whose mission is to support HE Institutions and subject discipline groups to provide the best possible learning experience for their students. It supports 24 academic subject centres (www.heacademy.ac.uk)

A survey of the literature identified three current dimensions (orientations) to teaching ESD:

1. Educators as role models and learners: This approach places an emphasis on how the tutor can act as a role model to develop a deeper understanding of the sustainability agenda. It also encompasses the mutual learning that can take place between tutors and students through personal actions. Supporters of this approach argue that if tutors do not change themselves and their lifestyles to be role models for students and their communities, akin to the function of elders in indigenous (traditional) societies, then there will be no transformation to a more sustainable society.
2. Experiential Learning: reconnecting to reality. This approach focuses on real and practical life issues and actual experiences as learning situations to avoid the kind of 'reductionist solutions', which have prevailed since the Industrial Revolution (Jucker, 2002, 296-297). Experiential learning is based on messy reality, with all its paradox and untidiness, its ever-changing pattern, its refusal to conform to our expectations.
3. Systemic learning: This approach emphasises the need to move from a 'reductionist' path towards making interdisciplinary and transdisciplinary connections. Sterling (2004) argues that sustainability education requires a deeper or Transformative learning approach, in which the learner is helped to see things within a whole system and to deal adequately with messy or complex situations.

We might also include here critical thinking, which is an important meta-skill because students need to be able to think critically about the nature of knowledge, and the ways in which knowledge is produced and validated. This ability is crucial because students will not be able to retreat onto the familiar and safe territory of their prime discipline, instead they must have the ability and confidence to assess processes and solutions which take their elements from many different disciplines. Successful ESD learning should also lead to individual behavioural and hence social change. Such social change cannot be prescribed by an ESD teaching programme, it should develop the capacity to manage, facilitate and enact change, rather than imposing a particular type of change on the students.

Educators as Role Models and Learners

The survey elicited a broadly positive response to this approach to teaching and learning, albeit with some caveats. Some subject disciplines such as engineering regarded this as an essential element of effective teaching. Set against this were concerns about promoting particular lifestyles and introducing an element of bias into a subject programme. Nevertheless, there was general agreement that HE teaching was not entirely value free. Respondents also had concerns that if this approach dominated the teaching and learning, then it could lead to a significant backlash in categorizing ESD as an ideology. There were strong arguments for not proselytising to students about sustainability.

Within this category there was a favourable reaction to learning being a reciprocal process between tutor and student and that teaching that embodied 'role play' and other forms of collaborative interaction were essential in taking forward the ESD agenda.

Experiential Learning: Reconnecting to Reality

There was almost universal support from subject centres for this approach to teaching and learning. Many examples were identified, particularly through student work placements where students gained hands-on experience of real-life, complex situations involving context, process and solutions to sustainability issues. Others highlighted the importance of the institutional context in setting out the reality of sustainability. Some respondents spoke of their institutions corporate social responsibility in enacting better community-student relations, but few provided very clear examples of good practice. Some subject areas were identified as too esoteric or abstract to support such engagement with local communities. Nevertheless, even in these subjects there were many opportunities to participate and reflect on real-life experiences. For example, in English where the prevailing view was that a student's personal experiences equated to subjectivity, yet within eco-criticism there were relevant and academically rigorous

opportunities to undertake site visits to natural settings and compare them with literary descriptions of the same geographical area. Many subject disciplines, ranging from Engineering to English also argued that experiential learning was essential in contributing towards empowering appropriate social change. However, in several disciplines a number of problems were identified of which the most significant was the students' disillusionment on meeting 'real world' constraints as well as the enormity of the environmental challenges society faces.

Systemic Learning

Most subject centre respondents strongly supported approaches to teaching that supported interdisciplinary and critical thinking about complexity. Yet there was general agreement that there were no easy ways to help students to adopt such approaches, partly because our school system through its teaching and assessment of learning processes inculcates a reductionist approach. Many respondents argued that critical thinking was an important skill demanded by employers, but that it was not easy to teach. However, several subject areas have developed teaching and learning approaches to support systems thinking and managing complexity (see www.systems.open.ac.uk). Thinking wide forms an important aim of several courses, especially to build intellectual bridges between the arts and sciences.

Curriculum responses

The survey identified three categories of response to ESD by subject disciplines:

1. Subject disciplines that have adopted a major process of embedding ESD curricula into undergraduate and post-graduate programmes. Examples include Engineering and Materials subjects, which are dealing with the day-to-day realities of industrial processes, English with its strong tradition of 'eco-literacy' and Geography, Earth and Environmental Sciences.
2. Subject disciplines that have made some limited progress in embedding ESD into their curricula, although acknowledging that these disciplines have some significant curricula content opportunities to do so. Examples include Biosciences, Economics, Philosophy and Religious Studies and Hospitality, Leisure, Sport and Tourism.
3. Subject centres that have an interest in the ESD agenda, but have found it relatively difficult to make credible and rigorous connections. Examples include: Information and Computer Sciences and Mathematics, Statistics and Operational Research, Performing Arts and Psychology.

Best practice examples elicited from the survey can be characterized in two specific ways:

1. Those subjects which were extending the boundaries of their discipline to include other non-cognate areas of study
2. Those subjects which have a close and continuing association with their institution's environmental processes and practices.

Two examples are summarised in the tables below.

***Vignette*[4]*:* Embedding Education for Global Citizenship and Sustainable Development (EGCSD) in Initial Teacher Education and Training Courses**

Course outline: This is sustainability and development orientated teacher-training course. The core areas of the course are interdependence and diversity, global and local dependencies, and values and perceptions. It was developed, *not* as a modular solution, but as a replicable cross-disciplinary course. Establishment of the course was carried out in parallel with research at Glasgow, Ulster and Gloucestershire Universities.

Teaching approaches: The personal role model is very important. However, this tutor is for students making up their own minds about which role model to follow. Teacher training is dealing very much with 'messy realities'. One technique used to connect people with nature, and consider their perceptions involves students being blindfolded, and feeling / sensing nature

[4] These vignettes are short characterisations of courses, based on interviews with course directors.

(e.g. trees, plants, etc.), only to then remove their blindfolds and reconnect with nature in quite a dramatic manner. Environmental Management Systems (EMSs) are key in the sense that the institution has to be seen to be acting sustainably, e.g. the University of Wales, Bangor has a sustainability policy, and an active group managing it: significantly, the latter must include student representation.

Vignette: **Representations of Spirit, Body and Beast**
[One-year course within BA Joint Honours Theology / Religion]

Course outline: The course is centred on concepts around the mind, spirituality and the soul, and therefore it is inherently a non-experiential type of approach. The tutors do not try to instil sustainability values in the students (in fact the word 'sustainability' is not used within the course), but aim to get them reflecting intelligently on the issues and their effects, in society. Students will have critically examined some areas of significant theological and contemporary anthropological interest.

Ethics and relationships with the environment, and environmental representation, within the Western religious context, are currently a core concern within both theology and this course. The course is valuable in that it explores personal and collective stances, in relation to environmental destruction or preservation, and the prevailing religious ethic. With many aspects of sustainability, there can be a strong or weak emphasis depending on whether students get stimulated to engage in debate around the issues. This is because of the discussion-based learning orientation adopted, where the course is not overly prescriptive and debate is encouraged, together with appropriate educational benefits.

Barriers and Solutions to Embedding ESD

The survey revealed four major barriers to the successful embedding of ESD into many of the subject disciplines in HE:

1. Overcrowded curriculum
2. Perceived irrelevance by academic staff
3. Limited staff awareness and expertise
4. Limited institutional drive and commitment

At one extreme the arts and humanities identified the largest number of barriers, whereas sociology, the built environment and environmental sciences identified relatively few. For example, performing arts subjects identified at least ten barriers, ranging from awkward fit with the subject area to lack of staff expertise, irrelevance, financial restrictions and limited institutional commitment. English with nine barriers, were particularly concerned with the difficulty in translating ecological concepts into literary theoretical concepts. Other subject areas raised the issue of ESD having limited academic rigour and problems with internal validation and accreditation systems.

Solutions

Subject centres identified a number of solutions to the barriers identified

Barriers & Solutions to Embedding ESD into HE Curricula	
Barrier	**Solution**
Crowded curriculum	Create space through a rigorous review of existing curricula
Irrelevance	Development of credible teaching materials which are fully contextualised and relevant to each subject area

Limited staff awareness and expertise	Significant investment in staff development and capacity building
Limited institutional commitment	Develop a credible business case for HE institutions, setting out triple bottom line benefits. Review and amend institutional mission and policy statements

Many of the respondents to the survey argued for the development of a generic ESD toolkit comprising some or all of the following:

- Glossary of ESD terms
- Specific subject-based definitions of SD and ESD
- Interdisciplinary case studies
- Materials which give more emphasis to non-scientific interpretations of sustainability, for example, ethical, moral and philosophical aspects
- Examples of position statements or discussion points from named authorities on contentious issues
- Examples which explore the forces which act against the implementation of sustainability
- Learning resources which enable personal involvement from both tutors and students (e.g. how to estimate a personal ecological footprint)
- The materials should be copyright free

Discussion

This paper sets out some of the progress towards embedding ESD in many of the subject disciplines within the higher education sector. It explores some of the barriers and solutions to further development of this process both within the disciplines and between disciplines. The importance of this report is that it is a reflection of the views of practitioners in the disciplines that make up the higher education sector within England. Their perspective is that there is no basis for settling on a single definition of sustainable development (or ESD), largely because of the contested nature of many aspects of sustainability. This justifies a much wider discourse in teaching and learning about sustainability than single definitions might permit. They endorse teaching and learning processes that empower students to explore these issues in a participatory and non-prescriptive manner, because sustainable development involves areas of complexity and uncertainty, which are not amenable to simple solutions. In response to the criticism that sustainability is an ideology, there was some support for not only permitting, but deliberately encouraging as many different perspectives as possible and by encouraging diverse approaches make ESD less of an ideology and more a matter of academic freedom for individual tutors. However, the post-modern dogma that any perspective is as valid as any other is simply not tenable in the context of a materially non-growing, limited ecosystem.

In conclusion, this report identifies a number of key challenges to staff in embedding ESD into HE. These include:

1. Subject tutors' caution against any single definitions of SD or ESD. Some recommend using multiple definitions to promote discussion with students.
2. There is no standard method of teaching SD in HE. Rather there is diversity in the principles and practice of teaching and learning in ESD. Systemic learning is in its infancy in most disciplines.
3. The curriculum content is diverse and on the whole tutors do not stray outside their specific discipline.
4. There are significant barriers in terms of staff awareness, expertise and institutional commitments to further progress in the embedding process.
5. There are a growing number of good practice models, which exemplify greater interdisciplinarity within the curriculum offered, and greater engagement with the

institution's implementation of its sustainability agenda. Few of the models of good practice have been disseminated.

In this paper we summarise some of the key trends in the teaching and curriculum development of sustainable development within the higher education system. We recognise that this is only a snapshot of a dynamically changing process. Indeed, some evidence of the dynamics is provided by UCAS statistics: in 2001 there were 24 courses in the subject search for sustainability, for 2006 applicants this has risen to 85 (see www.ucas.com) This research sets a challenging agenda for the Higher Education Funding Council for England and the Higher Education Academy if they are to support teaching staff in building a cadre of well qualified and sustainability literate graduates who can contribute to the resolution of our current unsustainable practices and lifestyles.

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9. Integrating Sustainable Development in Engineering Education Reshaping university education by organizational learning

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Abstract: Sustainable Development is a challenge for engineers. In 1996, Delft University of Technology embarked on a course to make SD one of the cornerstones of its education. It agreed on a three-step plan. This paper analyses the background of the plan. It briefly describes the 7-year project that implemented it.

A pragmatic course was chosen based on two basic premises:

1. SD offers a challenge for engineers, not a threat.
2. Introducing SD should be a "learning by doing" process.

The paper focuses on the cultural and organizational factors that have contributed to the success of the project and the barriers that had to be overcome.

- Academic culture in general perceives external forces as threatening Academic Freedom;
- Engineering culture resists concepts that cannot be precisely integrated into mathematical models;
- Disciplinary cultures strongly emphasize that one should not deal with subjects beyond the area of disciplinary expertise.

Organizational factors of importance were:

- Timing: curriculum change is impossible if a change has just been implemented;
- Availability of teachers/resources;
- SD champion in the department;
- Signals of relevant external stakeholders of a department showing that SD is important.

Main conclusion of the paper is that preaching should be prevented: critical dialogue between SD specialists and University lecturers is of key importance. Starting point is not how to put as much SD into courses as possible, but what engineering disciplines can contribute to SD, and how this can be explained to (potential) students.

Introduction

Sustainable Development is a challenge for engineers. In 1996, Delft University of Technology has embarked on a course to make SD one of the cornerstones of its education. The university agreed on a three-step plan in1997. First this paper briefly analyses the background of the plan and the 7-year project that implemented it.

Afterwards we will analyze the barriers that were met and the opportunities. We will analyze the approaches we applied to overcome these barriers. Main conclusion of the paper is that preaching or command/control procedures should be prevented: critical dialogue between SD specialists and university lecturers is of key importance.

SD at Delft University of Technology

DUT is the largest and oldest Technical University in the Netherlands. It employs about 5000 people. There are about 13.000 undergraduate students which study in a Bachelors-Masters scheme.

In the 1960s and 70s, DUT was a rather traditional Engineering School. The uproars of the seventies affected DUT considerably. By the end of the seventies, environmental and societal issues had influenced some engineering curricula such as Architecture, Civil Engineering and Chemistry (Cf. Lemkowitz, 1992). However, environmental issues only marginally affected most other engineering curricula.

A second wave of environmental awareness was triggered by the Brundtland report (WCED, 1987). This renewed interest in environmental issues resulted in various new initiatives, like a chair in recycling technology and centre in environmental technology. These changes were all add-on, i.e. new elective courses and research projects. There were hardly any changes in the basic training programs of engineers, nor in research programs.

In 1991, DUT adopted an environmental policy plan. This plan included the introduction of an environmental management system, and more scope for environmental issues in education and research. It also stated that guidelines for introducing sustainable development within engineering curricula and research programs had to be formulated within three years. However, the education plans that were made were not accepted due to the coincidence with government induced university education reforms.

In 1994, the University adopted a strategic vision: 'Towards a new commitment'. The mission statement was formulated as:

> *DUT will function as an internationally leading technical university, both in regard to education as well as research. DUT is committed to the main social and technologic-scientific problems and challenges. She contributes to its solutions and holds itself accountable for that (College van Bestuur TU Delft, 1994).*

New initiatives were needed to integrate Sustainability into DUT's core activities. There was scope for new courses. There was some criticism of corporations regarding lacking social skills of engineers. Moreover, the high drop out rate of engineering curricula became politically unacceptable. Pressure on students had to be eased.

A steering group explored the significance of Sustainable Development for DUT. A committee was installed in 1996 to make plans regarding SD in education and research at DUT using the findings of the steering group. The committee was an active working group that formulated a plan after two rounds of discussions with representatives of all departments. The plan consisted of three interconnected operations:

- The design of an elementary course 'Technology in Sustainable Development' for ALL students of DUT;
- Intertwining of sustainable development in ALL regular disciplinary courses, in a way corresponding to the nature of each specific course (Bras et al., 2000, Peet et al., 2004);
- The possibility to graduate in a sustainable development specialization within the framework of each engineering Masters degree. This possibility was opened in 2000 and described elsewhere (De Werk/Mulder, 2003).

After the plan had been agreed by the University Board, its execution was transferred to the Technology Assessment unit of the Department of Technology, Policy & Management. Hereby it was emphasized that SD offers a challenge for technology, not a threat. However technology should be socially acceptable and stakeholders should be able to influence its course.

It was not a priori clear how several of the tasks should be carried out and therefore the project should have a "learning by doing" character (for a more detailed description see Jansen et al., 2005).

Barriers and opportunities

The barriers and opportunities that were met in executing the project were of cultural and organizational nature:

- Academic culture in general
- Science and Engineering culture
- Disciplinary cultures.

Organizational factors of importance were:

- Timing

- Availability of personnel/resources
- Political processes within the department
- External stakeholders

These factors, as we experienced them at DUT will be dealt with in this order.

General Academic Culture

a) Academic culture in general perceives external forces as threatening academic freedom. This tradition is rooted in the resistance of scientists to control by political authorities, be it the rule of the Catholic Church in the 16th century (Galileo), Stalin's' control over biologists (e.g. the Lysenko affair) or McCarthyism at US universities in the 1950s (trying to remove Marxist scientists). However it must be clear that the call for Sustainable Development is not prescribing any specific world order. It only calls scientists to address the global problems that threaten the continuity of civilized society, and does not prescribe specific solutions.

b) Scientists are caught up in a race for scientific credentials. Those credentials are earned within the scientists' community. Activities outside that community show that the scientist is not fully committed to his scientific endeavor, a sin among scientists. In that sense, scientific "laziness" to cross-disciplinary borders pays off.

c) Science and Engineering are divided in disciplines. Disciplinary borders determine the areas of expertise. Beyond this borderline the expert becomes a layman. Disciplinary cultures strongly emphasize that one should not deal with subjects beyond the area of disciplinary expertise. However in real (societal) problems and in innovations almost always the complexity requires cross-disciplinary approaches. Working on such cross-disciplinary problems always involves crossing disciplinary borders otherwise communication is impossible. Cross disciplinarism can only become acceptable by emphasizing the necessity of solving the problem or by making the cross-disciplinary research a new discipline. However, this formation of a new discipline will necessarily create new boundaries and conflicts of interest, and might easily lead to isolating SD.

d) Many scientific disciplines maintain a self-image in which the topics for research emerge from the discipline itself. The societal legitimation of research emerges from the improvements in technological/organizational efficiency that results from the disciplines' newly produced knowledge. External needs for Sustainability are seen as unimportant for the research agenda of the discipline. As research funding bodies tend to emphasize utility of research results, this attitude is changing; at least scientists pay more attention to describe the foreseen utility of research results.

e) In general, academic career patterns are determined by research performance. Education is often regarded as something that comes with the job, and therefore receives only a low priority. Low quality education is often defended as a way to select the most talented scholars that are able to make it despite this lacking education. Changing curricula and courses is sometimes refused as it is taken as an offence to the lecturer (what was good enough for us, is good enough for them).

Science and Engineering culture

Science and engineering cultures have various aspects in common. They differ on one major aspect: Engineering aims at problem solving (using scientific methods); science aims at providing new knowledge. Science is therefore often more strictly disciplinary than engineering, as problem solving sometimes requires often more than strictly disciplinary knowledge. Scientific disciplines that are not directly related to major SD related problems generally tend not to be interested in integrating SD in their curricula.

The engineering community and the related institutions, have a number of rather specific cultural characteristics. Some of these characteristics are good starting points for integrating sustainability while other characteristics hamper integration.

Sustainable Development has a rather qualitative nature. Many problems can hardly be quantified in a relevant way such as social phenomena like participation of citizens and equity.

Some natural phenomena are also hard to express in relevant and bias-free numbers: For example noise, bioaccumulation of toxicity or risk of catastrophes. Attempts have been made to express Sustainability by developing indicators based on various variables. However, these indicator systems have to assign weights to the variables and are therefore necessarily biased no matter how creative they sometimes might be (cf. Rees/Wackernagel, 1996). The rather qualitative nature of teaching Sustainability to engineers does not fit well with the numerical/science-based practices of modern engineering.

Engineering is about developing technical-rational solutions, i.e. optimized economic solutions for well-defined problems. The political system applies a different rationality, i.e. choosing those solutions for which there is enough support among relevant stakeholders, taking non-technical aspects into account. "Providing for the needs….etc" poses complex socio-technical problems, which are subject to political biases. Engineers often do not recognize these different frameworks, and tend to reject working on problems in which the political rationality, i.e. building up coalitions and gathering support play a dominant role. Engineers seem to be losing power in decision-making processes as a technocratic approach becomes less and less acceptable.

Disciplinary Cultures

Disciplinary cultures take pride in the achievements of the discipline. The institutions of disciplines regard it as their task to react to threats to public image of their discipline. In general we observed that engineering disciplines tended to pay attention to the issues in public debate. In that respect, the bad image of chemical engineering in the 1980s created an opportunity to insert SD in chemical engineering education, In the 1990s, public debate on air transport and airport noise made aerospace engineering susceptible to SD as an issue in their education. From the end of the 70s to the 1990s, civil engineers were often publicly depicted as concrete and tarmac fans. The civil engineering discipline emphasized that it was willing to contribute to the preservation of nature by "building with nature", instead of "taming nature".

General organizational Factors

The Not Invented Here (NIH) syndrome also plays its role when introducing SD in academic education. External ideas are often rejected just because departments want to stay in control of their own assets. It is therefore important to commit departments to the idea of SD in early stages. If they are approached too late, NIH becomes strong.

Images of failures in the past might have the same effect: "*We tried to set up interdisciplinary projects in the 1970s but it failed and therefore that is not the way to go"*. The real reasons for failures in the past are often unimportant, and can hardly be checked. It is the negative image that might be killing.

Timing is very often crucial. The introduction of a new SD course is generally only possible when a curriculum changes. Afterwards it becomes impossible for several years ("we just have our new curriculum, which cannot be changed before a major re-evaluation). Also revisions of individual courses are often triggered by curriculum changes.

Availability of resources and teachers that are able to teach SD is relevant. Teachers often lacked skills and resources to adapt their courses. At the department level, the presence of a SD champion is important just to ensure that the issue of SD is kept alive within the department.

University departments have their own dynamics. Good plans can fail as they are linked with the wrong persons or they might be regarded as serving the interests of specific groups.

Several departments had a self-image as being well attuned to the demands of their **stakeholders**: *Industry does not need SD educated engineers.* These kinds of arguments were often countered by Corporations that expressed the need for SD in engineering education, research funding that required applicants to address the issue of SD, SD as being an element in accreditation procedures and students demanding more SD in their curriculum. External stakeholders are therefore powerful allies for SD.

Strategies for success

Engineering experiences a crisis in many countries. Participation in academic education is increasing, but the number of engineering students remains behind. Engineering is regarded as tough and many youngsters see it as only being fun for nerds. *Why work hard to become an engineer if I can become his boss with fewer efforts?*

Engineering schools are aware of this problem, but do not know how to deal with it. SD has certainly been helpful to show that engineering is very important and committed to the challenges of the large problems that modern society faces. Many engineers are still hesitating to address their students and potential students in this line of reasoning, as they fear that it might affect engineering too much. We must give them confidence that successful engineering in our days involves the willingness to change.

Engineering is important for SD and SD is important for engineering. This does not mean that SD should become an effort to be managed by technocratic engineers. It implies that engineers must be committed to enter dialogue with stakeholder groups. Technical Universities must educate their engineers for interaction; for developing solutions for the problems of people, not for the problems as the technical community might perceive them.

This is a major change of culture, and it also involves a change in structure and orientation of technological research in Universities of Technology. It is evident that these changes cannot be initiated in a command and control like way by a University Board. Bottom up processes in the university are crucial for this change. However, without support of the University Board, bottom up process will lead to frustration, as the changes that are needed cannot be achieved only by bottom-up activities of students and committed lecturers.

Conclusion

The road to educate engineers that are committed to contribute to SD is a long one, but a promising one. It involves an interactive approach, and therefore preaching should be prevented. The slogan *practice what you preach* should not play any role: We don't want to show a higher morality to our students but to show that engineers have an important task in our future society, which is also fun to fulfill as an engineer. Moreover, the inequality of preaching should be prevented: We experienced that if we challenged the engineering scientists at our university (What does your sub-discipline have to contribute to SD?) very often far better ideas emerged that we could have ever imagined ourselves.

Command and control should be prevented at all costs. Interaction and consensus building are the key words for the successful introduction of SD in Engineering.

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10. Education for Professional Sustainability Management Competences - Opportunities and Obstacles

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Abstract: It is noted that industries, municipalities and many other organisations (the "middle level") is a key level for introducing sustainable regimes. This is where new policies can be implemented and a new - sustainable - society created. On this level a number of professions, such as planners, engineers, architects, economists, etc, are working. To achieve sustainability these professions need a new competence. To provide that is one main task for education for Sustainable Development. The Baltic University Programme at Uppsala University has since several years developed courses to address this need.

Since some years a number of companies and an increasing number of local authorities and other organisations have introduced management systems, most often according to the ISO standards. The management systems, originally addressing only environment, are now often integrated to include safety and quality and increasingly often also social issues and economy are integrated; They are thus moving towards fully integrated management systems. These may be seen as forerunners to real sustainability management systems. The introduction of these systems has a considerable component of education and training. They point to one route to introducing professional skills related to sustainability in the core middle level of society.

The introduction of management has however not been without thresholds. The study of why individuals and companies are reluctant to introduce such systems is a practical way to understand which are the obstacles for the introduction of sustainability management on this level.

Background

The strategies for future change

Many discussions on education for sustainable development have been concerned with issues, such as "how to understand sustainability", "the responsibility of individuals", "the global situation" and so on. One attitude seems to be that it is enough to be aware of the seriousness of the situation, and be informed that we need interdisciplinarity, participation and democracy to achieve ESD. This way to look at the future may be called *Rio development* (1). It is in the spirit of Agenda 21. It is also clear that on the many places where an Agenda 21 work has been pursued participation and information were core concerns (2).

Other commonly held views include the *business-as-usual* philosophy, which counts on that the market will solve all problems: If a resource is getting scares price mechanisms will either make its use more efficient or make alternatives available as it becomes more profitable. T*echnological optimism* counts that new technologies is the answer to environmental shortcomings. The American (and Australian) way to deal with the challenge of climate change and Kyoto protocol requests is in this category. The ethical strategy, sometimes called *deep ecology*, maintains that it is enough to implement new values to achieve sustainability. This, which, has been pursued by several ethicists e.g. Aldo Leopold and Arne Naess (3). The alarmingly rapid decrease of biodiversity and landscape changes is in focus and it is maintained that humankind's devastating impact on all life is deeply immoral, not acceptable, and need to change.

Certainly all these strategies will play a role in the future. They will, however, neither alone nor together, be enough to achieve sustainability (1). To do that we need both to understand better what is sustainability, and the technical details of it. We need to go beyond this stage of general strategies and come to discuss the "nuts and bolts" of sustainability. It is this detailed level that education for sustainable development (ESD) sooner or later will have to address. The "nuts and bolts" way to deal with sustainability as a strategy may be called *structural change*. It addresses the physical infrastructure of society, in fact also the institutional

infrastructure. It deals with details of industrial production, transport, urban development and energy. The fine structure of society has to be changed for sustainability to occur.

Key professions for sustainability

Actors, who will contribute to a future sustainable world, span from the individual to the global level (3). A special role is played in this instance, by the intermediate level, that is, the companies and local communities and municipalities. These will be responsible for actually implementing whatever needs to be done. The upper levels, the state and the levels above the state, such as the European Union, will set the rules. The rules have to be right to make the action on the lower levels possible and reasonable. The middle level – companies, communities and other organisations - will need to create the circumstances that make initiatives on the part of the lower levels, such as individuals and families, practical. Each one of these levels will need education for sustainable development. In this paper I will focus on the middle level, organisations especially companies and municipalities.

One often assumes that the companies are the most powerful economic actors. However in many countries local authorities are at least equally strong economic actors. Cities and regions typically have many thousands of employees, especially in the social sector and education. They make very considerable investments in infrastructure and are large buyers of all kinds of material. In Sweden the six economically largest organisations are the largest cities and regions. Only thereafter the large companies such as LM Ericsson and IKEA are listed. Looking only to who has the economic power to make a change the middle level is a key one for promoting sustainable development. A powerful and necessary tool for change, on this as well on all other levels, is education.

A number of professions will have important roles in implementing sustainability on this middle level. These include engineers who will design industrial production, and build the future infrastructure of our societies. It also includes the planners especially in cities and regions, which will plan the society and its development. It includes the architects who will design the buildings and cities of future societies. It includes the farmers who will produce the food for our future population. And it includes the economists to run the economy. On this level it is not enough to have a general understanding of what is sustainability. Theoretical understanding, theoretical tools, practical tools and skills are all needed. Many small details are important for actually achieving sustainability. Education is needed to make these groups competent to identify the weak spots in present regimes and understand how to change them into better practices.

The Baltic University Programme (4), coordinated by Uppsala University, Uppsala, Sweden is a network of 183 universities in 14 countries in the Baltic Sea region. In the programme we have since 10 years been developing education to promote the professional competences needed for sustainability. The courses are on academic masters level. Today they include sustainable community development and urban planning, environmental management including management systems, product design, cleaner production, and water management. Further courses are discussed. These experiences of the development of university courses forms the basis for this paper on how to introduce an education for sustainable development reaching key professional groups in our societies.

A model for introducing professional competences

Since the mid 1990s certified management systems – mainly environmental, quality and safety management according to the ISO standards – have been introduced in industrial societies all over the world. From a slow beginning the introduction of the systems is now fast (6). In the end of 2004, 670 000 quality management certificates and 91 000 environmental management certificates had been issued worldwide; the growth of certificates from 2003 to 2004 was 35 per cent. In Sweden alone 3 478 ISO 14001 certificates at the end of 2004 places the country at the top with a record number of certificates per capita or GDP.

This unusual success of certified management systems provides a model for how skills needed for sustainability may be introduced and implemented in companies, in municipalities and finally in all kind of organisations. The reason for this success includes the fact that the

systems are generic, that is they may be used in almost any kind of activity, that they are recognised, and that they are profitable. They can be used on any scale from the personal level to large-scale organisations.

Many companies, and also cities, which have introduced a management system and become certified underline that it is profitable. It is simply good business. As one manager of a Polish large company said about environmental management, "it is cheaper and better to invest in the employees' education, than to pay environmental fines and buy expensive cleaning equipment" (6). Similar judgments have been made regarding the so-called corporate social responsibility, CSR, which may be seen as a kind of social management system. Also CSR is considered profitable (7).

To the economic aspects of why we should have management systems is added the fact that certification is often required by the customers. The buyer in this situation requests a documented and established guarantee of what he/she obtains. An extension of this is the use of the results in reports to the stakeholders, the customers, or the owners or perhaps the citizens for a city. The most comprehensive system for sustainability reporting is the so-called global reporting initiative, GRI (8), which seems to become a global standard for sustainability reporting. This system is already in use for a number of larger companies, especially in the USA and Australia. Recently a manual for GRI of public organisations, such as cities, has been developed.

The introduction of management systems requires education and training. It is always an important part of the process. The introduction of management systems may for this reason be seen as a model for how to introduce education for sustainability in a number of organisations, which play key roles in the societies we live in.

More recently the environmental management systems have been, more often than not, introduced in combination with other systems of management, especially quality management and safety management. Some companies are also looking at corporate social responsibility in combination with their management systems. We may guess that in the not so far future the special management systems will be merged into a single total management system that includes, environmental, safety, social and of course economic management. The issues of social, economic and environmental concerns are then integrated. This may be the ideal platform for designing sustainability management system.

Below I will illustrate the question of how to introduce education for sustainable development in several professions through the areas of industrial production and urban development. There are several other areas, which may be addressed in a similar way in, e.g. the agricultural sector, teachers training, the health sector and the social services, etc. However the experiences we have so far are mainly in the two areas mentioned.

Education for sustainable industrial production

Industrialism is unsustainable

Industrialism has been with us since the mid 18th century and is the basis of our western societies. Industrial production was made possible through the large-scale use of fossil fuels, and the construction of more or less ingenious machines. Wood was substituted by coal, and later oil, while cars replaced horses. All of this is unsustainable for the simple reason that it relies on a non-renewable resource, fossil fuel. But there are also deeper reasons why industrialism has become the epitome of un-sustainability. The production processes themselves are typically extremely inefficient. Efficiencies are often in the order of 30-50 per cent of input material, and sometimes it is much lower. For example the combustion motor in a car converts no more than 18 per cent of the fuel energy to mechanical movement at the wheels. In an ordinary light bulb only 2 per cent of the electric energy becomes light, the rest heat. In addition to being inefficient typical industrial processes results in huge quantities of pollution and waste.

What would then be a more sustainable production process? The proper reference, I would suggest, is the living cell. Here we find biological processes with yields typically closer to 100 per cent. The side products are few, and used by other processes and thus not wasted.

The cellular chemistry itself is cleverly designed. By the use of specific catalysts, called enzymes, the processes can be carried out in a water environment, at room temperature and with high efficiency. This is to be contrasted to industrialism's typical processes, which often occur in nasty organic solvents, at high temperatures over many hours and with low efficiencies.

Sustainable industrial production should be possible if we could work in a way similar to what the living cell does. Such processes are not typical but possible.

Cleaner production

Since some ten years industrial production has been challenged by the concept of cleaner production (9). This concept embodies the idea that instead of fighting pollution industrial production should be made in such a way that the pollutants never appear. Early application of the cleaner production strategies led first to a series of rather simple changes in a production line. It included for example saving energy by proper insulation, making use of material in a careful way and managing resources efficiently. As the strategy of cleaner production is further developed, it leads to entirely new processes. Today we are in some cases approaching what may be called "sustainable chemistry". One category of sustainable industrial processes is found in biotechnology. We may for example use the enzymes found in living cells to make processes efficient and specific. Another approach is to use renewable resources, e.g. vegetable oil, for what in general may be called vegetable chemistry.

The further development of the cleaner production approach leads to another "biological" strategy: What was earlier considered as waste may be sold to other companies as raw material. This is called industrial symbioses. In its most developed form industrial symbioses refers to networks of industrial plants, which cooperate by selling and buying material from each other. This started by simple things such as selling steam as energy from one plant to another. Today one may find examples of all kinds of material being sold for new uses. In the longer term it develops to what may be called systems design (10).

Industrial symbiosis is an important part of the general strategy of recycling. As more material is used more carefully a recycling society develops. It is supported by the European Union IPP Directive (Integrated Product Policy), which if fully implemented would approach a sustainable industrial production (11). It is in contrast to the present regime in Europe, in which more than 90 per cent of the product flows ends up as waste.

How to introduce competences and its obstacles

It seems obvious that reforming an industrial process so that all material is used efficiently, less energy is needed and that pollution does not happen should be a very good idea. How could anyone be against such a development? The advantages are obvious: The economy is improving, the health situation becomes better, and environmental management improves. Nevertheless it is not easy to introduce cleaner production strategies in factories. The reasons are many. To reform an industrial process is a sensitive issue, and if no outside incentives are present, it is much easier to continue the way it is. Investments are needed, risks exist – it may not work. It is easier to let the old production continue and let the customer pay what it costs. In general industries, or rather engineers, seem to be conservative.

But the consequences of pollution have been serious enough to enforce a change. Fines for pollution mounts and tougher permits for production support the introduction of cleaner production. Firstly state guaranteed loans were offered for the investments needed. Secondly costumers' requests were pressing some productions to change. Slowly changes in the direction towards a more clever industrial production do occur. It is simply good business. The most important single circumstance that has changed the situation in the direction of better management is the introduction of certification of environmental management from the mid 1990s. The ISO 14001 system for environmental management (now mostly replacing the EMAS system of the EU) has been an important for introducing new thinking in the industrial sector. However EMS is just the beginning. To come to a more advanced industrial production and greener chemistry there is still a big step.

Management systems may be seen as a method of introducing sustainable production methods in industry. It should be noted that all introductions of certification has a considerable educational component. All personnel are given some education in environmental management. The key personnel are going through a more thorough education, which, in larger companies, is regularly updated. For sustainable industrial production much more than this is needed, but the introduction of EMS is pointing to a model for how to achieve it.

Introducing education for sustainable city development

The challenges of city life

In 2005 the 50 per cent level of urban life was passed by the population on the planet as a whole. In western countries this happened some time ago, and typically many countries and states in Europe and USA today have close to 80 per cent urbanisation. The rapid increase is seen in the developing world where massive migration to the mega cities occurs without proper planning. Before 1900 about 6 per cent of the population of the planet lived outside cites. Large-scale urbanisation is a phenomenon that was propelled by industrialism and is part of the development that led to our present unsustainable world.

Why are cities unsustainable? In principle one would assume that it is more environmentally friendly to live close together to reduce the need of travel and to improve economic exchange – trade and business – and provide more opportunities for social development. However cities were from the beginning struck by difficulties. Inappropriate management of water, waste and other types of pollution made city life difficult. Cities hundred years back often smelled terribly, the risk of being infected by disease was high and poverty was the rule.

Several of these old problems have been solved today. We know how to provide safe water, and how to take care of toilet and other waste. The life expectancy is not lower in cities as it was earlier. But we have new problems. Cities of today are typically flooded by cars, and plagued by congestion. Air pollution, again due to car traffic, is often problematic. Instead of less we have more transport. Instead of less social problems we often have more social problems and criminality. Instead of less environmental impacts we often have more. The footprint of a city is often around 1000 times larger than the surface area of the city itself (12).

The relevance of the local level

The local level of administration is a very important one for SD (13). Sustainability strategies have to finally be implemented at the local level. Thus a strong local society, municipality, is a good starting formula for sustainability. To achieve this the local level needs three competences – economic competence, legal competence and know how. The municipality has to be economically strong enough to be able to carry out what it finds necessary. Economic strength is created by local taxation, and charges for local services, such as water and waste treatment. Legal competence refers to the planning monopoly and other needed authority tasks. Finally the third competence, the know-how, refers to competent personnel with education, and data needed, to act for sustainability.

In most parts of the world the local level is however not very strong. Although a planning monopoly may exist, in many countries the municipalities are not economically strong enough to force local landowners to follow, lacking economic means to buy them out when needed. Thus implementation may be lacking. In authoritarian states power concentration to the central level is typical. Still the local level may have many responsibilities, but then the budget comes from the state, together with orders what to use it for. This is very different from e.g. the Nordic countries where the local level has a very large part of public responsibilities and of the public budget. As mentioned the largest municipalities have a stronger budget than the largest companies. After the systems change in 1989-91 in Central and Eastern Europe a transfer of power to the local level is ongoing since more that ten years.

What does the city administration need to know?

What competences are needed to create sustainable cities? Is it at all possible? This has been the topic for a large number of projects created in the follow-up after the 1992 Rio conference and the Habitat agenda.

A city is the place where the different dimensions of sustainability are naturally linked together and needs to be managed together. In the project *Baltic University Urban Forum, BUUF*, which the Baltic University Programme is running during 2003-2006, has been formulated, as the city has to manage three limited resources (14). These are the material flows (energy, water, waste) urban space (built environment, the green structures and the traffic structure) and people or, if one wishes, the human resource (education, social care and work). All of these can be discussed from the sustainability perspective. Again we are close to establishing a management system requiring coordination and understanding of the basic sustainability conditions, even if it is less well developed than the management systems used in the industrial sector.

The introduction of such a management system in cities is still only at a preliminary stage in general. However some cities have taken the lead. The Global Community Initiative (15) has introduced a system of city development in a number of cities in Canada and Northern United States. Several more cities have elaborated long term visions and will face the challenge to implement them. Management systems now in use are mostly limited to the environmental side and are therefore limited in scope. Some cities, e.g. Nacka in Sweden (6), have recently implemented an integrated management system according to the ISO standards, but these are exceptions. Several other cities have introduced simplified management systems.

Only few cities have adopted a strategy for learning about sustainability for their cities, but those, which have, are performing better. According to a report from the DISCUS project initiated by ICLEI and carried out as a Norwegian-Finnish cooperation (16) the most successful cities were found to be “learning cities”.

Final comments

Education for Sustainable Development has to be introduced on all levels in our societies to contribute efficiently to the goal of a sustainable future. In this paper I have focused on the middle level, the organisations and in particular companies and municipalities and the competence needed to run these organisations in a sustainable way. Even if research and development is needed to develop this knowledge, also sometimes on a basic level, much of the understanding needed already exists. The issue is what to do to make this understanding and knowledge available to those who need it, and how to make them use it.

One concern is the so-called implementation gap. Why is existing knowledge not used? Why are not e.g. buildings made more energy-efficient when we know how to build them, that they are cost efficient, and that all material is easily available? Why are not cars which use less fuel built when we again know how to do it, that it is cost efficient and that all components needed are available? The implementation gap is often discussed in terms of lacking customers’ requests and market failures. Stronger regulations and economic incentives, such as higher fuel prices, may be able to change these failures. Another answer may be better-informed customers, that is, basic education.

An interesting model for what I have been asking for in this paper, an informed and integrated approach to sustainability management, may be the mobility management centres (16). These centres have been created by a number of municipalities in Europe. They typically run a wide range of projects to support sustainable mobility and public transport. Competences from the economic, planning and socio-economic side of the municipalities are cooperating in the centres. The mobility management centres have inspired the Baltic University Urban Forum project to propose Sustainability Management Centres for the cities in the project. Such centres should have an important component of education, both for the personnel in the centres and that the centres be responsible for educating the rest of the personnel of the municipalities. A similar

initiative for industries would be an interesting possibility to support the needed competence development for creating a sustainable society in the future.

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11. Exploring Effective Approaches For 'Education for Sustainable Development' In Universities of China

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Abstract: Green university, including green campus, green technology and green education, is a popular concept in China as a result of implementing the strategy of sustainable development at the university level. Applying green education as the core issue, the paper analyzes the opportunities and barriers of carrying out education for sustainable development (ESD) through higher education in China by providing some examples. This paper focuses on effective curriculum design frameworks for ESD. Four types of courses about ESD could be adopted including compulsory courses for every student, selective courses in each department, the infusion of the idea of sustainable development into some professional courses and implementation of practical activities and research projects. The university mechanism to ensure the curriculum system has also been discussed. Issues such as the atmosphere of environmental education, curriculum reform adapting to ESD, teaching material development and teacher training of ESD etc. have been emphasized.

Introduction

Higher education developed very fast after the implementation of China's reform and open-door policy. Especially after 1990's, facing to the situation of economic globalization and China's entry into WTO, the higher education reform which includes the reform of educational ideology, educational system and teaching approaches was carried out at an even higher speed (N. Chen et al., 2004). During the phase of higher education reform, under the ambient of world environmental protection, the greening of education is becoming a trend. "Green University" is the expression of greening education in higher education. Along with the emphasis on scientific development and harmony society establishment in China, universities are very important sites for disseminating and implementing the strategy of sustainable development. Meanwhile, Green Universities will also benefit the formation of green awareness, the culture of green professionals and sustainable development of the university itself (Y. Zhang, 2000).

The Concept of Green University

China's environmental education in universities started in the 1970's, when environmental science was developed as a discipline mainly focusing on the cultivation of environmental professionals. Along with the development of environmental protection in China, especially after stepping into the 1990s', Green University gradually became one of the popular approaches to implement sustainable development of universities.

There is no generally accepted definition of a Green University. As the pioneer of Green University in China, the president of Tsinghua University, academician Dazhong Wang thinks that Green University is centering on education of human beings by implementing the principle of sustainable development and environmental protection in all activities and the whole process of education (Z. Wang & Y. Zheng, 2001).

The direction of the university development reflects the understanding of the culture and social development as well as the self-development orientation of the university. Thus, the first element of a Green University is to adopt 'green' as the ideology of university development. Green awareness, green products and green campus are becoming important components of quality education for all students.

The objective of higher education is to foster different professionals. Over a long period of time, caring for the environment hasn't been a component of the quality structure of university students. How to strengthen the students' capacity for environmental protection is one important content of higher education reform as well as a necessary element of Green University.

Green University also demands an effective management system. ISO 9002 and ISO 14001 are encouraged to help universities set up a management system including environmental policy, action plans, training and evaluation. This is an essential element of Green University which hasn't been emphasized enough.

Campus culture is absolutely necessary for educating students. The fourth element is to let 'green' culture become one connotation of campus culture. There are three contents of the 'green' culture: the green campus environment and its radiation to surrounding communities, the campus management regulations, and green curricula, environmental awareness and responsibility.

Thus Green University is regarded as one of the best approaches to implement the strategy of sustainable development in higher education.

Opportunities and barriers of carrying out education for sustainable development (ESD) through higher education

How to carry out ESD is the core of the Green University. The late start of environmental education (EE) and ESD in China led to a serious lag of its development. However, opportunities and barriers are always there together for every new event.

Opportunities

Scientific development as the national development strategy

After about 20 years of high-speed economic development and great investment in environmental protection, the trend of environmental deterioration hasn't been stopped yet in China. The quality of economic development is now being greatly emphasized. Scientific development, with the nature of sustainable development, has become the national development strategy of China. Universities, together with primary and secondary schools, are responsible for the improvement of public awareness of environmental protection and sustainable development. Thus, ESD in universities will also gain enough importance as the absolute necessity of implementing sustainable development.

The stress of environmental degradation

Resource and environmental issues have become the bottleneck of economic development in many places of China. The deterioration of environment made itself a focus of the whole society. People with all kinds of background are caring for the environment. In universities, more and more fields of environmental science are developed for research purposes, which also means great improvement of ESD opportunities. Many universities started to open environmental protection related courses as public awareness improvement courses. Students with different majors are interested in this topic and have chances to learn about that.

The sustainability of the university

One objective of higher education is to cultivate capable persons to serve the society. Nowadays, when the whole society is implementing the strategy of sustainable development, universities should also educate students with the awareness of scientific development and environmental protection to meet the new requirement of the society. Those universities that cannot meet the requirements will be washed out under the competitive higher education system. Thus, ESD is gradually becoming an inner drive for the sustainable development of the university itself.

Barriers

However, as a recently born event, the development of ESD in universities will definitely meet obstacles.

Incomplete EE system

For a long period of time, the whole EE system of China is not complete. EE in primary and secondary schools is not enough and there are almost no EE for general public and in adult education. This situation makes it difficult for universities to fulfill the task of EE on their own. Especially there exist many problems in the higher education system such as the out of date curriculum design, the shortage of ESD textbooks and teachers, the indifferent self-restriction attitude and poor environmental awareness and behavior of students.

Limitation of disciplinary divisions

In the traditional disciplinary system, physical science and social science developed independently. The early division of physical science and social science in high schools makes it difficult for students to have systematic and scientific ESD training (M. Han, 2002). Except the students in the school of resource and environmental sciences, those in other departments hardly have any opportunity to achieve professional ESD, which greatly limits the popularization of environmental knowledge, not to mention the improvement of environmental awareness. And for those who major in environmental sciences, the scarcity of social and human science also makes it difficult to become persons with high quality integrated knowledge.

Lack of emphasis

The evaluation system of universities in China is now mainly emphasizing on academic achievements, which leads to an excessive emphasis on scientific research rather than carrying it out. To see ESD mainly as an approach for humanity spirit establishment is difficult for both the leading group of the university and the general teachers to comprehend. Thus the implementation of ESD in higher education is still obviously facing great obstacles without support from the university president. ESD is usually a volunteer activity in some universities greatly dependent on personal enthusiasm and on a great crisis of sustainability.

Curriculum Framework of ESD in higher education

For those carrying out ESD in universities, the curricular system mainly contains four types of courses. The first part is public compulsory courses or limited selective courses with 2 or 3 subjects emphasizing on systematically introducing environmental and ecological issues, environmental and development strategies and environmental protection approaches. After taking these courses, the students could have basic capability of analyzing and dealing with environmental issues.

The second type is selective courses and all kinds of lectures the students could freely choose. Different university institutes could develop courses related to ESD according to their own disciplinary features. For example, the course of Ecology could be developed in the Department of Biology, and the course of Environmental Ethics in the Department of Philosophy etc. The students can understand environmental issues and sustainable development from different aspects according to their own interests.

The third part is called hidden EE curricular, which means infusing the contents of environment and sustainable development into those professional disciplinary courses. Having these courses will help the students gradually improve environmental awareness and enlarge fields of vision through their daily learning.

The fourth part of the curricular system is practical activities and research such as field trips in summer or winter holidays about environmental protection, or green communities activities in universities, which provide a great chance for participation. With the responsibility to solve the real problem of the society, students could improve their environmental behavior.

These four types of courses play different roles for ESD, the compulsory courses mainly deliver knowledge, the selective courses and the hidden curricular mainly try to cultivate environmental values and attitudes, while the practical courses provide a chance for improved

environmental behavior. The effective combination of these four types will form a relatively complete curricular system for reaching the targets of ESD.

The Supporting System of ESD in higher education

The curriculum is only one important part of carrying out ESD in higher education. The successful implementation of ESD in higher education requires a set of supporting system.

The need for ESD

The most important step for implementing ESD in higher education is to establish the 'green' atmosphere in universities including the awareness of the leaders, staff and students, the campus environment and the university culture. At the same time of launching the program of Green University, Tsuinghua University proposed to build up a green campus to educate people. The ecological campus established by advanced environmental knowledge is expected to become an educational base for environmental protection and sustainable development. Meanwhile, teaching inside the classroom, university culture establishment and all kinds of practical activities related to environmental protection are also definitely helpful to gradually make ESD an integrated part of the university. Each university should design ESD according to its own programs and needs.

Detailed program and curricular reform

Each university interested in ESD should set it up as a program and carefully plan a series of ESD related curricular. There should be a compulsory environmental related course for the whole university, several selective courses and practical opportunities about environmental protection. The reform of the normal education contents is of necessity to propel the progress of environmental protection. In one word, environmental protection and sustainable development should become a part of the basic knowledge structure of all the students as well as one important component of integrated quality education.

Teaching resources

Most of the environment related textbooks we have now in higher education are mainly for those who major in environmental sciences. There is a lack of teaching resources of ESD in higher education, which combine well physical science and social science together. Thus the development of teaching resources like textbooks including the updated information of environmental protection and sustainable development is very urgent.

The quality of ESD in higher education, to a great extent, depends on the level of teachers. Today, neither the quality nor the quantity of teachers in universities could meet the requirements of ESD in higher education development. Thus teacher training is the urgent affair. Since ESD itself is integrative, the universities should take the advantage of multidisciplinary education to train teachers in different institutes.

Conclusion

Green University is now becoming one of the important directions of higher education reform in China, and ESD is gradually gaining importance in more and more universities due to the requirements of social development. The effective approach to propel ESD in higher education is still in the pilot stage. However, we could believe, just as the great progress of ESD in primary and secondary schools in China during this decade, that ESD in higher education could also achieve great success. A complete and well-implemented ESD in formal education is expected to have great impact on the sustainable development process in China.

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12. Universities and Sustainable Development in a Liberal Democracy: A Reflection on the Necessity for Barriers to Change

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Abstract: This chapter reviews recent developments in England in relation to higher education and sustainable development, and raises questions about the role that universities in a liberal democracy might have in relation to this. The chapter argues that sustainable development is an important focus for universities, but that their freedom to explore this idea in ways that make contextual sense to them and their stakeholders needs to be safeguarded against too instrumentalist and prescriptive a view which would serve only to inhibit the possibilities for sustainable development. The chapter argues that too close a focus on society's *present* expectations for the future – based on presently available knowledge – may have the effect of limiting that future, through a failure to encourage students to test or challenge those expectations. Under these circumstances higher education would have failed not only society but also, more specifically, its present and future students. The chapter draws on data from a number of universities, provided in feedback on the draft strategy for sustainable development of the Higher Education Funding Council (England). It ends by arguing that universities do need effective barriers if their staff and students are to have their freedom to research, teach and learn protected.

Background

Over the last 30 years, the idea of sustainable development has come to be seen in policy circles across the globe (e.g., UN agencies, national governments and international NGOs) as a necessary and urgent response to a range of social and environmental issues that threaten both the integrity of the biosphere, and human well being (Scott & Gough, 2003; 2004). Increasingly, higher education is seen to have a key role. The context is exemplified by this quote from the 1991 *Halifax Consultation* – sponsored by the Social Sciences and Humanities Research Council of Canada, University Leaders for a Sustainable Future, the Canadian Consortium for Sustainable Development Research, and the UN University.

> *"Internationally, sustainability is considered an essential component to the future well being of humanity and the planet. While sustainable development cannot be achieved through changes in one sector alone, higher education in particular is seen as a focal point to help catalyze a sophisticated, action-oriented conversation regarding global sustainability, as well as create (*sic*) sustainable solutions for the future. Sustainability in higher education (SHE) is a relatively new and emergent area of inquiry, yet not without strong foundations. It draws on various disciplines including environmental education, policy analysis, economics, higher education, management theory, sociology, ecology, psychology and philosophy. Despite some success of SHE research to date, the international community has indicated a lack of cohesion amongst researchers and has called for the development of a comprehensive SHE research plan". (See: http://www.unesco.org/iau/sd/rtf/sd_dhalifax.rtf)*

There have been a number of such consultations/declarations, e.g., Talloiries (1990), Halifax (1991), Copernicus (1994), Lüneburg (2001), which many universities have signed.

In England, universities as institutions, and individual academics have interests in relation to sustainable development through research, consultancy, teaching, and management, and there is evidence of an acceleration of interest as the political agenda has come to focus on issues such as climate change, poverty reduction and biodiversity loss. Alongside this work within universities, there has been a parallel increase in interest by external agencies in stimulating its growth, as these significant developments over the past 15 years attest:

1993 The Committee on Environmental Education in Further and Higher Education produced a report Environmental responsibility: an agenda for further and higher education [the Toyne Report; updated, 1996] (HMSO, 1993)

1997 Government funds the two-year project: Higher Education 21, to work with 25 institutions to identify and promote examples of best practice for sustainability in the Higher Education sector (Forum for the Future, 1999)

2000 The Higher Education Funding Council for England (Hefce) funds a three-year project: Higher Education Partnerships for Sustainability (HEPS), to work with 18 institutions to help them deliver their own strategic objectives through a positive engagement with the sustainable development agenda, and share that experience across the sector [http://www.heps.org.uk]

2003 The UK government's Department for Education and Skills published its sustainable development action plan [http://www.dfes.gov.uk/aboutus/sd]

2004 The Higher Education Funding Council develops a sustainable development strategy for itself and for the way it interacts with the higher education sector [http://www.hefce.ac.uk/pubs/hefce/2005/05_01]

The Higher Education Academy (HEA) funds baseline research into embedding ESD into higher education [http://www.heacademy.ac.uk/news/1370_2120.htm]

2005 The Higher Education Funding Council funds two Centres for Excellence in Teaching and Learning for ESD –£4.5million each over 5 years [e.g., http://www.plymouth.ac.uk/cetl/esd].

In 2003, when the House of Commons Environmental Audit Committee enquired into ESD[1] they noted:

> *We are disappointed at the dismal response shown by the Government and the majority of further and higher education institutions (FHEIs) to the Toyne Report and its review. … The Toyne recommendations have clearly not spurred the sector to embrace sustainable development. Although, they have given those who were already starting to explore sustainable development, a framework to build upon … .*

In some respects, quite a lot has been done and achieved, not only in relation to research and development, advanced courses spinning off from this, and undergraduate courses incorporating a range of sustainability issues because of internal interest and external accreditation requirements, but also in relation to environmental management (estates, transport, energy, waste, etc). However, if the extent to which Universities have reoriented themselves such that environmental and sustainability issues pervade the institution ('greening the universities') is examined, then the conclusion has to be that not very much has happened. The reasons for this are reasonably clear in that, over time, universities have responded to:

- their own interests (individual / groups of academics)
- stakeholder interests (community / students / partner institutions)
- external stimuli (research funding opportunities / accreditation requirements)
- pressure of legislation and regulation (waste / transport / energy / etc)

They have, however, been less likely to respond to exhortation or rhetoric from government or NGOs where demand (from staff / students / the local community) has been absent. All this reflects the notional independence of English Universities from government, where a university is quite likely to say: we agree sustainable development is important, but it's not government's place to tell us what to do; we shall think that through for ourselves, according to our own situation. There is a fine line between offering support to the higher education sector, and steering it in a particular way. The paradox may well be that more steering results in a lesser response. An unpublished evaluation of the *Higher Education 21* (HE21) initiative commented:

[1] See http://www.publications.parliament.uk/pa/cm200203/cmselect/cmenvaud/cmenvaud.htm

The existence of HE21 as a significant external initiative has … been helpful in a number of institutions where change was underway or being attempted [but] there is considerable criticism of the … way that HE21 conducted its business with higher education institutions [and] of the way (format and structure) that the (curriculum) specifications were presented to higher education…. [University of Bath, Centre for Research in Education and the Environment]

When the *Higher Education Partnerships for Sustainability* initiative (HEPS) was set up in 2000 to help higher education institutions deliver and share strategic sustainable development objectives, some of the lessons of the HE21 process had been learned: there was institutional buy–in at senior level, with a resource commitment. However, the outcomes of that subsequent initiative show a clear divide between environmental management (where much progress was made) and curriculum (where it wasn't). *Primae facie*, this is easy to understand. Environmental managers have to take the university's environment seriously. It's their job; there is a clear legal and regulatory framework within which they have to act, and clear financial incentives to do so. Academics, however, don't *have* to take sustainable development seriously, except to the extent that there is accreditation pressure, or that they are interested, or that students demand it. Moreover, they usually resent being told what their job entails.

Recent Initiatives

Since 2003, there have been two significant developments by the funding council. The first was to establish centres for excellence for teaching and learning. The one based at the University of Plymouth focuses on education for sustainable development (ESD):

aims to transform the University of Plymouth from an institution characterized by significant areas of excellence in education for sustainable development into an institution modeling university-wide excellence and, hence, able to make a major contribution to ESD regionally, nationally and internationally. Students across the university and its network of partner colleges will be provided with opportunities to engage critically with sustainability agendas and their social, ethical, professional and personal implications. The impact on student learning will be reinforced through opportunities for action research projects into the greening of the campus and into community and regional sustainability initiatives.
(http://www.gees.ac.uk/projtheme/cetls/cetls.htm)

The second involved all universities. In September 2003 the government published its *Sustainable development action plan for education and skills* which asked the Higher Education Funding Council to develop a sustainable development strategy for itself and for the way it interacts with the higher education sector. The Council chose to do this by producing two interlinked documents: a support strategy and an action plan. The support strategy sets out Hefce's vision for higher education's contribution to sustainable development and, in broad terms, its approach to pursuing this vision. There was a consultation period for these proposals, which ended in April 2005.

Responses have been diverse; from the polemically averse, to the broadly supportive. This was a vice chancellor writing in *The Guardian* newspaper:

It is not the job of universities to promote a particular political orthodoxy; it is their role to educate students to examine critically policies, ideas, concepts and systems, then to make up their own minds. The Funding Council should support that objective, including, from time to time, telling the government that the university curriculum is none of its business. (http://education.guardian.co.uk/egweekly/story/0,5500,1407543,00.html)

These were more supportive comments:

We feel that the action plan is a good start, but feel that the Funding Council could be more ambitious.

University A

> *If achieved, the action plan and support strategy are clearly linked. There are many sensible and encouraging comments included in both; however, there are major barriers to overcome.*

University B

This is a critical view from a research-intensive university:

> *The University … is committed to the implementation of sustainability in a wide range of operational areas (e.g., estates services, energy supply, purchasing and waste management), and to support research and teaching that seeks to address environmental issues, as part of the University's wider academic portfolio. But the University is not persuaded that the concept of sustainability espoused in the strategy should form a central principle of institutional management. According to a definition suggested by the Hefce, strategic management is concerned with formulation of a number of long-term, high-level principles outlining the long-term direction of an institution and the sort of characteristics it should have. This is possible only if a plurality of principles is considered, driven by the advancement institution's founding vision. A strategy with the overarching aim of "embedding the principles of sustainable development in [its] values, strategies and organisational learning", with little regard to the institution's own objectives, is likely to subvert this balanced approach. … The fact that the proposals regarding the development of curricula and pedagogy could be put forward with apparently little awareness of how they offend basic principles of academic freedom and institutional legal autonomy is deeply troubling. Not only would the development of "values, skills and knowledge" be inappropriate and contrived for many academic disciplines, but also it is arguable that, in purely intellectual terms, the concept of sustainability is still essentially contestable. Perhaps the most fitting role for universities is to provide space for debate about the concept of sustainability, rather than to implement a strategy and action plan which seem to presume that many of the basic issues surrounding the concept are settled.*

University C

Note here the focus on institutional autonomy, strategic institutional management, academic freedom, and sustainable development's contested nature, and, in particular, the last sentence which echoes, in more measured terms, the points made by the university leader in the Guardian. This is a near-classic expression of the argument that freedom of thought and action are required if society's interests (now and in the future) are to be realized.

The next quoted response is from a university, which, though deprecating the approach taken by the funding council, also criticizes it for a narrow vision of sustainable development:

> *The scope is too narrow, and the top-down approach inappropriate for a funding council. It is hard to see how what is proposed will contribute to minimizing the accountability burden. Whilst we welcome initiatives from the [government] to support Universities in progressing sustainable development education and behaviours, we are disappointed by the apparent narrowness of the understanding of sustainability evinced by these initiatives; nor are we able to support [the funding council's] proposals. The funding council takes … an approach to sustainable development that focuses on the environmental issues and pays scant attention to the ethical, social and moral dimensions of sustainability. Perhaps this is not surprising given the composition of the external advisory group. It is our belief that sustainability has to be approached through preparing our graduates as global citizens which also requires leading by example.*

University D

For this university, there is too much focus on the environment, at the expense of other perspectives, for example, social justice. Note this university's commitment to "preparing [its]

graduates as global citizens" and to "leading by example". The university goes on to note: *"[sustainable development] is an integral part of our learning and teaching strategy, and it intersects with our strategy for internationalization and human resource strategy, the latter primarily through the work of our … steering group."*

Discussion

So, what are we to make of this seemingly vast range of views? The first point to note is that all this action in relation to sustainable development is occurring in parallel with a quite fundamental (and separate) debate about the purpose of higher education. A common contemporary view is that universities exist in order to provide for the skills-needs of the economy in the future. Indeed, this perspective has become so widespread that it may often take the form of an unconsidered, tacit assumption rather than an explicit rationale. One obvious difficulty with this instrumentalist view of higher education is that the skills-needs of the future economy are not only largely unknown, but also, to a significant degree, unknowable. In fact, it seems likely that such skills-needs will be partly a *consequence* of the university curriculum of the present. If so then, ironically, too close a focus on society's *present* expectations for the future – based on presently available knowledge – may have the effect of limiting that future, through a failure to encourage students to test or challenge those expectations. Under these circumstances higher education would have failed not only society but also, more specifically, its students. To say this is not, of course, to argue that a society has no legitimate reason for taking an interest in what its universities are doing. Rather, it is to suggest that there are some desirable social ends, which cannot be achieved through explicit, linear processes of planning, monitoring and evaluation.

If this is true for future economy-related skills-needs, it must be doubly so for sustainable development which is a wider concept within which the economy is subsumed. The idea that our future may be impoverished if we are too narrowly dogmatic now, is particularly powerful. Perhaps it is not going too far to suggest that, not only sustainable development, but also the underlying principles of liberal democracy itself are in danger of being forgotten where a culture of central initiatives and performance targets gain too prominent an influence in universities. As they relate to higher education, such a way of thinking was summarized by the philosopher Michael Oakeshott as follows:

> *This, then, to the undergraduate, is the distinctive mark of a university; it is a place where he has the opportunity of education in conversation with his teachers, his fellows and himself, and where he is not encouraged to confuse education with training for a profession, with learning the tricks of a trade, with preparation for future particular service in society, or with the acquisition of a kind of moral or intellectual outfit to see him through life. Whenever an ulterior purpose of this sort makes its appearance, education (which is concerned with persons, not functions) steals out of the back door with noiseless steps. (Michael Oakeshott quoted in Fuller, 1989, 101)*

Of course, challenges to Oakeshott's view are possible from *within* a broadly liberal-democratic position. Possible examples relate, e.g., to issues of social justice, liberty, social development, the proper role of the state, and of emancipation. Indeed, a concern with social justice issues has led to recent government policy on social inclusion in higher education in England, although a strong overall focus on skills development remains.

Sustainable development is obviously an important issue for higher education, and also provides a highly instructive contemporary case study of policy and practice in relation to the foundational issue described above. Quite simply, it may be asked whether it is any part of the proper business of a university in a liberal democracy to advance what is, after all, a recent and very much contested policy initiative. In essence, it is possible to see government attempts to mandate sustainable development (in a particular conception) as a special case of a wider process in which the university curriculum is subordinated to a kind of instrumentalism which is, at best, simplistic and at worst self-defeating.

More fundamentally, it may be asked whether sustainable development itself is a set of predetermined policy objectives to be implemented once-and-for-all, or a process of adaptive

individual and collective learning in the face of shifting environmental and social circumstances. In the latter case, education as conceived by Oakeshott seems to be not only desirable but actually integral to the process of creating and maintaining sustainability. However, under the former conceptualisation, the transmission by universities of established skills and knowledge in accordance with a centrally determined plan would fit the bill very well.

Conclusion: the necessity for barriers

In discussions around sustainable development and higher education, the idea of barriers features strongly, and these are viewed as impediments to progress to be side stepped, vaulted over, hurled aside, or cast down in one way or another. This negative [barrier = obstacle] perspective is commonly found in the fields of institutional development and the management of change, as well as in wider society where all sorts of barriers are striven against through social policy: e.g., the glass ceiling, poverty, illiteracy, access to education, and discrimination on grounds of age / gender / sexuality / ethnicity / etc.

But in wider society, the idea of a barrier as a positive, protective feature is also widespread. Most often, perhaps, they take the form of physical things: e.g., flood defences, retaining walls, protection against weather, micro-organisms and poisons, as well as more mundane things such as skin and clothes which offer humans the most basic protection of all. There are also barriers erected for the social good: e.g., the idea of a job qualification, an entrance requirement for access to university courses, regulation and legislation that act to discourage crime, etc. In the light of this, it seems important to ask what role such positive barriers might have in relation to sustainable development and universities. We shall do this by re-examining the evidence that universities gave to the Higher Education Funding Council in its consultation.

In none of the university responses would there seem evidence of any *internally-erected* barriers to the freedom that academics have to research and teach about sustainable development issues – and clearly the reverse is true in some responses, especially that of university D where the university's commitment to "preparing [its] graduates as global citizens", and to lead by example, might suggest that not only do barriers not exist at senior management / institutional level, but that they don't exist at departmental or individual levels either – although the latter might be an over-extended reading of what is said.

However, turning to University C, it is certainly possible to see its stance against what it sees as the funding council's prescription as a protective barrier that operates at a number of levels, serving to shield the university itself, and both staff and students from undue external pressure and influence to act or think in particular ways, whilst enabling internal freedom of action. Another reading of this is that the university's stance offers staff and students protection against the university itself – a protection that those in university D would not seem to have.

This tension between externally driven ideas and internally-set agenda is found throughout all the initiatives put in place over the last fifteen years, and to some degree at least, it has been a creative tension, where ideas have grown through interactions. However, to restate aspects of our earlier arguments: universities cannot simply meet future skills needs, because what those needs will turn out to be, depends on a range of factors, some of which are uncertain or unknown. One such factor is the influence of the higher education curriculum itself in determining (rather than meeting) such needs.

Similarly, universities cannot in instrumental fashion teach *now* for sustainable development *in the future*. The precise requirements for sustainable development will also depend on a range of factors, some uncertain, some unknown. Again, one such factor is the influence of the higher education curriculum in determining (rather than meeting) those requirements. Too close a focus on society's *present* expectations and understandings of sustainable development – based on presently available knowledge – may have the effect of limiting sustainable development through a failure to encourage students to test or challenge expectations. Under these circumstances higher education would have failed society, its students and the future. To say this is not, of course, to argue that a society has no legitimate reason for taking an interest in what its universities are doing in relation to sustainable development;

rather, it is to suggest that sustainable development is one of those desirable social ends that will not be achieved through explicit, linear processes of planning, monitoring and evaluation. In this sense the protection that some universities offer their staff and students is a valuable safeguard: a barrier to defend rather than overturn.

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13. Barriers for Incorporating the Environmental Perspective Into Engineering Programs in a Mexican University

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Abstract: The *Metropolitan Autonomous University*, campus *Azcapotzalco* in Mexico City, was one of the pioneer higher education institutions in Mexico to recognize the importance of environmental problems. In 1974, it was the first institution in the country offering an environmental engineering undergraduate program. With the creation of this major, it was thought that the university community would be more aware of environmental problems. However, this did not happen and the environmental perspective was absent in curricular plans of other bachelors programs on the campus.

In the last fifteen years, a team of professors has made several proposals to incorporate the environmental perspective and principles of sustainable development into undergraduate engineering programs that articulates the work of academics and future practitioners in a comprehensive and interdisciplinary way, in the hope of changing attitudes towards the environment.

This effort has not been fruitful. The opinion of this team of professors is that, among others, the engineering community is not aware enough and ready to have a change of this magnitude. Besides, staff of other undergraduate engineering programs, facing the challenge of changing study plans, considers they are not qualified in environmental issues and simply avoids this amendment. In few attempts to achieve this incorporation, it is found that new subjects are inserted without any rigorous content analysis, nor questioning the relevance of large and formal incorporation of the environmental perspective.

A new effort is required, that leads to achieving such a goal, in which several aspects are important to take into account: firstly, aware of collaboration, not only in academic and student community, but particularly with authorities. They are the ones who can make decisions to change institutional management policies. Secondly, experts' collaboration and consulting in environmental instruction during the checking process of study programs. The one mentioned above is not excluded, but it must be complemented with lifelong awareness and information exchange.

Introduction

The *Metropolitan Autonomous University* (UAM) was one of the pioneer higher education institutions in Mexico to recognize the importance of environmental problems by incorporating in its educational syllabus (since its foundation in 1974), an environmental engineering undergraduate program in its campus *Azcapotzalco* in Mexico City.

At that time, the United Nations Conference on the Human Environment, at Stockholm, Sweden (1972) had been recently held. It was underlined in it, for the first time, the necessity of an economical development that does not deteriorate the environment. This way, the new undergraduate program at UAM had a profile focused on engineering and addressed to studies, assessments and technical solutions of problems caused by human activities such as air pollution, water pollution, soil degradation, solid waste management, inappropriate exploitation of natural resources and energy. Thus, the Institution totally answered to this international call, to train such professionals able to solve environmental problems and avoid progressive degradation of environment.

The concepts, environmental dimension, sustainable development, environmental education and environmental training, among others, arose subsequently, with their different interpretations and application modes. It was known in diverse international summits (Belgrade, Yugoslavia, 1975; Bogota, Colombia, 1976; Tbilissi, Georgia, 1977; Managua, Nicaragua, 1983; Moscow, Russia, 1987) that the integration of any of these concepts into study plans and

programs would be a complex process that requires particularly the awareness and a new vision of teachers and professors towards the day-to-day professional activities in every undergraduate program. Then, starting from proposals of different sectors, multiple activities such as workshops, and events, among others, were organized in Mexico in order to foster environmental training and strategies for implanting it. References [1] to [8] are only a sample of mentioned activities.

The UAM Campus *Azcapotzalco* was not outside this changing stage, because some professors of environmental engineering in the undergraduate program participated in an opportunity to think over the role that they could play, in particular, in Basic Sciences and Engineering (BSE). However, the interest did not cover the rest of professors of the whole campus, understanding at the interior of the academic community that 'the environmental' (ambiguous expression) was a working topic specifically for "experts in pollution", another confusing expression. The consequence of such a position was that, except in the environmental engineering undergraduate program, it was not given any space in the environmental dimension of the other programs.

Experience to incorporate an environmental perspective into study plan and engineering undergraduate programs

Being aware of the situation, in 1997, a group of professors of the Basic Sciences and Engineering (BSE) Division developed a proposal in order to incorporate the environmental perspective into study plans and engineering undergraduate programs except in Environmental Engineering, where such perspective was already developed. It was an attempt to articulate in an integral and interdisciplinary way the day-to-day activities for future practitioners, with a vision for changing attitudes towards the environment. Another important aspect of this proposal was that it did not compromise more Division resources, because existent subjects in the actual program were taken into account, without opening new ones. [9]

It was the right moment for two reasons: on the first hand, it was starting a process to update the study plan and programs in the Division, and on the other, the Divisional Council (maximum collegiate body of the academic Division) had just approved a document called 'Guidelines for the Homologation of Undergraduate Study-Plan and Programs of the Basic Sciences and Engineering', in which it was established, as an important issue, the inclusion of the environmental dimension towards sustainable development with emphasis in environmental protection for preparing engineers. [10]

The analysis showed what was already known, that is to say, the environmental dimension only appeared as optional subjects; scattered into curricular plans, without any direct reference in the rest of subjects' contents, as it is indicated in table 1.

Table 1. Environmental Engineering subjects offered to other engineering programs, at the Basic Science and Engineering Division until 1995 (Source: [9])

Subjects	Undergraduate Engineering Programs							
	Civil	Electrical	lectronics	Physics	Industrial	Mechanics	Metallurgy	Chemistry
1. Meteorology of air pollution						Optional		
2. Analytical Chemistry						Optional	Optional	
3. Air quality monitoring and sampling						Optional		
4. Biology	Optional		Optional			Optional		
5. Environmental pollution	Optional	Optional		Optional		Optional		
6. Water supply	Optional							
7. Limnology and water treatment	Optional							
8. Nuclear energy and the environment				Optional		Optional		

Subjects	Undergraduate Engineering Programs							
	Civil	Electrical	lectronics	Physics	Industrial	Mechanics	Metallurgy	Chemistry
9. Waste-water treatment plants	Optional							
10. Population challenge			Optional					
11. Noise pollution						Optional		
12. Urban and regional environment	Optional		Optional					
13. Drinking-water plants	Optional							
14. Treatment of residual liquids from industry	Optional							
15. Environmental Science workshop	Optional	Optional	Optional	Optional		Optional	Optional	
16. Environmental impact assessment						Optional		
17. Solid waste management	Optional							
18. Unitary operations in environmental engineering	Optional					Optional		
19. Unitary processes in environmental engineering	Optional					Optional		
20. Control of gases						Optional		
21. Control of particulates						Optional		
22. Environmental evaluation of technologies						Optional		
23. Atmospheric pollution from industry						Optional		
24. Ecology	Optional					Optional		
25. Resources, environment and development	Optional	Optional	Optional			Optional		
26. Environmental management					Optional	Optional		Optional
27. Underground-water management	Optional							
28. Imaging	Optional							
29. Environmental systems	Optional					Optional		

This study gave place to elaboration of an offer considering a general vision of environmental problems and the impact of practitioner's activities on the environment and their role in the solution and/ or mitigation of such problems, (table 2). These last two issues were really new for professors because the position was "environment for environmentalist", and to dare to state that an electronic or electrical engineer might provoke any kind of pollution, or even worse, might take remediation, was a revolutionary paradigm in those programs.

Table 2. Proposal of Subject from Environmental Engineering Program to offer as optional in other Undergraduate Programs in Basic Sciences and Engineering Division (Source: [9])

Subjects	Undergraduate Engineering Programs							
	Civil	Electrical	Electronics	Physics	Industrial	Mechanics	Metallurgy	Chemistry
1. Environmental Pollution	√	√	√	√	√	√	√	√
2. Environmental Science Workshop	√	√	√	√	√	√	√	√
3. Environmental Management	√	√	√	√	√	√	√	√
4. Environmental evaluation of technologies	√	√	√	√	√	√	√	√
5. Resources, environment and development	√	√	√	√	√	√	√	√
6. Environmental legislation	√	√	√	√	√	√	√	√
7. Nuclear energy and environment		√		√		√		
8. Noise pollution				√	√	√		
9. Environmental toxicology								√
10. Physical-chemical process in environmental engineering					√	√	√	√
11. Underground water management	√							
12. Water supply	√							
13. Water reuse					√		√	√
14. Treatment of residual liquids from industry					√	√		√
15. Control of gases					√			√
16. Control of particulates					√	√		√
17. Atmospheric pollution from industry					√			√
18. Treatment and final disposal of solid waste	√							
19. Management of hazardous and solid industrial wastes					√		√	√
23. Environmental impact assessment	√				√	√		√
24. Selected topic in environmental engineering					√	√		√

This effort to incorporate the environmental dimension into study plans and in engineering programs was not fruitful; modifications were not made even though the Divisional Council Guidelines specified them. Our opinion is that the engineering community was not aware and prepared enough to receive such a big change. Facing decision-making, undergraduate engineering coordinators felt they were not qualified to give an opinion on this issue and they simply avoided it.

During 2001 and spring quarter 2002, the BSE Division checked study plans and programs again, on this occasion through a structure organized by "thematic hubs". Changes made in the frame of such updates are summarized in Table 3.

Table 3. Environmental Engineering Subjects that are taught as optional or required in other Engineering Programs as Basic Sciences and Engineering Division during 2002 Autumn Quarter

Subjects	Undergraduate Engineering Programs							
	Civil	**Electrical**	**Electronics**	**Physics**	**Industrial**	**Mechanics**	**Metallurgy**	**Chemistry**
Environmental Science Workshop	Optional	Optional					Optional	
Environmental Pollution	Optional	Optional		Optional		Required		
Environmental Management	Optional				Optional			Optional
Nuclear energy and environment		Optional						
Resources, environment and development	Optional		Optional					
Urban and regional environment	Optional							
Ecology	Optional	Optional						
Environmental systems	Optional							
Pollution of environment	Optional							
Noise pollution						Optional		
Environmental evaluation of technologies						Optional		Optional
Prevention and minimization of environmental pollution								Optional
Required credits in order to take environmental courses	Take between 12 & 33 optional credits in social, humanistic or environ. dimension	Take 9 optional credits in environ. dimension	There are not	There are not	There are not	There are not	There are not	There are not

Source: [11]

Table 3 shows that the environmental perspective itself is not present in study plans and programs in the Division yet. It seems that undergraduate engineering coordinators had inserted new subjects, keeping the old ones, without making any rigorous content analysis, nor questioning the importance of formal and broad incorporation of the environmental dimension.

A new effort is required that leads to such intentions, in which several aspects are important: firstly, conscious collaboration, not only from the academic and student community, but particularly from authorities. These are the ones that can make decisions inscribed into institutional management policies. Secondly, expert collaboration and consultation in environmental formation during the process of checking study programs. The previous one does not exclude but it must be complemented with lifelong consciousness and information exchange; as well as, diffusion in the community of progress of the programs tending to improve the environmental quality.

Conclusions

Results of initial experiences give examples of the difficulty in incorporating environmental dimension into study plans and programs, beginning with the individual consciousness of academic and institutional people in charge. Good will and interest of some participants in working groups is not enough to achieve effective goal setting.

It is necessary to look for an improvement and interchange of experience among those in charge and experts in environmental formation in order to introduce environmental perspectives in a professional, efficient and joint effort.

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14. Sustainability as an Outcome of Transformative Learning

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Abstract: In this paper, sustainable development is not seen as an end or goal but as one of several inputs or drivers for transformative learning. While there is a constellation of ideas as to what sustainable development might entail, the lack of consensus about the implications of an exact meaning in variable contexts prevents global prescriptions. Forcing consensus about the perspective of an ill-defined issue such as sustainable development, is undesirable from a deep democracy perspective and is essentially 'mis-educative' (Dewey, 1938).

Deep democracy offers a way of thinking about difference, as opposed to consensus. Democracy, from this perspective, depends on difference, dissonance, conflict, and antagonism, so that deliberation is radically indeterminate (Goodman and Saltman, 2002). The conflicts that emerge in the exploration of sustainable development, for instance, the inevitable tensions among the three P's (People, Planet, Profit) or the three E's (Efficiency, Environment, Equity), are prerequisites for rather than barriers to higher learning.

Universities in particular have a responsibility to create space for alternative thinking. They have a profound role to play in developing students' dynamic qualities or so-called competencies. They will need these qualities to cope with uncertainty, poorly defined situations, and conflicting or at least diverging norms, values, interests and reality constructions. The development of these dynamic qualities and related competencies sets higher education apart from institutions that provide training or conditioning, and makes the prescription of particular lifestyles or codes of behaviour or convergence towards a particular set of privileged values and interests problematic. Such prescription stifles creativity, homogenizes thinking, narrows choices, limits autonomous thinking, and minimizes degrees of self-determination.

In this paper we will focus on dynamic qualities for transformative living, and on the kinds of learning processes and university structures that are conducive for their development.

Sustainable development as autonomous thinking and systemic change

In a postmodern world, pathways towards sustainable universities are unlikely to develop without friction, controversy, and conflict. After all, we live in a pluralistic society, characterized by multiple actors and diverging interests, values, perspectives, and constructions of reality (Wals & Heymann, 2004). The ill-defined and uncertain nature of working towards sustainable living and the complex and contextual nature of higher education itself, do not allow for universally applicable recipes for implementing sustainability in higher education. University boards cannot rely on the exclusive use of economic incentives, rules, standards, and regulations to enforce sustainability in higher education. At the same time, reliance on the instrumental use of education, training, and communication to promote or even force one particular view of sustainability, is problematic as well, particularly in higher education where critical and autonomous thinking should be emphasized.

When recognizing that sustainability is an inchoate concept that derives meaning in a specific context with the involvement of multiple stakeholders, an important question is raised as to how one deals with the inevitable tension among the divergence of interests, values, and worldviews on the one hand - and the need for the shared resolution of issues that arise in working on sustainability in higher education on the other. Pluralism of thought, when applied constructively, can be a driving force for reaching solutions to sustainability issues in higher education. It is this pluralism of thought that can lead to creative solutions to complex challenges. Higher education has a responsibility to cultivate such pluralism. This means that universities should be wary of the trap of standardization, of mainstreaming, and of privileging one economic perspective over others.

We think that integrating sustainability in higher education can be advanced by processes that anchor it in university life systems. These principles can serve as such anchors in developing autonomous thinking and systemic change.

Principle	Description	Examples
1. Total immersion	Fostering a direct experience with a real-world phenomenon	Observing and monitoring sustainability impacts Managing a specific site
2. Diversity in learning styles	Being sensitive to the variety of learning styles and preferences that can be found in a single group	Offering a variety of didactic approaches Reflecting on the learning process with the learner
3. Active participation	Developing discourse and ownership by utilising the learners' knowledge and ideas	Soliciting the learners' own ideas, conceptions and feelings Consulting learners on the content of the learning process
4. The value of valuing	Exposing the learner to alternative ways of knowing and valuing through self-confrontation	Giving learners opportunities to express their own values Creating a safe and open learning environment
5. Balancing the far and near	Developing empowerment by showing that remote issues have local expressions which one can influence.	Relating issues of biodiversity or sustainability to last night's dinner Showing examples of groups of people successfully impacting the local and global environment
6. A case-study approach	Digging for meaning by studying an issue in-depth and looking for transferability to other areas	Assigning different people to explore different angles of a particular theme and bringing the different angles together
7. Social dimensions of learning	Mirroring the learner's ideas, experiences and feelings with those of others through social interaction	Taking time for discussion and exchange Addressing controversy Stimulating flexibility and open-mindedness
8. Learning for action	Making the development of action and action competence an integral part of the learning process	Allowing learners to develop their own course of action and to follow through with it Studying examples of action-taking elsewhere

Table 1. Some Process Anchors for Integrating Sustainability in Higher Education (source: Wals et al, 1999, p.28; Wals & Dreyfus, 2000, p. 81)

Stephen Sterling maintains that the nature of sustainability requires a fundamental change of epistemology, and therefore, of education. He writes:

> *Sustainability is not just another issue to be added to an overcrowded curriculum, but a gateway to a different view of curriculum, of pedagogy, of organizational change, of policy and particularly of ethos. At the same time, the effect of patterns of* un-sustainability *on our current and future prospects is so pressing that the response of higher education should not be predicated only on the 'integration of sustainability' into higher education , because this invites a limited, adaptive, response…. We need to see the relationship the other way around—that is, the necessary transformation of higher education towards the integrative and more whole state implied by a systemic view of sustainability in education and society (Sterling, 2005, p 50).*

A challenge for all of us in a higher education system that is part of the un-sustainability problem, is how we can address the problem from within by analysing learning levels and learning responses. Sterling offers possibilities for deeper and more transformative learning. Sterling writes that "the process of sustainable development or sustainable living is essentially one of learning, while the context of learning is essentially that of sustainability" (Sterling, 2005, p 52). But how do we create such a context?

Longing for Kindergarten

What makes higher education higher than other educations? Or what does higher education need to do in order to be labelled 'higher'? It can be argued that the qualification of 'higher' has little to do with the quality of the learning that takes place in most universities. After all, the academy remains notoriously stubborn in changing its unidirectional, hierarchical, and essentially reproductive approach of teaching. Most professors are still there to 'profess', while most students are still there to absorb it all. The same holds true for the way the content of most universities is structured. 'Content' is still organized in disciplines both in research and in education. By often failing to approach our problems holistically, we tend to create new problems in attempting to resolve the old ones. As our problems become increasingly complex, our ability to effectively respond to them diminishes.

Ironically, the 'lower' we go in education the more real-life-oriented and experiential it becomes. Robert Fulgham once said "wisdom is not at the top of the graduate school mountain, but there in the sandbox". He illustrates this in his famous 'All I Ever Needed to Know I Learned in Kindergarten.'

> *Most of what I really need to know about life, I learned in kindergarten. These are the things I learned: Share everything. Play fair. Don 't hit people. Put things back where you found them. Clean up your own mess. Don 't take things that aren't yours. Say you're sorry when you hurt somebody. Wash your hands before you eat. Warm cookies and cold milk are good for you. Live a balanced life. Learn and think, draw and paint, sing and dance, play and work a little everyday.*
> *Take a nap every afternoon. When you get out into the world, watch for traffic, hold hands, and stick together. Be aware of wonder. Remember the little seed in the plastic cup. The roots go down and the plant goes up, and nobody really knows why, but we are all like that.*
> *Goldfish, hamsters, white mice, even the little seed in the plastic cup, they all die. So do we.*
> *And then remember the book about Dick and Jane, and the first word you learned, the biggest word of all: LOOK. Everything you need to know is in there somewhere. The Golden rule, love and basic sanitation; ecology, politics and sane living.*
> *Think of what a better world it would be if all of us, the whole world, had cookies and milk at about three o'clock every afternoon, and then lay down with our blankets for a nap. Or if we had a basic policy in our nation, and other nations, always to put things back where we found them, and cleaned up our own messes.*
> *And it's still true, no matter how old you are, when you go out into the world, it's best to hold hands and stick together. (Fulgham, 1986)*

Fulgham's memories of what he learnt in kindergarten illustrate the possibilities education offers for moving towards a more sustainable world. They also make painfully clear that the education system from kindergarten onwards appears to be eroding these possibilities as we move 'up' the ladder. David Orr even goes further by suggesting that by failing to develop some of the values Fulgham refers to and by failing to challenge some of the unsustainable lifestyle patterns, education in general is basically equipping us to become more effective vandals of Earth, while those who educate for sustainable development and who remain oblivious of this, are 'walking North on the Southbound train of globalisation (Orr, 1994; 2003).

Why do kindergartens offer more possibilities for moving toward a more sustainable world than many of our universities[1]? Kindergartens ideally are or can be places where young children live and learn, and explore boundaries in a safe and transparent world without hidden agendas. Kindergartens are places where conflict emerges everyday and is used as a 'teachable' moment. Kindergartens today are multicultural places where children with different backgrounds come together and get to know each other as they are, not as they are portrayed by

[1] At the same time it can be argued that we, like Fulgham, romanticize kindergarten. Not all childhood experiences in kindergarten are good ones (see for instance Polakow, 1992). All we try to do here is to make the point that in moving towards higher education, we seem to regress in both the content and process of teaching and learning.

others[2]. Kindergartens are also places where different generations meet and interact (children, parents, grandparents). They are often located in the heart of the community. There are no "dumb" questions in kindergarten and there's always time for questions and questioning. The life-world of the child forms the starting point for learning, not for disciplinary problems. There is room for exploration, discovery, and multiple ways of expressing oneself. It's a place filled with energy. And there are some basic rules, principles, and skills needed to function in an organic whole.

So does this mean our universities should become more like kindergartens in order to contribute the creation of a more sustainable world? Yes and No. 'Yes,' in that the learning processes and learning environments need to become more authentic, inspiring, and driven by existential issues. The rigid disciplinary structures that block more systemic and holistic ways of looking at the world need to be broken down. 'No,' in that there will still be a need for disciplinary knowledge as the resolution of existential issues may still require such knowledge.

Yet, higher education can play a pivotal role in turning society toward sustainability. In order to do so it must rediscover and teach indigenous and ancient truths, generate new concepts and ways of thinking, and must inspire students with a hopeful vision. Certainly the principle of intergenerational responsibility is at the heart of formal education from – from kindergarten through tertiary education. The assumption of human culture has been that the beauty and bounty of Earth would be transferred across generations, that the process of education would transfer the values, skills, and knowledge to survive and thrive in the cultural and natural systems of which we are a part. In the modern world, universities have had a pivotal position in defining education for this task. Yet certain core ideas embedded in disciplinary thinking and the practice of those ideas are increasingly problematic. Hence, a challenge to higher education is to reconsider its disciplines, its institutional practices, and, indeed, its mission to account for economic and human development that is sustainable.

Sustainability as Transformative Social Learning

Exploring sustainability in higher education can be seen as a process of simultaneous individual and institutional confrontation in order to arrive at a better understanding of both the potential significance of sustainability for both the institution and for oneself. Adopting such a position means putting emphasis on the process and its facilitation. There is a need for facilitated cultivation of pluralism and conflict in order to create space for social learning in moving towards contextual sustainability in higher education.

The process undertaken by a group determining how to become sustainable as an institution of higher education can be viewed as a particular manifestation of social learning. Social learning here is seen as a collaborative re-framing process involving multiple interest groups or stakeholders (Vandenabeele & Wildemeersch, 1998). Through discursive dialogue and cooperation between people positioned within different configurations or frames with regards to the key issues involved, such learning can be intensified and lead to change. Hence, social learning can be viewed as an intentionally created, purposeful learning process that hinges on the presence of alternative constructions of reality.

If indeed the exploration of sustainability in higher education involves the reconciliation of diverging norms, values, interests, and constructions of reality, then the innovation process should be designed in such a way that differences are explicated rather than concealed. By explicating and deconstructing these differences it becomes possible to analyze their nature and persistence. This is an important step since it helps to improve both the dialogue between the stakeholders involved and to identify strategies for utilizing conflict in the social and individual learning process.

The promotion of sustainability in higher education requires more than consensus in the present, but rather requires a dialogue to shape and re-shape situations and conditions. A dialogue here requires that stakeholders involved can and want to negotiate as equals in an open

[2] We are not referring to private kindergartens and head start programs designed to track children and reduce diversity in order to 'excel' academically at a very young age.

communication process which views diversity and conflict as the driving forces for development and social learning (Kunneman, 1996; Wals & Bawden, 2000). As Wals and Heymann (2004) point out elsewhere, such dialogue rarely emerges spontaneously, but requires careful designing and planning. Sustainability can and perhaps should be a highly contested concept and the potential differences in interests and possibilities can be significant, especially when there are significant power imbalances within a university.

Sustainability in higher education can be regarded both as the collaborative creation of an ever-evolving concept and as an engaging creative process involving a variety of different actors. Moving towards sustainability as a social learning process has up until now received less attention than concepts of sustainability as expert predetermined and teachable products (Wals & Jickling, 2002). One question to be raised is: How can academia help develop personal capabilities that generate positive but often unanticipated outcomes? This is a question related to determining the kind of competence that is needed to contribute to sustainability and academia's role in developing such competence amongst its staff and students. With Raven and Stephenson (2001), we agree that competence here does not refer to getting a job done effectively, but rather to making an effective contribution to society by going beyond boundaries and by influencing the systems in which the competence is developed. From this perspective, sustainability can, at the institutional level, be viewed as a catalyst for systemic institutional and organizational change.

Education for sustainability, above all, means the creation of space for transformative social learning. Such space includes: space for alternative paths of development; space for new ways of thinking, valuing and doing; space for participation minimally distorted by power relations; space for pluralism, diversity and minority perspectives; space for deep consensus, but also for respectful disagreement (Lijmbach et al., 2002) and differences (Olson & Eoyang, 2001); space for autonomous and deviant thinking; space for self-determination, and; finally, space for contextual differences. This observation reminds us of John Dewey's views on education and democracy, almost a century ago, when he argued that education should realize a sense of self, a sense of other, and a sense of community. It should create space for self-determination as individuals and members of groups exercising greater degrees of autonomous thinking in a social context (Dewey, 1916).

Conclusion

The place of sustainability in the curriculum of higher education is not one of integration but rather one of innovation and systemic change within our institutions that will allow for more transformative learning to take place. Transformative learning emphasizes learning for being, alongside learning for knowing and learning for doing. It requires permeability among disciplines, the university and the wider community, and between cultures, along with the competence to integrate, connect, confront, and reconcile multiple ways of looking at the world. These multiple ways of looking at the world can perhaps best be summarized by four transformative shifts or movements that characterize transformative learning towards a more sustainable world: *transdisciplinary shifts* (looking at sustainability issues from a range of disciplinary angles but also in ways not confined by any discipline), *transcultural shifts* (looking at sustainability issues from a range of cultural perspectives but also in ways not confined by any one culture in particular), *transgenerational shifts* (looking at sustainability from different time perspectives – i.e. past, present and future) and *transgeographical shifts* (looking at sustainability issues from a range of spatial perspectives – i.e. local, regional and global). This shifting back and forth between perspectives along these four area's (Figure 1), needs to be well-organized by our institutions of higher education and ultimately demands a whole system redesign of our educational system. In this chapter, we have provided a number of ideas for innovation of teaching and learning in higher education, which will, we hope, lead to educational institutions deserving of the label 'higher'.

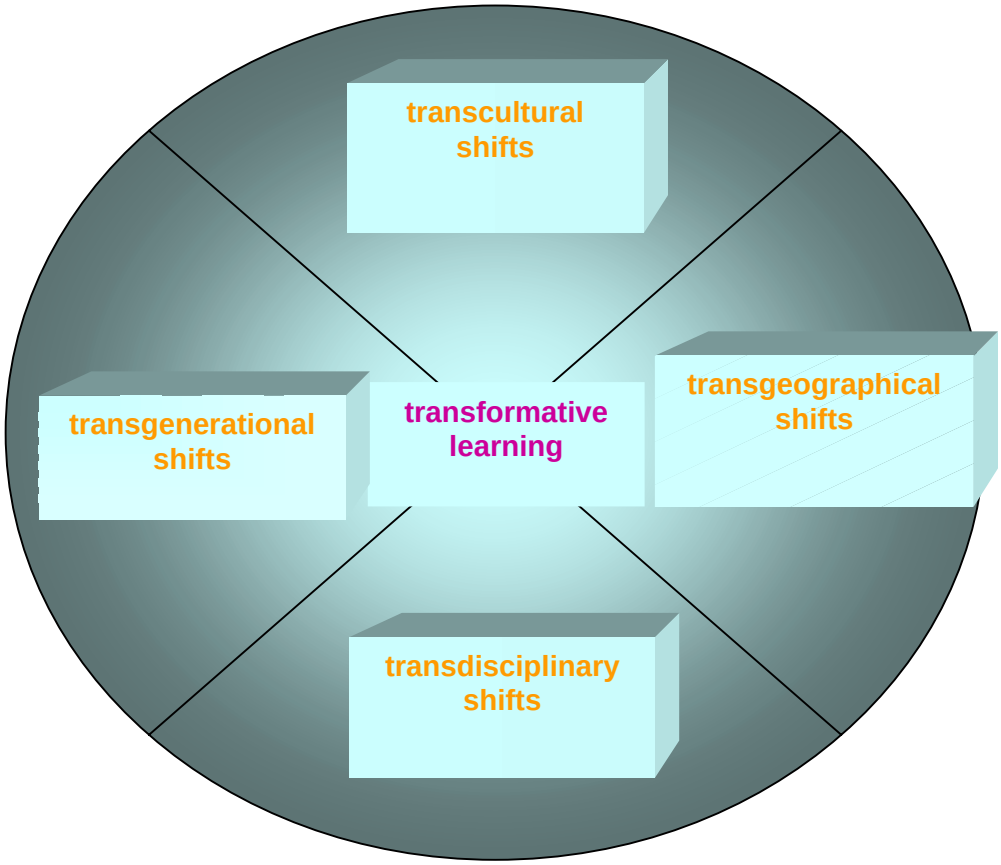

Figure 1: Four dimensions of transformative learning

Our search for a more sustainable world requires new thinking that can break the cycle of un-sustainable knowledge creation and transfer, un-sustainable technological development, and unsustainable consumption patterns tied to un-sustainable economic principles. At present most of our universities are still leading the way in advancing the kind of thinking, teaching, and research that accelerate un-sustainability. In order to correct this pattern, we need to question and reform deeply entrenched routines, structures, and practices by taking advantage of the privileged position universities have in our society. We must utilize some of the brightest minds on the planet to find ways to preserve, rather than to destroy, that very planet.

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15. Norm Supporting Actors and Structures At the very Local Level of Implementation of Sustainable Development in Higher Education

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Abstract: In this sociology of law article on implementation of Sustainable Development (SD) in Higher Education, the aim is to present and sum up some main results from my research studies during 1993-2005 from a *norm science* point of departure.

The process of norm creation is important, as is the 'norm triad' as an analytical tool for the understanding of the university's work with the new sustainable development theme. A 'norm' is in a simple meaning an "action directive" or "action direction" that is quite related to and vital in the understanding of the notion "action competence". An important result from this perspective is the understanding that it is knowledge, commitment, and inspiration from the actor's lifeworld that has been allowed – contrary to earlier ideals – to influence the professional role (in the system) of the University's actors. This mode of professional practice has been introduced by exceptionally dedicated individuals or key actors that have acted as forerunners and norm setters. This development would not have been possible if the professional and bureaucratic-administrative actors had not adapted to this development by creating *norm-supporting structures* in the local environment of the universities. The norm support given by the University´s leaders is necessary and crucial to success in this respect of local implementation.

Norm Supporting Structures are essential to identify, create and make use of in the very local level of implementation of new education policy and practice in universities to support the local key actors like the "souls of fire", the very dedicated persons from the groundswell.

Education for Sustainable Development (ESD) in Higher Education are vital areas in those learning and clarifying processes for future actions.

In this sociology of law article on implementation of Sustainable Development (SD) in Higher Education, the aim is to present and sum up some main results from my research studies during 1993-2005 from a norm science point of departure. The first research report – my doctoral thesis and some following studies – examines and focuses on the convergence of the three processes of influence in the local educational context[1]. This article, however, also tries to focus on the more or less similar activities taking place right now in Higher Education. The aim here is to apply the earlier results in the application of SD in the universities and Higher Education – specially the implementation of the forthcoming amendment on sustainable development in the Act on Higher Education. What will and could or could not happen? What is possible? Drivers and Barriers?[2]

Introduction and Background

Education from a social science perspective is basically seen as something with the main social function of changing or maintaining society (Bernstein & Lundgren, 1983; Richardson, 1998). Education is not to be seen or studied isolated from its social context. In *The Order of Discourse*, Michel Foucault writes about education as a system from a power perspective. He states that "every educational system is a political instrument to maintain or to change the mastering of discourses and thereby also the knowledge and the power that it brings" (Foucault, 1971:25). There are also a number of other social science perspectives on education. That education function as an arena for norm creation and norm maintenance, socialisation and

[1] More detailed and elaborated views and analysis on those law and policy processes are presented in the books mentioned above, Wickenberg (1999; 2000, 2002 and 2004).

[2] It is given in the Goverment´s Budget Bill 2005/06:1, the suggestion that an amendment should be inferred in the Act on Higher Education (1992:1434) in 1 Ch. 5 § with the following wording: "Higher Education institutions are required to promote sustainable development in their activities, which means that present and future generations are ensured a healthy, sound environment, economic and social welfare and justice." (p. 23).

discipline is well known above all in the fields of pedagogy, political science and sociology as well as an important factor in economical expansion and growth (Segerstedt, 1957; Boalt & Husén, 1964). Other functions can be that of a platform for social order and control (Illich, 1971), social custody, social differentiation, transformation of culture (Bourdieu, 1986), social mobility and individual class travelling as well as democratic empowerment of teachers and students. Education is thus an institution with a long history and in Sweden it is also an officially sanctioned and vast area for influence and indoctrination. By definition, education is an organisation and institution created by society to deliberately influence children and youth in a certain direction. The Swedish public schools and higher education can also be seen as an expression of modern society's idea of citizenship (Englund, 1986/1990; Östman, 1995; Boman, 2002 – see also Öhman in the anthology, Wickenberg et al, 2004). It has become the greatest societal welfare institution in Sweden today and one that is almost impossible or hard to steer (Lundgren, 1977; Wallin, 1997; Alexandersson, 1999; Lindesjö & Lundgren, 2002). Although being this great Swedish welfare institution the research in education from a social science perspective – except educational science and pedagogy – today is very limited.

Since 1990, it has been the mission of all Swedish schools to provide education and teaching on the environment. This was clearly stated in the opening paragraphs of the amendment to the Education Act adopted by Parliament on December 10 of that year: "Everyone who serves in the schools has a mission to foster … respect for our common environment" (SL 1 kap 2§). This means: everyone active within the school system has to address and relate to the new environmental theme in society. Soon after this amendment was enacted, the Government appointed a new curriculum committee with a clear mission regarding the environment. The new national curricula were decided upon in 1994. In those policy and steering documents 'sustainable development' was added as a mission (task) of the Swedish school system (Lpo 94 and Lpf 94). Before the curricula were decided upon, in June 1992 at the United Nations Conference on Environment and Development (UNCED, also known as the Earth Summit) in Rio de Janeiro, the Agenda 21 action plan on sustainable development was adopted. Education is in fact a substantial part of Agenda 21 – the word "education" alone or in combination occurs 486 times in this UN document. Parallel to these two events – the Swedish environmental education amendment and Agenda 21 – commitment to and engagement in the environment has been growing at the local level and in the community ever since the 1960s. What happens when these three influential processes (see Figure 1 below) converge at the local level? That is the main research question in the sociology of law research project I conducted between 1993-1999.

The text in the Education Act with its normative messages and signals takes on a concrete form in different curricula and syllabi. In those new curricula "sustainable development" also was introduced and added in the official and societal tasks or missions of school.[3]

3 Lpo94 (1994), p.7; Lpo94 (1998), p.8 and Lpf94 (1994), p. 26. In 2004 a Governmental official investigation, SOU 2004:103, "Learning for sustainable education", suggested that "promoting sustainable development" should be added in the Act on Education and in the Act on Higher Education. Those proposals in a Governmental Bill are probably to be adopted by the Parliament in Autumn 2005. 'Education for sustainable development' was also brought into the Government's Research Bill "Ny värld – ny högskola" ("New World – New University", Regeringens proposition 2004/05:162, June 2005). They say: "Education and research has an important and forwarded role in the work for creating conditions for a sustainable development". In Autumn 2005 research and educational work started at Lund University, heading for research studies in the ways the new mission to Higher Education in Sweden are to be implemented at the University within and between different faculties (ESDiL, Education for Sustainable Development in Lund). A special in depth study are to be included in that focussing the political initiation processes on different levels behind the amendment in the Act on Higher Education (see also above in foot note 2).

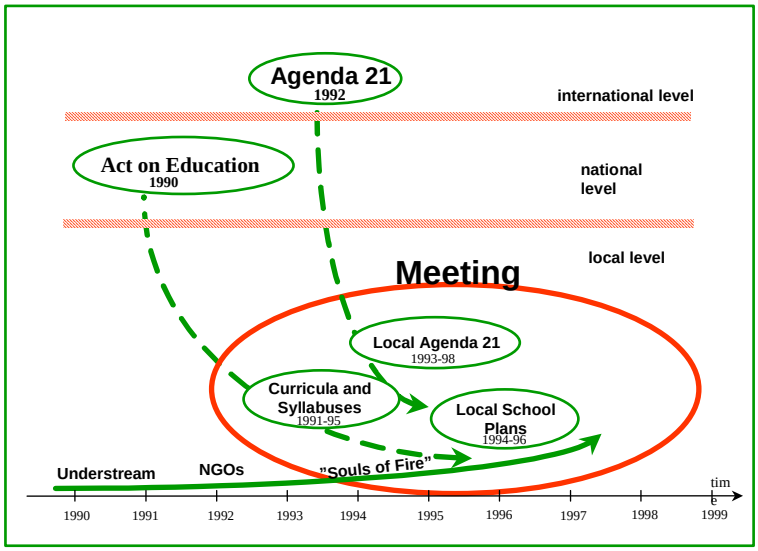

Figure 1. Distant and top-down indications of influence and control and their convergence on the local level with a groundswell of environmental and sustainability activities (bottom up perspective).

Education, instruction, schools and universities belong to what, in sociology of law context, can be described as different "forms of influence" or "forms of control". The latter concept is often used in a top-down perspective; the concept of "regulation" is also sometimes used. A more comprehensive concept for this form of influence in higher education, school, etc., from the sociology of law point of view is referred to as "social forms of influence." Other forms of influence are "market or economic" ones, and "political or administrative" ones, in which justice in the form of laws, ordinances, statutes and so on are included as a subset. A fourth form of influence is the "socio-technical infra-system," our infra-structural systems.

In relation to the size of the area and its scope, there is surprisingly little such scientific research on ESD carried out so far in Sweden.[4] The new millennium has indeed started in a promising way with some research groups on ESD growing in different places in Sweden. That is a result of common and united efforts in research and networking during mid and end of the 90s. Today the most elaborated research nodes in these EE (Environmental Education) and ESD-areas (Education for Sustainable Development) are the following three: Uppsala-Örebro; Stockholm area (in itself) and Malmö-Lund-Kristianstad-Växjö. Gothenburg might be a fourth node.[5]

Finishing this broad introduction I will get back to the main question in this article: What will happen when these influential processes mentioned above converge at the very local level in the universities and higher education? What Drivers and Barriers are to be foreseen and how to handle these using a critical social science perspective?

[4] For pedagogic or didactic views on this educational area of EE and ESD in Sweden: see other articles in Wickenberg et al (eds. 2004). For an overview of this research field in Sweden: see Östman (ed.), 2003.

[5] Since the spring of 2000, a national research network – "Education & Sustainable Development" – has been gradually built up with financial support from the Swedish Council for Planning and Co-ordination of Research (FRN) and the Swedish Research Council. The Network presently includes about 35 to 40 researchers (at the doctoral and post-doctoral levels) from 13 universities and colleges in the country. Most of them have contributed to the anthology (Wickenberg et al, eds., 2004). In this respect the initiatives in and around "Agenda 21 for education for sustainable development in the Baltic area – Baltic 21 Education" has also been inspiring and created a new arena and resources for new research and development on EE and ESD. This document was approved by the Ministers of Education from all Baltic countries – completed by Norway and Island – at the Haga Castle in Stockholm, January 24-25, 2002. The Government in Sweden has also in June 2002 formulated a national strategy for sustainable development to the world summit on sustainable development in Johannesburg, September 2002. In this policy document education has got a vital role as an instrument for sustainability.

Main Results of the Research

The main question in this article was: What happens when these three influential processes mentioned above converge at the very local level at the universities? What could be seen and learned from other educational arenas? The findings of my norm related research was earlier presented in an organised and structured fashion under the following subheadings:

- The Norms
- Base of Sustainable Development Knowledge and Learning
- The Commitment of the Lifeworld and the Very Dedicated Actors
- Norm Supporting Actors and Structures (Organisation)
- The Distant Impulses of Influence and Action

In this context and article I will not focus all factors or subheadings in this context but due to the connections to and parallel findings in my further and ongoing research I will only but shortly present the first four items of the subheadings above. The universities in Sweden are now facing the task or mission via the Act on Higher Education (above no 5: The Distant Impulses of Influence and Action – see also footnote 2 above) to integrate 'sustainable development' in their main activities – education, research and in communication their results in the society.

The Norms

Using the norm concept as a departure in order to be able to interpret and understand the actions and action patterns of individuals and groups has been the theoretical centre of my research. By 'norm' in this context I refer to 'action directives' or 'action direction'. A point of interest for myself has been whether I would be able to use the 'norm triad' or 'norm model' (Hydén, 1998; 2002) as an instrument to analyse, interpret and understand under what circumstances the sustainable development theme has been established with adult key actors in the higher educational system. What lay behind the dominating norms in this context? Furthermore, I was interested in what/who represented the 'supporting' (drivers) contra the 'obstructing (barriers) structures' with respect to the creation, development, and maintenance of the norms.

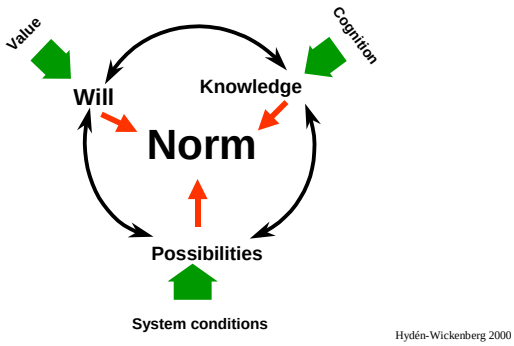

Figure 2. The Norm Triad as presented by Hydén-Wickenberg (1998). The Norm has three main dimensions: Knowledge – Will & Value & Emotions – Possibilities or Systemic Conditions

Norms created in the lifeworld and brought into the professional atmosphere play the most important part in the communication and activity relating to environmental and sustainability work. The norms used by the system for sustainability work are relatively unknown for the key actors, but on an intuitive (cognitive-emotional) meta level they form a moral background or "life belt of legitimacy" for the key actors' normative sustainable development related work. However, the normative contents of the professional (that is, the everyday pedagogical tools) goal and policy statements' (the curriculum and syllabi) are well established with the key actors. The meeting of these normative systems of activity carries great weight for the development of sustainability pedagogy – see further below. Ethics represents a concept of great weight for the key actors dealing with sustainability activities. The sustainable

development related activities and activity patterns also form ethical models for the creation of norms. Moral-ethics, values, and desire-will form the third pillar of the norm.

The *norm supporting structures* that are mobilised in universities as a support for dedicated key actors, as well as the norms and sustainability related activities associated with sustainable growth, carry significance for the actors in the anchoring, development, and forwarding of norms and activities. This carries a collective significance for the initiation of a new theme at the local University level. Phronesis, one of Aristotle's knowledge forms (intellectual virtues), which has received new-found attention in neo-aristotelian ethics, centres around judgment and wisdom, and is a practical knowledge closely related to norms, activities and activity patterns. Phronesis forms a focal point for norms and for my study. Phronesis is active knowledge – or wisdom in practice – viewing action as a goal in and of itself. This is significant for the ethical aspect of the activities or activity patterns of 'dedicated individuals,' when the former are viewed as goals in and of themselves. This is also significant for teachers/researchers as public servants as well as our public ethos, a subject I address below. There are no judicial obstacles to the teacher passing his lifeworld commitment into the education, but there are given frameworks and norms. I shall return to the 'dedicated individuals'. Phronesis – knowledge and judgment in practice – is a stimulating topic of discussion within the framework of norm science, and interesting to address further in practical research. Flyvbjerg (1991) presents in this context an interesting topic of research on the science of the concrete, described as "progressive phronesis." Lundquist (1998) expresses a want for a methodology related to 'phronesis.' I see in this a possible connection to norms in my continued research.

Base of Sustainable Development Knowledge

The first step in a Norm Analysis – as a Driver or a Barrier – could be the knowledge and the conceptualisation of the meaning of the concept "sustainable development" in the activities in different University subjects or knowledge areas. Widely discussed as problematic and impossible from a scientific point of view. Furthermore it is of importance to try to *operationalize* what it means in a certain context to the specific University and its different University subjects or areas. Today there is a lot of scientific literature in this knowledge field[6]. That is one of the pillars of implementation and a real stepping-stone for further work.

The Commitment of the Lifeworld and the Very Dedicated Actors

Teachers and staff working with the sustainability theme in universities attain the majority of their convictions, commitment, and feelings from their personal lifeworlds and the experiences of colleagues. Key actors bring their commitment and driving force from their lifeworld into their professional sphere. The profession and the professional arena form a part of the societal system (e.g. the System – Habermas, 1995:119-126). The personal commitment attained from the personal lifeworld carries a *probably decisive significance* as to the carrying through of sustainability work in universities by individuals and groups. There is significant support for this theory from various concentrations of pedagogical research. The lifeworld perspective has not been visible in the professional discussion of the higher education sphere. Another aspect on the teacher is that he or she is a public servant of the community, with the accompanying responsibilities, duties, rights, and expectations of engaging in activities corresponding to the basic democratic and ethical values of society; that is, in correspondence to "our public ethos" (Lundqvist, 1998).

The University's own organisation of subject, staff, and time may cause a hindrance to the development of sustainability work. At the same time, sustainability work at the universities and teaching/learning using the processes inherent in sustainability work may stimulate other pedagogical development within the universities. Training and learning in the sustainability theme may also give further meaning to the University as an organisation as well as to the individuals working within it, and serve as an integrating *social driving force* between the University and local community.

[6] See for instance: Kates & Perry (2005): "What is sustainable development", *Environment*, 2005.

We know from recent evaluations that staff/teachers/educators with background in the natural sciences still pose as the dominant actors of the University's sustainable development work. Sometimes they are the 'dedicated individuals' for the sustainability work. In order for sustainability work to become more multi-based with respect to different scientific approaches – which the sustainability question in itself is – it would be helpful if teachers, researchers, staff, and others from different cognitive backgrounds were given the opportunity to partake in this process of integration. This requires individual courage as well as decisiveness from 'non-naturists,' as well as support and stimulation from staff with a background in the natural sciences, other colleagues, and University leaders and administrators.

In my research, successful cases in environmental work I have noted rest on individual desires and interest in activities. We know from experience that requirements and rules have little long-term effect on the development of sustainability work, and do not serve to create any self-generating driving force. Whenever new ideas and activities, such as the new sustainability theme, are introduced in higher education, extra committed individuals – called 'dedicated key actors' or 'dedicated individuals' – play a decisive role. Several other studies also indicate that dedicated individuals play a significant part in the sustainability work. Other expressions to describe these 'dedicated individuals' might be engines, locomotives, or key actors. The dedicated individuals display a great personal commitment, conviction, strong feelings, and enthusiasm toward specific subjects concerning the organisation, such as sustainability work in universities. The dedicated individual is often keen to be active. He or she could be an 'individual actor,' working alone with little social peerage but a great personal driving force and needs to satisfy. The 'dedicated individual may also be a 'collective actor' for 'the good of the community,' in other words a democratically and ethically well-anchored member of a group, with the social and communicative competence to be able to participate in and affect the processes of influence that continually occur within the University organisation. The difference between the two is largely determined by the individual's personal democratic and ethical values.

Key actors play an important and partly decisive role in the communicative norm development process constituted by the normative action taking place in the (professional) organisation. Normative balance or symmetry serves as a pointer for the relative symmetry between will-values, knowledge, and possibilities in the Norm model. In order for such individuals to be able to function over a long period of time, it will be necessary to create *norm supporting and supporting structures*, and to maintain and develop these structures on a continual basis in the individual University organisation. If any one aspect of the norm becomes too dominant (for example the personal needs, motives or driving force of a key actor) or certain others grow too weak (such as support, anchoring, participation, communication, or the distribution of power), the norm structures tends to keel over. A "normative asymmetry" (Hydén-Baier, 1998) may occur, causing significant effects on activity patterns and affected actors and organisations. The practical possibility for actors to allow their lifeworld commitment to be expressed in the professional sphere has a decisive significance on the quality and development of the organisation's (the University's) activity. If teachers/researchers are not *supported*, in their efforts to find time, place, and other resources to collectively plan, support, or reflect over their activity, wherein lifeworld commitment plays an important role, there might occur, as we have seen in interviews with key actors, a successive decline into fatigue or exhaustion.

The most common direction of movement in the processes of influence studied is that of the sustainability issues being introduced on the organisation´s arena, normally aided by dedicated key actors. This is significant for norm creation, normative activities, communication, expressing opinions within the organisations, learning, and cognitive development. Self-reflective tools such as *Grön Flagg* (Eco Schools), as well as ISO and EMAS certification processes also function as reinforcements in such processes. What is possible of theses activities

in Higher Education (an Oscar for Sustainability or a Nobel Prize in Sustainable Development?) We thus find ourselves approaching the *norm supporting structures*[7].

Norm Supporting Structures

An issue often overlooked or even forgotten entirely in organisations such as universities is the importance of creating *local (norm) supporting structures* around and in collaboration with particularly committed actors, key actors, or dedicated individuals, as the environmental program is developed within each individual University. These *supporting structures* must be imposed at the local level, where the actual program – new legislation, universities policy documents, syllabuses, etc. – is to be carried through. The initiative to introduce these structures should come from the people directly involved in the program or organisation – in this case the University. I have identified the following occurrences and found them to be working as significant (norm) supporting structures:

- the active support and participation of University leaders – the vice chancellor(s) and the University board and central officials;
- the dedicated key individuals within the University, so long as they are given adequate opportunity to act; interested colleagues and work mates;
- social arenas for students to exercise participation, influence, communication, and creativity (such as student sustainability committees, etc.);
- other social arenas for communication, democratic participation, anchoring, and collaboration, as well as for reflection, creative thinking, and the circulation of knowledge, competence, and experience;
- external persons and other resources that may be mobilised to support the processes of influence and participation;
- self regulating instruments providing long term support for the sustainability process;
- clear quality criteria and evaluations in teaching and learning; as well as basic and operational definitions of sustainable development knowledge; and
- sustainability centred infrastructure including the University buildings and its surroundings (models and symbols creating and supporting meaning).

Concluding Discussion and Summary

The process of norm creation is important, as is the 'norm triad' as an analytical tool for the understanding of the university's work with the new sustainable development theme. A 'norm' is in a simple meaning an "action directive" or "action direction" and that is quite related to and vital in the understanding of the often used notion "action competence" (further reading on this notion– see Bruun-Jensen et al, 2000). An important result from this perspective is the understanding that it is knowledge, commitment, and inspiration from the actor's lifeworld that has been allowed – contrary to earlier ideals – to influence the professional role (in the system) of the University's actors. This mode of professional practice has been introduced by exceptionally dedicated individuals or key actors that have acted as forerunners and norm setters. This development would not have been possible if the professional and bureaucratic-administrative actors had not adapted to this development by creating norm-supporting structures in the local environment of the universities. The norm support given by the University's leaders is necessary and crucial to success in this respect of local implementation.

Norm Supporting Structures are essential to identify, create and make use of in the very local level of implementation of new education policy in universities to support the local key actors like the "souls of fire", the very dedicated persons from the groundswell. This in turn has collected its nourishment and driving force from the distant management and action impulses connected to the policy development that has taken place at the national and international level.

[7] This is clearly seen in the Johannesburg Summit 2002 and the following UN and UNESCO documents forming the "Decade on Education for Sustainable Development" (decided upon by the UN General Assembly in December, 2002). All this ESD-work during the start of the new millennium is ending up among others in the Swedish initiative in Johannesburg: the Göteborg meeting in May 2004 – "Learning to Change Our World: International Consultation on Education for Sustainable Development".

Whether or not the initiation of sustainable development as a cognitive, competence or experiential learning field in universities will last, still remains to be seen. It will require a development and restructuring of sustainable development knowledge itself as well as in concrete applications. Education for Sustainable Development (ESD) in Higher Education is vital in those learning and clarifying processes for future actions.

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16. The Role of Research in Achieving a Sustainable Future?

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Abstract: Universities have been recognized as key institutions to achieving a sustainable future. While much has been written on education and pedagogy, to date, the role university research can play in achieving a sustainable society has largely been neglected. This short paper will focus on how universities can be agents of change through academic inquiry. It will explore the priorities for research by reporting on the results of the 2005 Halifax Consultation in which 35 international experts gathered to further intellectual understanding of higher education for sustainability research and to explore the development of research priorities for the future. Finally, the paper will examine how research can help cross barriers and create drivers for achieving sustainability.

Universities as Agents of Change

Achieving Bruntland's vision of a sustainable society in which the needs of the present are met without compromising those of the future is no small feat. Such a vision will naturally require a multi-stakeholder approach in which all major actors and institutions in society work together to create change. What role can universities play in working collectively toward a sustainable future? When examining the ability for universities to act as agents of change, there seem to be two opposing positions. The first states that universities are merely indicators of changes in attitude within a society, and cannot themselves provide the impetus for change (Althusser, 1971; Bourdieu, 1976). According to this stance, educational institutions are created by society and are therefore a reflection of it. As such, universities inevitably echo societal norms and are in no way a force for social change.

The second view states that the university can be a leader in creating societal change (e.g. Coleman, 1966; Giroux, 2005; Jencks, 1972). Within the emerging discipline of sustainability for higher education (HES), the belief that universities can indeed be agents of change is obvious:

> *The goal of education is to make people wiser, more knowledgeable, better informed, ethical, responsible, critical and capable of continuing to learn…Education, in short, is humanity's best hope and most effective means in the quest to achieve sustainable development (UNESCO, 1997).*

While much of the literature in this field has focused on the role education and pedagogy can play in creating a sustainable citizenry, it is important to also consider the other main focus of the university: research. This short paper will focus on how universities can be agents of change through academic inquiry, will explore the priorities for HES research, and examine how research can help cross barriers and create drivers for achieving a sustainable future.

HES Research and its Priorities

What constitutes HES research? Recent HES studies have focused on sustainability education (Taylor, 1999; Herremans and Allwright, 2000), curriculum development (Bowers, 1997; Leal Filho 2000; Orr, 1995), physical operations (Creighton, 1998; Keniry, 1995), HES policy analysis (Walton, 2000; Wright, 2002; Wright, 2003), assessment methodologies (Roorda, 2000), and the development of theory (Eagan and Orr, 1992; Leal Filo, 1999; Cortese, 1992; Leal Filho & Wright, 2002; Shreiberg, 2002). Until recently, however, no definition of HES had been attempted. In preparation for a recent consultation in Halifax, Canada, Glasser *et al.* (2005) developed a draft definition:

> *Research in Higher Education for Sustainability (HES) refers to any research that is directed at advancing our ability to incorporate sustainability concepts and insights into higher education and its major areas of activity: policy, planning, and administration; curriculum/teaching; research and scholarship; service to communities; student life; and*

physical operations/infrastructure. It also refers to research that treats higher education institutions as complex systems and focuses on the integration of sustainability across all of its activities, responsibilities, and mission. Research in HES includes six general focus areas:

- *defining and envisioning "Higher Education for Sustainability;"*
- *integrating sustainability into higher education activities and responsibilities;*
- *assessing how well academic institutions incorporate and model sustainability;*
- *improving the ability of scholars to teach about sustainability or incorporate sustainability concepts and principles into courses, curricula, disciplines, and research programs;*
- *addressing questions—in science, technology, social science, or the humanities—that are crucial to our transition to a sustainable future; and,*
- *addressing processes for social learning, innovation diffusion, knowledge transfer, policy analysis, decision-making, and educational reform that are crucial for our transition to a sustainable future.*

Research in HES covers theoretical and practical approaches and may be content- or process oriented. Its purview includes all disciplinary, multi-, inter-, and trans-disciplinary research that addresses questions with a "sustainability lens

Glasser *et al's* definition demonstrates that there are many types of research that can help us to travel along the continuum of sustainability ranging from the specific (i.e. engineering research that produces widgets for improved energy efficiency) to the more philosophical (i.e. examining the very premise of sustainability). While most would agree that all research addressesing questions of sustainability is important, an interesting question to ask is if there are some areas of inquiry that are more significant for the university community to engage in than others?

In a recent workshop in Halifax, Canada, 35 international HES researchers representing 17 different countries gathered to tackle this topic. The goal of the workshop was to further intellectual understanding of HES research and to explore the development of research priorities for the future. By the end of the three days, the group developed a list of 19 important areas of HES research which were later ranked in priority order:

- Impacts of Teaching & Learning Methods
- University & Community Linkages
- Mainstreaming Sustainability
- Institutional Culture & Organizational/Governance Structures
- Evaluating Educational Approaches
- Case Study Analysis
- Legitimizing HES Research & Practice
- Leadership & Management
- Transformative Learning
- Philosophy & Epistemology in HES
- Networking
- University & Politics
- Inclusiveness & Voice in Sustainable Development
- Campus Sustainability Assessment
- Individual and Social Change
- Capacity Building
- Disciplinarity, Transdisciplinarity & Interdisciplinarity

While it is beyond the scope of this paper to discuss all of these important areas, I will briefly discuss some of our findings in general.

Research on Teaching and Learning. Education is considered one of the key ways in which universities can contribute to a sustainable future. This was echoed in the results of the Halifax workshop. Future important areas of inquiry should involve investigating the impacts of teaching and learning methods, evaluating educational approaches, and investigating the role of transformative learning in achieving sustainability. This type of research cuts across the traditional boundaries and can involve collaborations between disciplinary experts and educational researchers. Developing and assessing inter- or trans-disciplinary teaching programs that are effective and connect in fruitful ways with existing programs and conducting in-depth case studies on cross-disciplinary teaching were deemed important to advancing HES.

Research on Planning and Design. Physically modeling sustainability on campus necessitates research on both university governance structures and politics, as well as physical operations. Investigating the organizational structures that are effective for orienting institutions of higher education towards SD is of primary importance for creating change on campus. Examining how to integrate ecological principles into building design. (e.g. energy efficiency measures, indigenous landscaping, resource conservation and recycling, alternative energy systems, composting) is of equal value. An important exercise identified by the group was to define explicitly a vision of what a campus would physically look like if it were a model of sustainability.

Theorizing HES. Much of the HES research we have seen to date involves case studies and best practice examples. While these are very helpful to advancing the university along the continuum of sustainability, as an emerging field of inquiry, it is necessary for HES researchers to begin to theorize HES.

Theory plays an important role in any research. It adds meaningfulness by situating one's research in a larger context and explains the lens through which the research will be examined. Merriam (1988) explains that theory affects research in that it serves to guide the collection of information and the interpretation of results.

> *Theory gives us a common framework, a common perspective, and a common vocabulary that helps us ask questions in a sensible way and make sense of problems. By summarizing what we already know, theory helps us identify what we don't know, and so it is the starting point for deciding what really needs to be researched. (Moore & Kearsley, 1996, p. 197).*

Research that contributes to epistemology, framework, and contextualization is essential for the field of HES to move forward. An investigation of what epistemologies and research methodologies are best suited for HES was considered necessary to advance toe emerging field of HES.

Campus Sustainability Assessment. There is a growing body of work on assessing sustainability on campuses and investigating the impact HES policies and international declarations on a university. The Halifax workshop participants felt that the momentum in this area could be furthered by research focused on the refinement of assessments, and measurements and indicators of sustainability in higher education. Further research could also examine the social, ecological, and economic impact of adopting HES policies and declarations.

Cross-Cutting Issues. The group concurred that the first priority of universities must be to engage in research on themselves. How can universities be drivers of sustainable change unless they first “walk the talk”? Research that contributes to universities becoming models of sustainability through teaching, service and physical operations was considered paramount In HES as not engaging in this area of inquiry first would leave universities open to criticisms of hypocrisy. However, the group also recognized that some broader, cross-cutting issues much be researched in order to further the field and practice. These areas involved investigations into inclusiveness and voice in research; individual and social change; and the nature of disciplinarity, transdisciplinarity and interdisciplinarity. These broader conceptual areas of

inquiry and cross-cutting issues can be viewed in more detail in the final report of the consultation (available at http://halifaxconsultation.environmentalscience.dal.ca).

Crossing Barriers and Creating Drivers

How do these identified areas of HES research contribute to the goal of a sustainable future? The interdisciplinary and often trans-disciplinary nature of HES research demonstrated above can play a strong role in the process of crossing barriers and creating drivers for sustainable development.

First, HES research not only helps the university advance itself as a model of sustainability, but can also take on an educative role. Many universities have developed courses that use the campus as a living laboratory in which students and faculty are engaged in action research. Such experiential learning tends to foster a translation of knowledge into action, and therefore acts as a driver for education for sustainable development.

Second, the very nature of HES research makes it impossible to conduct research from the perspective of one discipline. This scholarship of integration (Boyer, 1990), interprets, adds context to, and explains research results from a new perspective and helps researchers to break the traditional fragmented and sectoralized bonds of disciplines within the university.

Finally, HES research is also often applied and action oriented. According to Boyer (1990), the scholarship of application links researcher's expertise in academic areas to specific problems. In this way, HES research is service related and includes both applied research and outreach. This type of action-research is slowly becoming recognized as a legitimate form of inquiry within academe, and the development of more HES research projects can only help in that legitimization process.

Identifying and Researching the Challenges

While there is much potential for HES research to help to cross barriers and create drivers for ESD, there are also many challenges associated with it. The Halifax Consultation group of experts acknowledged this and suggested that even these challenges could provide interesting research questions.

A fundamental challenge for HES researchers is funding. Traditional funding programs are usually set up with disciplinary committees to adjudicate research proposals. While the interconnections between various disciplines in HES research are unavoidable and often welcomed, where one situates their research when it comes to funding decisions is difficult. Should a research project on the industrial ecology of the university be adjudicated by a biology committee, a management studies committee or an architecture committee? Once the disciplinary committee has been chosen, does the researcher run the risk of being disadvantaged for not fitting into the pre-defined box of that discipline? Are there ways to change this system or are there alternative funding mechanisms that we should be looking to? These issues were of paramount concern to the Halifax Consultation participants, and need further exploration.

HES research is often looked upon with some disdain as a "soft" science, or an area of inquiry that people only engage in if they can't succeed in the discipline in which they were trained. One of the greatest challenges as HES researchers is to change this perception and work at legitimizing this emerging field. Establishing HES as a recognized area of inquiry is essential to the emerging field. This can already be seen happening in the creation of the International Journal of Sustainability in Higher Education (IJSHE) in 2000, various books dedicated to HES, and the work of the Global Higher Education Sustainability Partnership (GHESP). It is also encouraging to see graduate students choosing HES for their academic career path. This seems to be a new trend, as most working in HES currently began their careers in traditional disciplines before switching to HES as a focus of their inquiry.

Mainstreaming sustainability and legitimizing HES research and practice was also identified as a challenge. While motherhood statements regarding sustainable development are rarely challenged, integrating sustainability into an institution can be very difficult. One of the most common concerns in this time of fiscal constraint is that the economic costs of becoming a

model of sustainability will be too high. Examining the perceived barriers and opportunities to incorporating sustainability into curriculum and operations was identified as a helpful research project in order to continue our journey along the continuum of sustainability.

Conclusion

The three main thrusts of the university are teaching, service to the community and research. While these three activities are intricately intertwined in HES work, disentangling the concepts and thinking deeply and critically about research on its own can be beneficial for both the legitimization of the field and for creating positive societal change. The research priorities identified above are merely the beginning of what should be a long and reflective discussion within the HES community. HES research can play a significant role in creating a sustainable future. It is now our task to contemplate, challenge, and discuss how this will be achieved.

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Annex A: Abbreviations & Acronyms

AIDS	Acquired Immune Deficiency Syndrome
ANUIES	National Association of Universities and Higher Education Institutions
Biodiesel	Fuel used in internal combustion engines, produced from wastes generated in the Campus cafeterias
BSE	Basic Sciences and Engineering Division
BSE	Basic Sciences and Engineering Division
BUP	Baltic University Programme
BUUF	Baltic University Urban Forum
CDN	Course Development Network
CETL	Centre of Excellence in Teaching and Learning
Chronos ®	e-learning tutorial developed by the University of Cambridge and the World Business Council for Sustainable Development
CITIES	Interdisciplinary Centre of Technology, Innovation and Education for Sustainability
CSR	Corporate Social Responsibility
DUT	Delft University of Technology
ECTS	European Credit Transfer System
EE	Environmental Education
EESD	Engineering Education in Sustainable Development
EfS	Education for Sustainability
EHEA	European Higher Education Area
EMAS	Environmental Management and Audit System
EMS	Environmental Management Systems
ESD	Education for Sustainable Development
EU	European Union
FHEI	Further and higher education institution
FOMCEC	"Fomento a la Cultura Ecológica" (Fostering Ecological Culture)
GDP	Gross Domestic Product
GHESP	Global Higher Education Sustainability Partnership
GRI	Global Reporting Initiative
HE	Higher Education
HE-21	Higher Education 21
HEA	Higher Education Academy
HEFCE	Higher Education Funding Council for England
HEI	Higher Education Institution
HEPS	Higher Education Partnerships for Sustainability
HES	Higher Education for Sustainability
HIV	Human Immunodeficiency Virus
ICLEI	International Council for Local Environmental Initiatives
ICT	Information and Communication Technology
IJSHE	International Journal of Sustainability in Higher Education
IMF	International Monetary Fund
IPP	Integrated Product Policy
ISO	International Organisation for Standardisation
Lpf 94	Curriculum for Non-compulsory School System
Lpo 94	Curriculum for Compulsory school system, the Preschool class and Leisure-time centre
NEF	New Economics Foundation
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
NIH	"Not Invented Here' syndrome: reluctance to accept solutions developed by others
OECD	Organization for Economic Co-operation and Development

PET	Polyethylen-Terephtalate plastic resin for manufacturing beverage plastic bottles
RCE	Regional Centre of Expertise
REEP	Regional Environmental Education Programme
SADC	Southern African Development Community
SAIDE	South African Institute for Distance Education
SCP	Sustainable Campus Programme
SD	Sustainable Development
SEDUE	Ministry of Environmental Affairs
SHE	Sustainability in higher education
SL	Act on Education (Skollagen)
SMEs	Small and Medium Enterprises
UAM	Metropolitan Autonomous University, campus Azcapotzalco in Mexico City
UCAS	Universities Central Admission System
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDESD	United Nations Decade on Education for Sustainable Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNISA	University of South Africa
UNU	United Nations University
UPC	Universitat Politècnica de Catalunya
WCED	World Commission on Environment and Development
WRR	Wetenschappelijke Raad voor het Regeringsbeleid (Scientific Council for Government Policy)
WTO	World Trade Organization

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