

Higher Education and the Challenge of Sustainability: Problems, Promises and Good Practice

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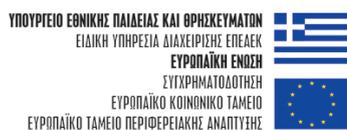
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Το έργο συγχρηματοδοτείται από την Ευρωπαϊκή Ένωση και από Εθνικούς Πόρους

Preface

This book contains the papers presented at the 1st European Conference on Education for Sustainable Development “Higher Education and the Challenge of Sustainability: Problems, Promises and Good Practice” which was held in the towns of Orestiada and Soufli, Prefecture of Evros, Greece, from 5 - 7 October 2007. The conference was organized by the Department of Forestry and Management of the Environment and Natural Resources of the Democritus University of Thrace, The Environmental Education Centre of Soufli and the International Journal of Sustainability in Higher Education and co-organized by the Municipality of Orestiada and the Municipality of Soufli.

The conference sought to bring together an international and interdisciplinary audience, and in particular, teachers, researchers and government officials whose work is related to issues of sustainability in higher education. The aims of the conference were to discuss the latest trends related to sustainability in higher education, with a special emphasis to the problems and ways to overcome them, to analyze present and future challenges, as well as promote best practice, and to introduce projects, programmes and other practical initiatives to further the cause of sustainability in higher education institutions.

The three-day meeting included presentations from 12 different countries, in particular, Australia, Germany, Greece, Italy, Latvia, Lithuania, Malta, Poland, Russia, Spain, The Netherlands and United Kingdom.

All contributions have been reviewed for publication, and not all papers submitted could be included in this publication. The papers in this book are ordered by the first author's last name. This publication will be widely disseminated in both printed and electronic form.

We would like to thank the authors for their valuable contribution and we are grateful to our many reviewers for graciously offering their invaluable comments that have enriched the quality of the papers in this volume and also for making available to us their valuable time and efforts.

We hope that the expert knowledge presented in this publication will not only offer a valuable source of information on issues of sustainability in institutions of higher education but will also become the basis for a fruitful dialogue amongst all interested parties.

The Editors

**Walter Leal Filho
Evangelos I. Manolas
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Table of Contents

- Aloj Eugenia, De Castro Mariagrazia, Zollo Anna: Higher education in environmental and ethical-social communication for companies: New challenges and new perspectives for the scientific community 1
- Bachiorri Antonella, Puglisi Alessandra: Promoting education for sustainability: A challenge for the University system 7
- Bezirtzoglou Eugenia: Educational strategy in enterprises: A case study involving students of Agricultural Development 17
- Chernikova Svetlana, Voropaeva Gallina: Approaches in education for sustainable development at St. Petersburg State University, Russia 23
- Drosos Vasileios, Farmakis Dimitrios, Giannopoulos Rigas: The contribution of Forest Cadastre's teaching in the development of environmental conscience 35
- Galkute Laima: Sustainable development in social sciences: A case of public administration 45
- Hatzopoulos John: Ideals and modern tools to achieve sustainability in higher education 53
- Janikowska Olga: Challenges and obstacles for the practical implementation of sustainable development in higher education 63
- Karageorgakis Stavros, Lithoxidou Loukia, Georgopoulos Alexandros: The impact of higher education on environmental beliefs and practices 69
- Kehagias Theodoros: Study programmes in environmental sciences: Recent trends in institutions of higher education 81
- Kimionis Georgios: An analysis of the effectiveness of environmental education centres: The views of local coordinators for environmental education 89
- Leal Filho Walter : International trends in sustainability in higher education: From theory to action 97
- Littledyke Michael: Ideology, epistemology and pedagogy: Barriers and potential drivers to environmental education for initial teacher education students with focus on the Primary Science National Curriculum for England and Wales 103
- Littledyke Ros: Making a difference: Outdoor education in early childhood education 115
- Loukeris Dionisios, Skanavis Constantina, Giannoulas Angelos: Evaluation of the new cross thematic curriculum framework of environmental education in Greek compulsory education 125
- Manolas Evangelos, Iliadis Lazaros: An application of two experiential learning models in teaching database systems: A comparative preliminary study 143

- Mulder Karel: Don't preach. Practice! The acceptability of normative statements in academic sustainability education 155
- Murga Angeles: Potentiality of collaborative learning to train behaviours oriented towards sustainability 167
- Norcliffe David: Education for sustainable development and global citizenship in Wales 177
- Novo Maria: Training key-people in sustainable development at post-graduate level: Complexity and resilience as basic principles 187
- Oreinos Theodoros-Dimitrios: S.E.M.E.P. – UNESCO secondary education project and network, giving ideas for higher education for sustainable development 197
- Pace Paul: Self- Evaluation as a tool in developing environmental responsibility 205
- Pavlova Margarita: Some practical solutions for achieving the ideals of sustainability: A case study of a technology teacher education program 225
- Pipere Anita: The sustainability-oriented researcher's identity: Action research in doctoral studies 237
- Platje Joost: Knowledge, sources of information and priorities on sustainable development in higher education 247
- Skanavis Constantina, Sakellari Maria: Films as an environmental education tool in higher education 259
- Slodczyk Krystyna: The effectiveness of Informal ecological education in the protection of underground water – A case study 273
- Sotirakou Maria, Lekka Alexandra: Education for sustainable development and teachers' trainings in Greece 277
- Stibbe Arran: Words and worlds: New directions for sustainability literacy 283
- Tampakis Stylianos, Tsantopoulos Georgios, Karanikola Paraskevi: Bulding environmental awareness: The case of forestry students in a Greek University 293
- Zaman Farhana: Education for sustainability: is rhetoric more welcome than the reality? Some thoughts from Primary Initial Teacher Education in Middle England 305

**Higher education in environmental and ethical – social communication for companies:
New challenges and new perspectives for the scientific community**

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Abstract

Nowadays, the environmental and ethical – social commitment of companies is a strategic path and a proactive approach towards these instances is not sufficient to reach competitive positions: it is necessary a communication of the results building a management oriented to a new culture in which environmental compatibility is exalted as driver for new opportunities of revenue and employment. It is possible through a system of higher education in which a process of active training involve not only top management but all employers developing a culture for which environment is not only a compatibility to be respected but a driver for growth satisfying more specific needs of customers as environmental and health safety of products. So, the scientific community has to be oriented to create educational and training models modelled on the concrete goals of companies and strongly oriented to results such as the improvement of relation with all stakeholders. Our effort in this paper will be to show the actual situation of higher education and training for environmental and social communication in Italy showing how the use of its tools (environmental reports, accounting and certification) has to be supported by education processes stimulating new challenges and perspectives for the commitment of the scientific community.

Keywords:

Environmental communication, green management, triple bottom line, higher education, scientific community

Introduction

Towards an innovative relationship between environment, economy and society for companies

Nowadays, the environmental and ethical – social commitment of companies is a strategic path. Corporate social and environmental responsibility could be considered as the integration of ethical and environmental items in the strategy and in the mission of companies. Ethical and environmental commitment as strategic component in the companies' choice, gives strength and value to the strategies building involvement in all stakeholders, building awareness, making easy the exchanges and confirming customers' satisfaction in the products and services of companies. In order to make

this proactive approach more competitive each environmentally and ethically oriented company needs a management oriented to a new culture in which environmental compatibility is exalted as driver for new opportunities of revenue and employment.

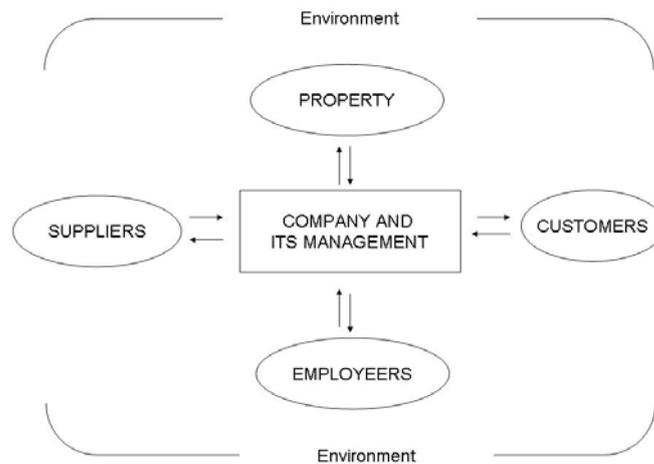


Table I. Relationship between companies and environment.

Triple Bottom Line as mission in the strategies of companies

So, companies should manage a process that starting from production, along all Life Cycle Assessment (LCA), in which environmental commitment could give value to the concept of sustainability for companies. Sustainability for companies, in the sense of continuous improvement, could be intended as triple and contemporary growth of economic, social and environmental goals while none of these three goals excludes the other two.

So, switching focus on the integrated goals of this triple development we have:

Environmental goals: protection of environment, control of damage to the environment;

Social goals: protection of employers through the adoption of rules and standards of quality in job;

Economic goals: improvement of revenue and sales.

The management has to be supported by a Triple Bottom Line vision that means expanding the traditional framework to take into account, environmental and social performance in addition to financial performance. The concept of Triple Bottom Line demands that a company's responsibility be to 'stakeholders' rather than shareholders. In this case, 'stakeholders' refers to anyone who is influenced, either directly or indirectly, by the actions of the firm. According to the stakeholder theory, the business entity should be used as a vehicle for coordinating stakeholder interests, instead of maximizing shareholder(owner) profit.

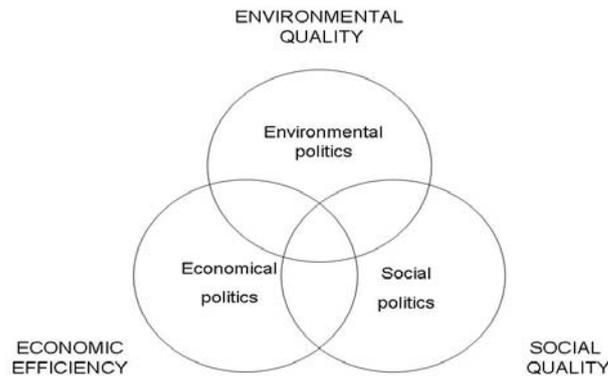


Table II Sustainability for companies: Triple Bottom Line

The integration of Triple Bottom Line in the mission and in the vision of companies is possible only through a system of higher education in which a process of active training involves not only top management but all employers developing a culture for which environment is not only a compatibility to be respected but a driver for growth satisfying more specific needs of customers as environmental and health safety of products.

A new need: environmental training for management and employers as higher education

New and innovative professional figures are required. They have to be trained in compliance with the most recent orientation of environmental training expressing in three forms: training, awareness and technical training. This is not only for top management but for all employers because the involvement in environmental and social problems has to be disseminated in all elements of companies. One of the goals of environmental training is the increasing of awareness in the employers thinking methods and topics to be aware of the environmental effects produced during the cycle of production.

Top management at the same time, has to receive, through environmental higher education, correct and high information on environmental and social items in order to make decisions in compliance with a point of view of sustainability.

Environmental higher education and training could reach the following goals:

- empowerment and development of specific skills;
- promotion of knowledge and integrated use of management environmental systems and environmental performances of products and services;
- updating of employers about the sustainability of development, about environmental laws;
- implementation or support of Local Agenda 21 processes.

The satisfaction of these goals through higher education is the satisfaction of stakeholders' needs as survival of companies in terms of excellence and environmental competitiveness. Among different choices and opportunities to improve the environmental performance of companies, the management has to choose the opportunities that give the best lead for all stakeholders. In other words it means a new challenge for management: the increasing of value for companies without sacrificing the interests of stakeholders.

Management could use *environmental benchmarking*: starting from an analysis of activities and behaviours of company, the goal of knowledge of processes and activities is developed individuating an external referring point on which makes possible the measurement of our activities.

Environmental communication for companies in Italy

From a qualitative survey about the use of environmental communication by companies stands out that the big number of companies does not consider environmental communication as a strategic topic even if the number of companies, the number of environmental communication tools is in growth. Mostly, environmental communication tools are used in high environmental impact production fields. What communication tools? The most frequently used are the environmental report, environmental accounting, and the environmental product declaration.

The *Environmental Report* is a document in which the relationship between environment and companies is described. It is voluntarily published by companies with its aim being direct communication with the public. It contains qualitative and quantitative information such as: the description of environmental management system, the environmental politics, environmental certifications, data about the atmospheric emissions, the consumption of waste, the consumption of energy, environmental costs supported by companies and so on.

Environmental accounting as part of traditional accounting is a voluntary tool to communicate the effects of owner environmental asset. It is the most disseminated environmental communication tool. It has to be clear, complete for all stakeholders.

Environmental accounting comprehends quantitative schemes to synthesize physical and monetary data about environmental management: these data are presented in different accounts and reorganised as indicators to evaluate sustainable performance of companies about: use of resources, waste, emissions, environmental costs.

The *Environmental Product Declaration* is a standardized (ISO 14025/TR) and Life Cycle Assessment based tool to communicate the environmental performance of a product or system, and is applicable worldwide for all interested companies and organizations.

A declaration is based on a Life Cycle Assessment. It includes information about the environmental impacts associated with a product or service, such as raw material acquisition, energy use and efficiency, content of materials and chemical substances, emissions to air, soil and water and waste generation. It also includes product and company information.

Certified EPDs are open for all products and services. There is no evaluation of the environmental information since no predetermined environmental performance levels are set. Instead it builds on well-structured and quantitative data certified by an independent third party.

New challenges and new perspectives for the scientific community.

Environmental Communication as the communication of environmental messages to audiences by all means and through all channels may be considered, for companies, a process which involves both communicators and audiences and is achieved through effective message delivery, interactive listening, and public discussion and debate. Communication about environmental issues should be a priority for all companies in a collective effort to address issues such as overpopulation, resource depletion and pollution, all of which are leading to widespread ecological degradation. We believe that effective communication can foster an environmental ethic that incorporates respect for natural systems and a sense of ecological integrity which, coupled with democratic citizen deliberation, can lead to sustainable communities and increased economic security.

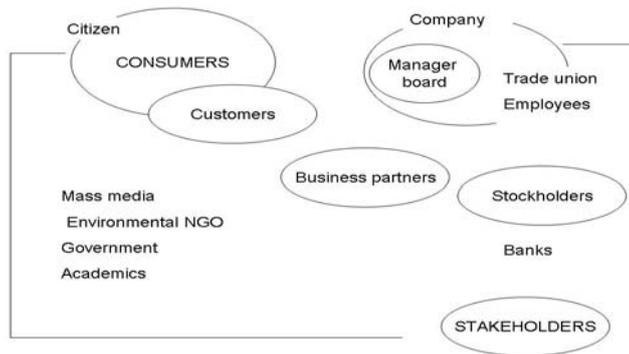


Table III A new concept of stakeholders from the point of view of higher environmental education in companies.

Conclusions

The final part of this chapter focuses on how to enable the scientific community, which includes academics but also engineers, managers, architects, urban planners and other professionals and policy makers, to make a more open and effective contribution to the decision-making processes concerning environmental communication for companies.

It is important that the role of science be more widely known and better understood, both by decision makers who help determine public policy and by the general public. The cooperative relationship existing between the scientific community and the general public should be extended and deepened into a full partnership through environmental communication tools. Improved communication and cooperation between the scientific community and companies will facilitate greater use of environmental information and knowledge in policies and programme implementation. On the other hand, companies should create more favourable conditions for improving training and independent research in sustainable development.

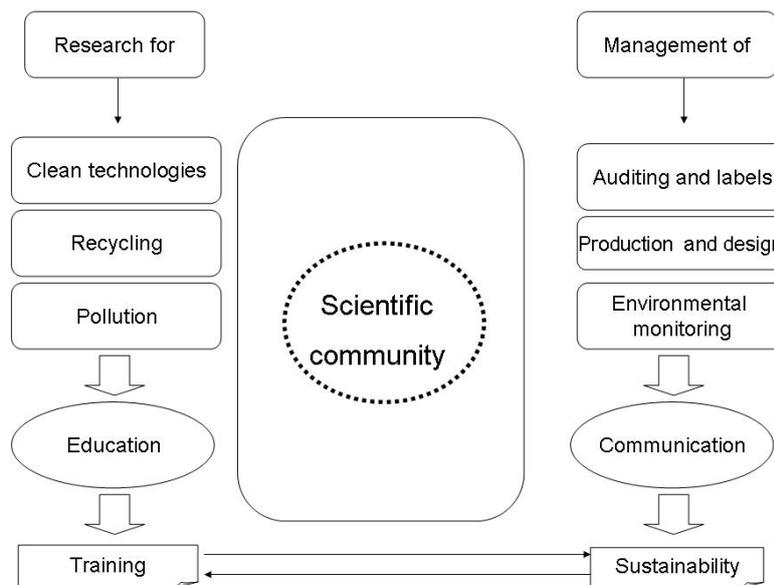


Table IV The role of scientific community. New perspectives and challenges

Existing multidisciplinary approaches will have to be strengthened and more interdisciplinary studies developed between the scientific community and companies and with the general public to provide leadership and practical know-how to the concept of sustainable development. The public should be assisted in communicating their sentiments to the scientific community concerning how science and technology might be better managed to affect their lives in a beneficial way.

References

Aloj, E., De Castro, M., Zollo, A., (2006), "The role of scientific Community for the Actuation of the SD strategies", in Leal Filho (ed.), Innovation, Education and Communication for Sustainable development, Peter Lang pp.23-40.

Aloj, E. (2005), Dall'educazione ambientale alla comunicazione ambientale ed etico sociale di impresa, Loffredo Editore, Napoli

Aloj, E., De Castro, M., Zollo, A. et al., (2005), The ethical – social communication for the company as strategy of environmental education from the point of view of sustainability, in 1st International Conference Committing Universities to Sustainable development, 20 – 23 April 2005, University of Technology, Graz, pp.490 - 493.

Frey, M. (1995), Il management ambientale, Franco Angeli.

Leal Filho, W. (ed.) (2007), Information, Communication and Education on Climate Change – European Perspectives, Peter Lang, Frankfurt am Main.

Leal Filho, W. (ed.) (2006), Innovation, Education and Communication for Sustainable development, Peter Lang, Frankfurt am Main.

Leal Filho W & Littledyke, M. (2004), International perspectives in Environmental Education, Peter Lang, Frankfurt am Main.

Palmer, J. (1994), The Handbook of Environmental Education, Routledge, Great Britain.

Polonsky, M.J. (1995), Cleaning up environmental marketing claims: a practical checklist, in Environmental Marketing, Polonsky M.J., Mintu – Wimsatt AT (eds), Haworth: Binghamton, New York, pp. 199 – 203.

Ranghieri, F. (1998), La comunicazione ambientale e l'impresa, Il Mulino Editore, Bologna.
WCED (1987), Our common future, OUP, Oxford 1987.

Promoting education for sustainability: A challenge for the University system
The experience of the Italian Centre for Research and Environmental Education (C.I.R.E.A.) of the University of Parma (Italy)

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Abstract

Education for sustainability is not a novel concept for the Italian context, considering the wide diffusion of experiences at different school levels. In spite of this scenario, the academic world seems to be globally far from a general awareness of the importance of education for sustainability and, consequently, not interested into an enduring contamination with this educational approach. While it is broadly understood that universities play an important role in the acquisition, dissemination and application of knowledge, it is not equally perceived, by the academic world itself, that it is expected to contribute also to values and ethics, and to take the lead in the transition to a more sustainable society.

Some significant examples emerged from this national scenario; among them is the Italian Centre for Research and Environmental Education (C.I.R.E.A.) of the University of Parma.

This Centre constitutes the first university structure doing research on Environmental Education in Italy. Promoted activities are shaped with the aim to strengthen interactions with actors outside the University, in particular from local communities. Some of the practices carried out by C.I.R.E.A., both in and out of the scholar contexts, will be discussed in the paper, together with related problems and perspectives, to endorse a common debate.

Keywords:

Education for sustainability, University, Italy, Environmental Ethics, Best practices, School.

Introduction

Since 1990, with the Talloires Declaration, many documents have emphasized the strategic role of universities for a strong and wide promotion of sustainability, playing their cultural role in supporting a new idea of development and society. Under these presuppositions each educational institution needs to revise all curricula and at the same time, improve its environmental management. After Talloires, several declarations or charters have been written, following the debate born during the Earth Summit of Rio de Janeiro (1992). Among them, the Copernicus

University Charter for Sustainable Development (1993), discussed by the Conference of European Rectors, supports the idea that universities have to be leaders in promoting a sustainable society, starting from their own activities. Nowadays, this charter represents the main reference for European higher education institutions in their involvement towards sustainability; the network of its signatories, in fact, is getting incessantly broader (more than 320 universities and higher education institutions from 38 European countries). In addition, the charter promotes a know-how transfer among higher education institutions together with the identification, promotion and dissemination of exemplary practices and strategies to make sustainability central in university life. Towards this end, in fact, it is necessary to ensure that the sustainability mandate would address curriculum, staff development, collaborative research, purchasing, waste management, community relations, and so on. Therefore, higher education institutions are facing different tasks towards sustainable universities. Firstly, since education may contribute to social, ecological as well as economic growth, we should look to universities as key players engaged in the promotion of a sustainable society. Secondly, universities have to train interdisciplinary specialists in sustainability and this means that specific concepts, methods and approaches have to be included in the different Degree Courses. Thirdly, since universities themselves should become more and more sustainable, standard management instruments such as good governance, environmental certifications, sustainability reporting, need to be incorporated in them. These commitments, consequently, could be considered as clear evidence of the strategic role of higher educational institutions regarding sustainability.

The Italian context

In spite of this international scenario, which emphasizes the role of higher education in an active involvement towards sustainable societies, the singular national contexts show several differences characterizing their practices. This means that universities, which have simply signed the charters or declarations, coexist with others that have adopted them as guidelines for their every day development both at curricular and practical level. Even if some best practices could be found in the European context, Italian universities seem far in taking this opportunity for a strong change in their policies and “lifestyles”. An evidence of this situation is given by the Italian universities (about fifteen), which have signed the Copernicus Charter: no mention to this document appears on their websites, although abounding in every kind of information.

However, an analysis of the Italian policies from these perspectives is not sufficient for an effective interpretation of the sustainability state of the art in higher education.

From a practical point of view, the Italian situation appears quite discouraging in relation to the implementation of environmental management towards sustainability. Unfortunately, there are not, till today, structured examples of good practices implemented by universities to become environmentally friendly (only recently, an interesting project has been launched by the University of Rome “La Sapienza”). In fact, in our context are not known (even if some local experiences cannot be excluded) global planned actions, such as: universities EMAS certificated, Greening campus experiences and local Agenda 21. Higher education seems not to play the role of cultural leader for a sustainable society; rather it has a conservative spirit and opts to maintain the status quo.

From the educational point of view, during the second half of the 1990s, thanks to the growth of the debate about the need of an interdisciplinary approach to environmental management and thanks to the commitment of some researchers, the Degree Course in Environmental Sciences has been founded. It aims at training professionals with a good basic knowledge and a strong environmental systemic culture. The integration of fundamental scientific information with ecological, economic and juridical knowledge and approaches, in fact, fosters the acquisition of key skills fundamental to approach environmental issues. In spite of the difficulties related to the novelty of the proposal, this

course had the value to contaminate the rigidly disciplinary academic approach with the interdisciplinary one, at the basis of the idea of sustainability.

In spite of this new Degree Course, the higher education system remains far from a deep contamination of its curricula since 2001/2002, when the Italian universities have been reformed according to the European Union. The organization of studies is now articulated in two levels: the first one consists of degree courses that usually last three years and the second level includes degree courses that last two years. This arrangement, promoted at Ministerial level, has been in practice the stimulus for a strong revision of courses, disciplines and curricula; in this framework, we can approach with an in depth analysis of the sustainability debate in the higher education context. Consequences of this reform, in fact, are the spread of first and second level Degree Courses, Master Degree Courses and Specialization Schools related to sustainability (Nature Conservation, Environmental Management, Engineering for the environment, Pedagogy for the environment, Economics for international cooperation, etc.) and by the activation of specific disciplinary courses on sustainability issues in many other traditional curricula (Environmental Economics, Sustainable Development, Environmental Education, Environmental Communication, etc.).

Starting from these thoughts, it is possible to argue that Italian universities have acquired a general attention towards sustainability and related issues, which has permeated the different disciplinary areas and so they are able to train professionals with a solid background on these topics. But, if we consider University the higher institution involved in formal education, which prepares the citizens of tomorrow, not only in relation to knowledge but also in their values, attitudes and behaviours, we are forced to underline its general inadequacy. This lack is not perceived as a weakness from the system, because it is broadly understood that the University plays an important role in the acquisition, dissemination and application of rigorous knowledge, keeping apart their ethical implications. Coherently with this view, University attributes to society, family and to the others school levels, the educational efforts towards the promotion of positive individual behaviours and lifestyles. So, the academic world seems to be globally far from a general awareness of the importance of education for sustainability and consequently not interested into an enduring contamination with this educational approach, and in taking the lead in the transition to a more sustainable society.

The Italian Centre for Research and Environmental Education (C.I.R.E.A.)

From this global and national scenario, some examples of good practices have emerged. In fact, while some institutions have focused attention on national and international sustainability declarations, others choose to take a micro approach to sustainability in higher education by supporting institutional environmental sustainability policies that are meaningful for their particular situation.

Among them, the experience of the Italian Centre for Research and Environmental Education (C.I.R.E.A.) of the University of Parma will be discussed in this paper.

The University of Parma is one of the most ancient Italian universities; nowadays, it has about 30.000 students, more than 1.000 teachers and researchers and about 1.000 units of non-teaching staff. It is organized in 12 Faculties structured in first and second level Degree Courses, Master Courses and Specialization Schools. C.I.R.E.A. has developed as the first university structure doing research on Environmental Education in Italy. Its activities, in fact, started in the 1960s by an ecologist whose commitment was fundamental to the foundation of the Centre of Environmental Analysis and Education (C.A.E.A.) and then (in the 1970s) of the Laboratory of Environmental Education within the Institute of Ecology. From then on, the Environmental Education Centres have become widespread in Italy, but outside the university context.

Subsequently, the idea of Environmental Education as an interdisciplinary cultural approach, led to the foundation of an Interfaculty Centre for research and regional services in this specific area. In

this respect, the *Italian Centre for Research and Environmental Education* was officially established by law on December 15, 1990 by publication in the *Gazzetta Ufficiale* (Official Journal of the Italian Republic) No. 292, where its identity and mission are stated as follows:

"C.I.R.E.A. is a research and services Centre, whose main objectives are to promote interdisciplinary research, to develop and realize interdisciplinary educational activities and to collect and preserve documentary and bibliographic material related to Environmental Education."

Following a reorganization programme within the University of Parma, C.I.R.E.A. was merged into the Department of Environmental Sciences in 2001; a Technical-Scientific Committee was established and a Coordinator was appointed.

C.I.R.E.A. endorses a view of Environmental Education that necessarily reflects the most recent national and international debates. The Centre explicitly considers the issues debated at the *United Nations Conference on Environment and Development* (Rio de Janeiro, 1992), particularly Chapter 36 of Agenda 21 "Promoting education, public awareness and training". At the national level C.I.R.E.A. recognizes the importance of the "*Charter of principles for Environmental Education oriented to sustainable and responsible development*" approved at the end of a Seminar held in Fiuggi on April 24, 1997. In particular, it shares the view that:

"Education for Sustainable development must become a strategic component in the promotion of a citizens' critical and active behaviour toward their environmental context.

Environmental Education contributes to restore, in individuals and groups, a feeling of identity and belonging, to develop a civic culture and sense of responsibility towards the "res publica", to disseminate a culture of participation and caring for the quality of one's environment, thus creating emotional relationships among people, community and territory."

Since its foundation C.I.R.E.A. carries out its activities in an "open system" perspective, paying particular attention to the establishment of strong links with the territory and its problems. Consequently, all the activities promoted by the Centre are shaped with the aim to strengthen interactions with actors outside the University, especially from local communities.

C.I.R.E.A.'s commitment towards sustainability: theory...

All activities developed by C.I.R.E.A. are addressed to the promotion of sustainability in its multi-dimensional vision.

From a methodological point of view, C.I.R.E.A. acknowledges the importance of an action-research approach and supports initiatives that:

"-involve knowledge, values, behaviour, experiences, to promote respect and interactions among all life forms in the environment;

- have the opportunity to build and spread a modern culture that is "capable of future", that is able to go beyond a "throw away" mentality and to base its actions on a "sense of limit";

- promote opportunities and contexts to foster the development of dynamic qualities, to build the capacity to make decisions in the face of uncertainty, to increase the awareness that the capacity to predict can not be separated from the willingness to face the unpredictable, to educate for dialogue and conflict management among different points of view;

- strengthen coherence between action and knowledge, between statement and behaviour".

(Charter of Fiuggi, 1997)

This means that C.I.R.E.A.'s staff considers as fundamental the research on its daily professional practices, emphasizing the importance of a continuous improvement of individual competencies. From a cultural perspective, the evolution of the Centre from its foundation till today is connected with international and national Environmental Education changes. In synthesis, the cultural policy of the Centre moved from "activities *on* and *in* the environment" (thanks to the strong naturalistic and ecologic competencies often characterizing the staff of the Centre) to "activities *for* the environment", aimed at the promotion of positive behaviour and characterized by a sound interdisciplinary approach. One of the consequences of this change is the elaboration of projects and activities related to the environment, intended in a broader meaning and so, overcoming a strictly scientific vision. In the last years, the Centre paid a major attention to environmental ethics, considered fundamental for Environmental Education. The promotion of reflection, sharing and diffusion of positive values became then a meta-objective fundamental for C.I.R.E.A. in relation with the Environmental Education goals. From our point of view, this aspect is particularly strategic, especially if considering that a higher education institution should support the growth of its students from both a professional and a cultural point of view.

C.I.R.E.A. constantly promote an idea of education for sustainability within a lifelong learning approach. This means that attention is given to activities for schools (privileged from several point of views), but at the same time are developed projects involving adults and all citizens' categories. In this perspective, the Centre aspires to become a place for a critical elaboration on sustainability issues from an educational point of view, starting from the needs of local environment and the suggestions from global (national and international) context. In this direction, an interdisciplinary approach, together with a strong cooperation with Non-Governmental Organizations (NGOs), Public Administrations, Parks and the actors of the territory, becomes fundamental. In particular, this scenario includes the relationships developed by the Centre with the structures shaping the INFEA (Information, Training and Environmental Education) National System, such as the Environmental Education Centres of the Emilia Romagna region, widespread on its territory.

...and practice

The academic connotation of C.I.R.E.A., together with its relations with the local context and the aspects mentioned above, are coherently traduced in different activities. Among them we can identify some categories, not separated in the practices but strictly interrelated, useful for discussion:

- Training initiatives;
- Extra mural activities;
- Research projects.

This diversity represents an important richness, considering that it identifies an interconnected and global approach toward education and at the same time, a higher education institution coherent with its role for a sustainable society.

Training initiatives

As training initiatives, C.I.R.E.A. has identified all those proposals (even if they are part of research projects or are related to specific activities within the local context) developed in the formal contexts of education, with the principal aim being professional training. We can consequently highlight:

- *Environmental Education course for Environmental Sciences Degree;*
- *scientific support and consulting for students in the preparation of Degree theses;*
- *training courses for environmental educators;*

- *in-service courses for teachers of each school level.*

Extra mural activities

These initiatives are developed following an idea of University as an “open system” which gives an active contribution to the growth of a sustainable society, not only thanks to training, its institutional mission, but also through the translation of competencies and ideas in an active citizenship. Both the C.I.R.E.A. scientific consulting for Environmental Education institutional committees and participation in local Agenda 21 processes could be seen in this perspective.

Research projects

In coherence with C.I.R.E.A.’s commitment toward sustainability, the projects promoted emerged from specific needs both “internal” to the context of the Centre (the evaluation of Environmental Education activities, for instance) and “external” to it. In this particular case, the projects growth thanks to the cooperation with different actors in the local contexts (Parks, NGOs, Public Administrations, for instance). The activities are sometimes developed, in addition, in the framework of international or national initiatives.

As significant sample of the research projects carried out by C.I.R.E.A., two specific experiences are discussed below. The first one, which put the attention to the improvement of the professional competencies internal to both the Environmental Education Centres and the local context (agencies, NGOs, for instance), is related to “*Environmental ethics as a resource for sustainability*” and it is articulated in three different projects. This research has its roots in a “cultural/theoretical” need: to take educators’ and then citizens’ attention back to reflection on principles moving individual’s actions; so, the research course has moved to identify practices coherent with these needs and with the idea of a participative and shared project between different actors.

The second research, further discussed, was named “*Scuola 10 e lode*” (“School ten out of ten”). It roots in a “practical” need: the necessity for the most important educational institutions to be coherent in the values “taught” and “practiced”. This means that sustainability commitment of schools needs to involve both practical actions to reduce their environmental impacts and the theoretical/educational dimension of the issues involved.

1) Environmental ethics as a resource for sustainability

The first project about environmental ethics carried out by C.I.R.E.A. was “*Environmental ethics as a resource for sustainability: a laboratory for an Ethical Charter of Environmental Education Centres (CEA) and Parks in the Province of Parma*”, funded by the Emilia Romagna Region and by the Province of Parma (Antonietti, Bachiorri & Giombi, 2006). It lasting one year (2003) with the involvement of every CEA of the Province involved and has been developed thanks to a laboratorial way of work with the purpose to draw up an Ethical Charter of Environmental Education Centres and to disseminate it in specific contexts, such as Parks.

Starting from the belief that a deeper knowledge can help in identifying paths and strategies useful to promote behaviour changes, the elaboration of the Ethical Charter began with training of CEA’s staff. This course involved different disciplinary approaches and contributed to discuss environmental ethics and values from a multidimensional scenario; it was the basis for different groups activities, which allowed the identification of nine principles that shaped the Environmental Ethical Charter. The project developed, afterwards, in relation to the dissemination of the Ethical Charter in the different Parks and protected areas located in the Province of Parma. In this framework, each context elaborated by itself specific proposals, in relation to its needs, interests, relationships, etc. This phase, consequently, implied a specific attention for:

- the target identification for the dissemination project;

- the choice of strategies for communication and for promotion of citizens involvement;
- the experimentation of the project.

Thanks to the contribution of external experts, a global analysis of the experimentation emphasized the relevance of the Environmental Ethical Charter as an interesting reference for a permanent discussion at the educational level. The attention given to the ethic dimension by C.I.R.E.A, after this project, growth and developed thanks to the following proposals:

- *Environmental Ethical Charter in action: itinerant counters*, aimed at spreading the charter in schools. Specific educational material has been elaborated to suggest cross-curricular activities for teachers of different disciplines in ways which support the reflection on students values, behaviours and the consequences of their every day actions;
- *The return of street singers...to disseminate environmental ethics*, aimed at spreading the Environmental Ethical Charter within citizens, using the theatrical language in ways which stimulate a deeper emotional involvement of individuals.

In spite of the difficulties of a job in strict cooperation with different partners, results obtained encouraged future efforts towards the integration and diffusion of environmental ethics in Environmental Education debate and practices.

2) The project “Scuola 10 e lode”

The project, promoted by Legambiente Emilia Romagna, one of the most important Italian NGOs, and by C.I.R.E.A., has been developed with quality criteria inspired by environmental certification systems for enterprises (EMAS, ISO 14001, etc.) and with the idea to integrate sustainability principles and international certification standards into schools curricula (Bachiorri et al., 2006). The project roots in the dynamic assumptions of international certifications (including periodical evaluations of the “state of the art” and continuous improving of performances) and in carrying out projects able to integrate in a wider vision the fragmentary activities often characterizing school context. “Scuola 10 e lode” wants also to promote an idea of Environmental Education, which goes beyond a strictly naturalistic-ecological approach, with the contribution of cultural and methodological tools in accord with the fundamental principles of education for sustainability (interrelationships, complexity, participation, active citizenship, etc.). Therefore, this project considers “action” as a key component of the educational process and thus lies within the picture of education “for” the environment.

The main tool characterizing the project, upon which it has been assembled and organized, is the sustainability *Decalogue*. It lists a series of issues (waste, water, energy, renewable energies, food, transportation, school building, school garden, school and its surrounding, biodiversity) that relate to aspects for which schools should improve their environmental performances. This in turn can be obtained melting together awareness-oriented initiatives and the implementation of good practices for sustainability.

The stakeholders’ involvement has been achieved through a *Commission*, which represents all the school subjects (students, teachers, parents, administrators, etc.). At the beginning of the school project, this Commission has to perform an *Audit*, useful to investigate the "state of the art" (strengths and weaknesses) and consequently to evaluate impacts and identify actions for their reduction. In addition, results from the Audit, allowed schools to elaborate a *School Project*, the action plan to implement sustainability in practice.

This project must deal with all the different issues listed in the Decalogue and implies a minimum level of action, such as increasing environmental awareness through every-day class activities. Moreover, at least in relation to one point of the Decalogue, the school must carry into effect real changes in its environmental performances with a concrete impacts reduction.

In order to award the environmental quality brand “Scuola 10 e lode” for each school project, promoters carried a critical analysis (*evaluation and monitoring* phase), based on the single school experiences, results achieved, school documentation and inspections, and through a structured system of criteria, specifically performed.

Conclusions

Even if the experience of C.I.R.E.A. could be “unique” and stimulating in the Italian scenario of higher education system for sustainability, several aspects need to be remembered.

One of the most relevant weaknesses of the experience discussed, is the difficulty to strengthen a strong interdisciplinary approach at the university level. This could generate clear effects also upon the Centre’s staff that should be supported with different disciplinary competencies. Our hope is that from this critical state, a strategic choice for an University that wish to acquire the stimuli of the most recent cultural debate in all different fields could grow and develop. Unfortunately, as mentioned above, the limited interest of the Italian higher education institutions towards the sustainability debate has deep roots and required specific strategies.

From another point of view, it is fundamental to take care of one more aspect: the coherence between “theory” and “practice”. In the context of its own autonomy and in respect to global university choices, C.I.R.E.A. tries to reduce its ecological footprint through some basic choices:

- No dissemination of advertising material but distribution only on request;
- No distribution of gadgets and explanation of this choice to citizens;
- Reduction in paper utilization, use of recycled paper and paper separate collection;
- Use of public transportations and car pooling practices;
- Limitation in air-conditioning of the offices;
- Energy save practices.

These efforts, however, have not been sufficient, till now, to promote a change in the Academic context, still far from the acquisition of awareness and commitment on these issues. But our auspicious is that our “day by day” actions can contaminate our “internal context”, students and other colleagues at least, which can, in their turn, promote a diffuse sensitivity and stimulate a deep rethinking and renewal of University. A University that agrees with the necessity to work together to preserve the future, that cannot draw back nor move too slowly and hesitating in putting into practice what several international reports have marked (Millennium Ecosystem Assessment, 2005; WWF, 2006), if it wants to be truly a strategic component “for” and “of” a sustainable society.

References

Antonietti, R., Bachiorri A., Giombi G. (2006), “La Carta dei principi Etici dei Centri di Educazione Ambientale e delle Aree protette della Provincia di Parma: una risorsa per lo sviluppo sostenibile”, in Salomone, M. (ed.), Proceedings of the 3rd World Environmental Education Congress. (3rd WEEC) Torino, Italy, 2-6 October 2005. Session 11., Scholé Futuro Editore, Torino, pp. 45-49

Bachiorri, A., Bondavalli, C. Puglisi, A. & S. Selmi. (2006), “*Scuola 10 e lode – An environmental certification project for schools in the Emilia Romagna Region (Italy)*”. in: Leal Filho, W. and Salomone M. (eds), Innovative approaches to Education for Sustainable Development, Peter Lang Publishing, Frankfurt am Main, pp.282.,

Carta Dei Principi Per L’educazione Ambientale Orientata Allo Sviluppo Sostenibile E Consapevole (Fiuggi, 1997), Available on line at: <http://www.regione.umbria.it/cridea/fiuggi.htm>

CRE – Copernicus Declaration, Available on line at: http://www.copernicus-campus.org/sites/charter_index1.html

Millenium Ecosystem Assessment (2005), Available on line at: <http://www.millenumassessment.org/en/index.aspx>

Talloires Declaration, (1990), Available on line at: http://www.ulsf.org/programs_talloires_td.html

WWF (2006), *Living Planet Report*, WWF International, Gland, Switzerland.

**Educational Strategy in enterprises:
A Case Study Involving Students of Agricultural Development**

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Program EPEAEK II-3rd phase, Action 2.4, sub-Action 2.4.2, Ministry of Greek National Education. Study subject: Students Education in Enterprises. Faculty of Agricultural Development (2005-2008).

Abstract

This paper refers to the engagement of teams of students of the Department of Agricultural Development, Democritus University of Thrace, in addressing real-world problems related to water and environmental pollution that may come from the enterprises or not and influence both biodiversity and microbial flora. This pollution constitutes a constant danger for public health. The project's focus was on supplementary training for students to develop their capabilities, as well as improve their potential for influence through the proposed collaboration with companies. This strategy permitted students to have a 'first contact' with specialized knowledge and equipment and helped them with their basic research. The teams analyzed remotely-sensed images to find solutions to open-ended earth science problems. Moreover, it gave them the opportunity to learn research methods from the professional personnel, interact with field scientists, and access real world data from endangered and damaged areas. It is noted that there was a permanent structural cooperation with the involved stakeholders, which led to an increase in the numbers of students to be educated effectively in enterprises. Additionally, the University offered supplementary education through specialized lectures given by invited speakers in relevant sectors, including topics such as sensitive habitats, endangered species, biodiversity and supporting the environment. All these activities contribute to a more dynamic profile for the University at national and European level, by establishing an effective educational policy titled "Innovative educational strategies for students".

Keywords:

Education for sustainable development, industry, University

Introduction

In the academic world, education has traditionally assumed a bipolar target role based on quality improvement (Askling, 1997; Alderman and Brown, 2005; Council of Europe, 2006) imposed by Universities and accountability reflecting the government's educational priorities. In recent decades, the context in which higher education operates, embedding quality culture (Bollaert, 2006), has included influences such as public policy, management policy (Brennan et al, 1993), globalization

trends and the growing influence of the European Union policies concerning educational skills (Conraths and Trusso, 2007). Multi-dimensional projects were also promoted including inter-University cooperation, i.e. ERASMUS programmes, as well as dynamic cooperation with the industrial (Neave et al, 1988) or professional world (Brennan et al, 1993). A University cooperates with other bodies through different educational strategies aiming at jointly reaching common goals, such as knowledge of the work places and of the stakeholders' necessities. This objective of jointly evaluating defined goals constitutes a better approach when addressing global problems.

The project sought to achieve important advances to the establishment of a computational system response to improve the performance of this composite type of educational system between University and enterprises. Therefore, a systematic surveillance of all education stages within the stakeholder's organization was performed and students were asked to fill in a questionnaire evaluating their educational training. The aim of the project was to bring students closer to market needs following completion of their University studies and help them to choose an occupational activity at the same time. In detail, the main objectives of the project were to:

- facilitate student mobility during the operational plan
- establish qualitative and quantitative knowledge of work places
- revise the University curriculum to consider the changing work priorities
- discover the needs of specialized personnel as stakeholders and orient the University master and Doctoral programmes to cover these specialized needs
- enhance the occupational experience of students
- develop an action plan for the exploration of project results such as market needs and promotion strategies in a sustainable development context
- produce knowledge of new strategic research items not only within the region of the University, but also at national and European level, in order to achieve the following:
 - continuous follow up of changes
 - positive influence on the design and policy plans
 - establishment of contacts and cooperation with stakeholders, political systems and structures, including associated information and needs
 - reinforcing mutual links between the University and enterprises promoting the acquisition of the necessary knowledge for sustainable development purposes

Material and Methods

The students were placed at 80 different stakeholders' organizations, which included agrochemical-pharmaceutical companies and associations, food and dairy industries, environmental policy organizations, scientific institutes, chemical state laboratories and other Universities. Collaboration was also assured with banks and enterprises with extensive knowledge in the domain of economic development.

Questionnaires included 17 questions, designed to find out about the existence of a social context for opportunities generated on different contextual levels, such as:

1. the University-Enterprise market binomial
2. the educational qualification as a collaboration mechanism, and
3. the students' recruitment profile

Since each University is different and has a different portfolio of activities and science specialization, the educational strategy to be followed is therefore different in order to reflect this diversity.

Results

The present study involved 134 students (70 male and 64 female) from the Department of Agricultural Development, Democritus University of Thrace. A summary of the main findings follows:

- In issuing an effective educational strategy for students involved in this type of action, there is a need for a major increase in direct collaboration activity between the University and stakeholders to underpin competitiveness and knowledge of the market activity.
- Embedding graduate survey indicators through questionnaires distributed to all students and evaluating their responses, is crucial because of the need for an understanding of the University and market linkage.
- Raising environmental problems such as climate change, loss of biodiversity, declined agrocultures, land clearance and degradation, vegetation loss, declining fisheries, invasive plants and animals, trade in endangered biological species, ozone layer depletion, malnutrition, food-associated behavior and finally sewage and waste disposal, led to offering students a global approach of the status of the environment incorporating them in appropriate educational strategies.
- Environmental issues are frequently complex, contested and influenced by many factors. The theoretical knowledge offered by the University coupled with applied knowledge stemming from industrial bodies was well received by students.

The questionnaire responses showed that students considered a bipolar type of education highly important (Figure 1) based on the relevance of practice content (47.9%), the degree of supplementary practice received on top of the theoretical part of their course syllabus (49.3%), and the usefulness of the theoretical education received in their practice (76.1%).

The respective collaboration with their University supervisor(s) during their practice (53.5%) as well as the frequency of the above collaboration (45.1%) was generally considered sufficient enough.

Most students considered as adequate the relevance of practice content to the processes demanded by the labor market (90.1%), the student expectation (77.5%) and experience (71.8%) respectively.

High percentages in the degree of satisfaction (92.9%) and collaboration (94.4%) of the students during their in-company practice were recorded, as private counselors were dexterous and cooperative (76.1%) to student proposals and provided them easily with any required infrastructure (66.2%).

However, after completion of their practice, most students believed that they were not able to respond adequately to the demands of the market (53.5%) as longer practice duration (53.5%) was necessary to enable them to do so.

Finally, companies seem to view positively this kind of collaboration, as they proposed to a considerable number of students future work contracts (39.4%).

Most students chose private sector industries for their practice and only a limited number of students selected other Universities (2%) or research Institutes (3.5%).

Research was rarely effectuated in the private sector, where our students trained (2.5%). Environmental education through this practice seems also to be of little interest (6%).

Discussion

Research, innovation (Advisory Council for Science, 2007), invention and adaptation are required

for collaboration with industries enriched by a clear understanding of the ecological policy issues involved. As most current environmental problems have solutions (Australian Government Publications, 1999-2006), there is an urgent need to effectively access actual environmental management practices and plans for a rational future (MacConville, 1999).

The knowledge, values, skills and tools needed to meet environmental challenges are all sourced from formal and informal applied education. To disseminate these to students, University information can be given through lectures and organized visits, while relevant information sessions on sensitive habitats, endangered species, biodiversity and environmental protection are organized. Knowledge needs to be spread to all social and educational classes, while specified information should be channeled to the work force (Martin et al, 2000) and to potential future workers, part of which is the trained student force.

In order to maximize investment in higher education (Harvey and Green, 1993; Horsburgh, 1999), it is vital that effective linkages between higher education institutions and enterprises are fostered which will facilitate the transfer of scientific knowledge. Closer interaction between universities and enterprises is widely recognized as being increasingly important, because global competition forces companies to invest in innovation (Stensaker and Norgard, 2001) and strengthen specific scientific core areas. Collaboration with institutions of higher education enables companies to gain access to new knowledge (Henkel, 2000), specialist skills and the latest technological expertise. Higher education should, therefore, be underpinned by a coherent policy approach (Dill and Soo, 2005) that includes both the public and the private sector. As a result, in Greece, the deepening of such enterprise and higher education collaboration is necessary in order to reinforce the low capacity absorption capacity of enterprises for research and the existing gap in the availability of applied research capacity that enterprises could readily access.

A holistic and structured approach is required to invest in new initiatives (Barnett, 1994) to develop in-depth competence in applied research conducted by the University in support of innovation in enterprises. In order to develop an ideal collaborative research, enterprises should be located on or in close proximity to the existing University campuses maintained by solid governance structure, i.e. Innovation Pole, which ensures the autonomy of each stakeholder and protects their distinct mandate and culture for applied research and education. Thematically focused programmes which apply an enterprise-driven approach should be developed along with a substantial exploration of the student theoretical potential to be prepared for future occupational action. Moreover, business and higher education representative bodies should facilitate networking and mutual exchange of information on the collaborative scientific field. In the framework of the Bologna process (Amaral and Magalhaew, 2004), quality assurance in Universities (Clark, 2004) is used as a tool for rationalizing these programmes. Universities should take the lead to transform and adapt their classic educational system in more flexible study schedules based on thematic areas of priority. Systematic benchmarking derived from applied knowledge in the industry and the synergetic effect of the developed structure should be promoted.

Conclusions

Students need to be able to trust an effective and efficient educational system to acquire up to date scientific information and knowledge. Indeed, the main knowledge factors that emerge are connected with effective education schemes with the aid of new technologies and research schedules. Last but not least, collaboration with enterprises through innovative strategies contributes to a dynamic profile for the University.

It is evident that the project achieved high usefulness for the students by providing complementary education in applied scientific fields and offering them knowledge on work possibilities and stakeholder needs.

References

- Advisory Council for Science, Technology and Innovation (2007), Promoting enterprise-higher education relationships, Forfas.
- Alderman, G., Brown, R. (2005), Can quality assurance survive the market? Accreditation and audit at the crossroads, Higher Education Quarterly, Vol.59, pp. 313-328.
- Amaral, A., Magalhaes, A. (2004), Epidemiology and the Bologna Saga, Higher Education, Vol.48, pp79-100.
- Anonymous (1999), Today Shapes Tomorrow: Environmental education for a sustainable future, Environment Australia, Australian government publications, Department of the Environment and Water Resources. <http://www.gov.au/todayshapes/1999/publications>
- Anonymous (2006), Australian Government, Department of the Environment and Water Resources, Envirofund Publications <http://www.nht.gov.au/envirofund/2006/round>
- Anonymous (1999), Australian Government, Department of the Environment and Water Resources, Publications, <http://www.nrm.gov.au/publications/index.html>
- Anonymous (1999), Australian Government, Department of the Environment and Water Resources, Threatened species Publications, <http://www.environment.gov.au/biodiversity/treated/-publications/index.html>
- Asking, B. (1997), Quality monitoring as an institutional enterprise ,Quality in Higher Education,Vol.3(1), pp17-26.
- Barnett, R. (1994), Power, Enlightenment and Quality Evaluation, European Journal of Education,Vol.29, pp165-179.
- Bollaert ,L(eds),(2006),Embedding quality culture in higher education,1st European Forum for quality assurance, European University Association, Munchen, Germany.
- Brennan, J. L, Lyon, P.A., McGeevor, P.A., Murray, K. (1993), Students Courses and Jobs. The Relationship between Higher Education and the Labour Market, Bristol, Jessica Kingsley Publishers.
- Clark, B. (2004), Sustaining Change in Universities: Continuities in Case Studies and Concepts, Berkshire, England, McGraw-Hill.
- Conraths, B, Trusso, A (eds)(2007)Managing the University Community: exploring good practice, European University Association.
- Council of Europe Higher Education Forum, The legitimacy of quality assurance in higher education: The role of public authorities and institutions. Conclusions and Recommendations, Strasbourg September2006 http://www.coe.int/t/dg4/highereducation/QA/Conclusions%20and%20recommendations_EN.pdf
- Dill, D. D., Soo, M. (2005), Academic quality, League Tables and Public Policy: A Cross National Analysis of University Ranking Systems, Higher Education, Vol. 49, pp. 495-533.

Harvey, L, Green, D (1993), Defining Quality, Assessment and Evaluation in Higher Education, Vol. 18(1), pp9-34.

Henkel, M. (2000), Academic Identities and Policy Change in Higher Education, Higher Education Policy Series, London, Jessica Kingsley.

Horsburgh, M (1999), Quality Monitoring in Higher Education: The impact of Student Learning, Quality in Higher Education, Vol.5 (1), pp9-26.

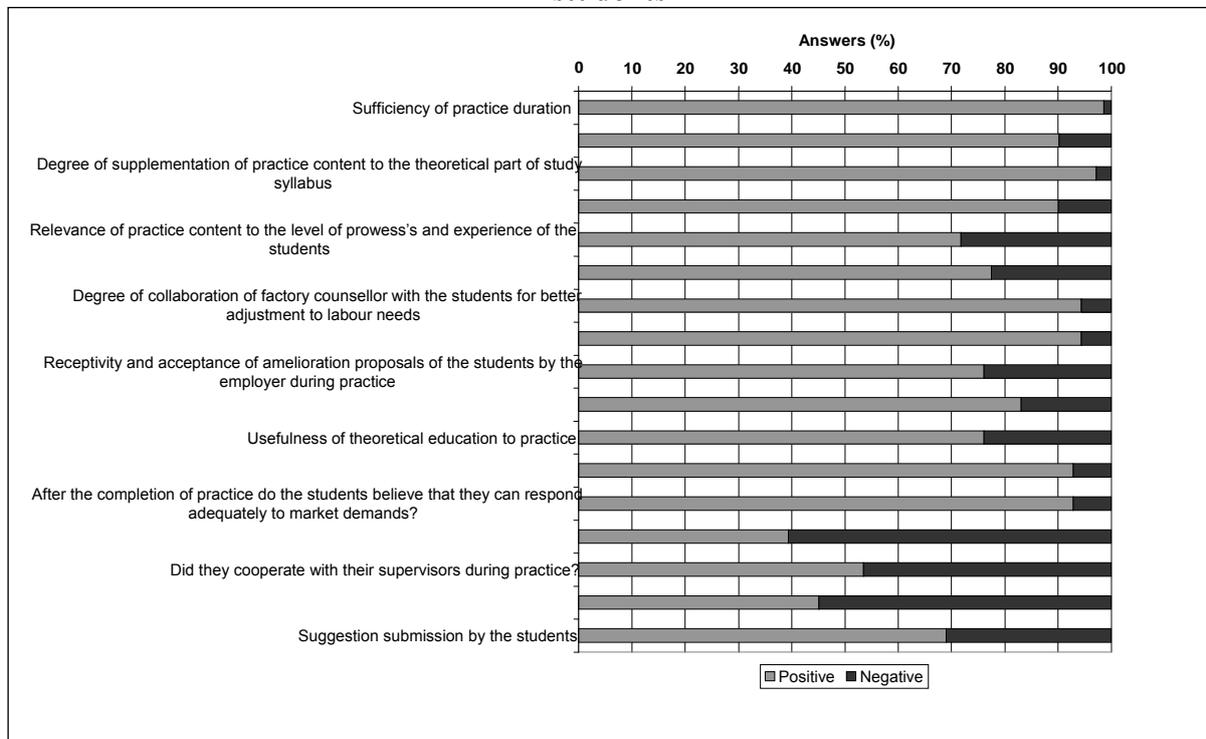
Martin, A., Milne-Home, J, Barrett, J, Spalding, E., Jones, G. (2000), Graduate Satisfaction with University and Perceived Employment Preparation, Journal of Education and Work, Vol,13(2), pp.199-213.

MacConville, G. (1999), Everybody Wants Quality Education: But what does it Mean? Australian Universities Review, Vol.42 (2), pp 2-4.

Neave, G. (1988), On the Cultivation of Quality, Efficiency and Enterprise: An Overview of Recent Trends in Higher Education in Western Europe, European Journal of Education, Vol.23, pp7-23.

Stensaker, B., Norgard, J. D. (2001), Innovation and Isomorphism: A Case Study of University Identity Struggle 1969-1999, Higher Education, Vol.42, pp473-492.

Figure 1: Positive vs. negative opinions expressed by participating students



Approaches in Education for Sustainable Development at St. Petersburg State University, Russia

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Abstract

There are three important aspects of Education for Sustainable Development (ESD) for Universities:

- Creating and teaching the new philosophy of development, based on the concept of SD, which we consider essential for all university students. Such lecture courses would promote the new consciousness and world view for future specialists and citizens of the XXI century.
- Integrating SD principles into training of specialists in various fields for relevant sectors of society (e.g., sustainable mobility, energy, spatial planning, etc.).
- Devising special interdisciplinary (interfaculty) educational programs for the training of specialists in SD. A new type of specialists able of holistic, strategic thinking and taking systems intersectoral decisions is needed for development and implementation of long-term action plans on and management of transition to SD.

The article discusses the practical experience of SPSU in:

1. implementing educational programs and curricula, based on SD ideas and principles, oriented on ecologists with various specializations;
2. modifying the functions and roles of the main actors of the educational process, thereby changing the traditional views of its methods, tools, and technologies;
3. engaging informal education like debate clubs, public associations and organizations, project activities, and participation of business and administration in the Local Agenda-21 process.

Keywords:

Education for sustainable development, innovative interdisciplinary approaches, educational methods

ESD activities at Saint-Petersburg State University

The Saint-Petersburg State University (SPSU) undertakes a wide range of activities on ESD, in particular:

- develops educational courses dedicated to various aspects of SD (at many faculties);
- opens new specialties to be incorporated into master, in particular, international programs,
- establishes public associations of students and lecturers;
- prepares and implements additional professional training programs;
- undertakes projects on educational, scientific, and practical aspects of SD;
- builds intersectoral partnership, networking.

This is paralleled by the integration of innovative methods and approaches, essential for developing a new culture of educational process, with

- changing the contents of educational programs
- integrating new organizational institutes,
- modifying the functions and roles of the main actors of the educational process;
- integrating new training methods.

Modern views of sustainable development are those of a new vision, a new philosophy of development, underlain by the integration of social, economic, and environmental aspects in decision making and practices. This implies addressing the ecologic, economic, and social dimensions in a holistic manner incorporated into management and decision making.

In solving environmental and developmental problems an essential role is undoubtedly fulfilled by ecologists. However, the mission, role, and tasks of experts in ecology need to be reevaluated to fit the present-day conditions. Universities and equivalent higher education institutions will have to revise the specializations, as well as the methods and quality of training in ecology.

Established in 1997, the Department of Environmental Safety and Regional Sustainable Development integrates the potentials of the Faculty of Geography/Geoecology, St. Petersburg State University, and the Research Center for Ecological Safety, Russian Academy of Science (SRCES RAS).

The organization of the Department was initiated by people who have been executors and supervisors in a number of international and Russian projects on SD topics since 1990. They discussed conceptual and practical aspects of transition to SD at major world and European conferences and joined the international communities engaged in this sphere.

Thus, from the very beginning the elaboration of education programs on training in ecology was underlain by SD ideas, as stems from the very title of the Department. The SD principles and concepts were invoked to substantiate the training profile and choose specializations, identify professional orientation and qualification requirements for Department graduates, design curricula, select subjects for undergraduate and graduate theses, and organize learning and industry practices.

Principles of education

In devising its education programs and curricula the Department relied on the following principles and approaches:

- interdisciplinary approach and interrelation of disciplines in education programs; enlarged the humanitarian component of curricula;
- interdepartmental and interfaculty integration in curriculum design and implementation;
- problem-oriented education;
- integration of SPSU and SRCES RAS potentials in training specialists; students involvement in research projects undertaken at the Department and in SRCES RAS;
- permeation of environmental safety and SD principles through virtually all the specialty courses in the curricula;
- incorporation into curricula of new special courses, Sustainable Development and Environmental *Policy and Politics, Agenda-21*, etc.

Qualification requirements

Adjusted to professional orientation, the qualification requirements for Department graduates in ecology imply being aware of:

- environmental safety and sustainable development basics;

- ways and methods to formulate sustainable development policy and strategy, as well as Local Agenda-21;
- basic methodology of decision-making and implementing decisions on environmental safety and SD;
- ways and methods to create adequate information systems to support the decision-making; etc.

Curriculum

The Department of Environmental Safety and Regional Sustainable Development designed its Curriculum in compliance with criteria set by the State Educational Standard for specialists in ecology. Every basic special course includes the sustainability outlook either as a conceptual framework or as special sections.

Also, there are disciplines that lay special emphasis on SD issues.

To highlight the importance of strategic thinking and setting long-term goals in moving toward SD, the Department devised the *Strategic Planning and Management* course.

Interconnected courses of *Methods of Management and Decision-Making*, *Collective Choice Problems*, *Decision-Making in Conflict Situations*, and *Information Support to Decision-Making* attach importance to wide participation of stakeholders and account of all their different (often opposite) interests in preparing and making decisions.

The *International Relations in Environmental Safety*, *European Environmental Regulations and Standards*, *Management of International Environmental Projects*, and *Environmental Management: Modern Approaches in Foreign Countries* courses emphasize international integration, an essential factor in solving the environment and development problems.

Traditional disciplines, *Basic Principles of Environmental Management* and *Management and Marketing in Ecology*, are supplemented by *Ecological Audit* and *Ecological Insurance* courses aimed to generate knowledge of state-of-the-art management tools among students.

Also, the Curriculum of the Department of Environmental Safety and Regional Sustainable Development includes disciplines that focus specifically on SD and Agenda-21.

A cycle of disciplines on SD

Students learn key sustainability principles when they begin a study at the Department as sophomores. The *Introduction to Specialty* course highlights the place, role, and tasks of ecology specialists in solving the development problems faced by society. The course discusses today's environmental problems and ways to solve them. Students have to realize that no solution to these problems can be found in isolation from general problems of development, as stated by a major principle of SD. Also, the United Nations Conference on Environment and Development (Rio-92) and the most significant events since Rio de Janeiro till Johannesburg (2002) and onwards are overviewed.

Teaching the *Ecology, Civilization, Culture and Self-Organization of Nature-Society Systems*, as well as the *Ecological Crisis: Current Problems* courses related directly to SD makes students prepared for the *Sustainable Development and Environmental Policy and Politics* course. The *Ecology, Civilization, Culture* and the *Self-Organization of Nature-Society Systems* courses concentrate on the main stages of development of civilization, interrelations of key processes and concepts, and major laws governing the development of nature-society systems. They emphasize generating and maintaining sustainable regimes in functioning of nature-society systems.

The *Ecological Crisis: Current Problems* course concentrates on the crisis phases of development and factors responsible for crises and accidents; it analyzes how to prevent and overcome crises. This course considers interrelationships of environmental and other global problems faced by

mankind, identifies possible ways of development of civilization, and introduces the concept of SD as one of the pathways of development.

Next goes a special course *Sustainable Development and Environmental Policy and Politics* which extends over the third year and considers the following matters:

- the crisis of modern civilization and search for ways to change the quality of nature and society development; the urgent need in and importance of transition to SD globally, regionally, nationally, and locally;
- shaping the sustainability concept;
- the United Nations Conference on Environment and Development (Rio de Janeiro, 1992) and its principal documents, the Rio Declaration on Environment and Development and the Global Agenda-21: Program of Action for Sustainable Development from Rio;
- formulating the SD term; SD principles; synthesis of environmental, economic, and social aspects of development; life quality improvement as the overall goal of the development of society;
- environmental policy and politics; changing views of environmental problems and ways of solving them; ecologization of all key activities and sectors of society; global, regional and national environmental policy and politics;
- transition to sustainable development on the global, regional, and local levels; major declarations in Europe; Baltic Agenda-21;
- Local Agenda-21: analysis of practices and methodical approaches;
- implementation of SD principles in major sectors of societal development (industry, power engineering, transport, agriculture, forestry, tourism, spatial planning, etc.);
- tools for managing sustainable development; decision-making methods; major actors; adequate information support to decisions-making;
- monitoring of transition to SD; SD criteria and indicators;
- conditions and preconditions for transition to SD; building civil society; changing the paradigm of thinking and activity; generating new outlook and environmental ethics; transforming the demand structure;
- transition to SD in the Russian Federation and its North-West region; borrowing from foreign experience and national specifics; achievements and difficulties in moving toward SD.

The *Agenda-21* elective course is an extension to the *Sustainable Development and Environmental Policy and Politics* course. It aims at practical learning of techniques and methodical approaches to development of a local Agenda-21. The course identifies the main steps and tasks of Local Agenda-21 developers in each stage of elaboration and implementation of long-term action plans on transition to SD, exemplified by specific cities and their programs of transition to SD.

Disciplines dedicated to SD and Agenda-21 are underlain by a rapidly developing subject area abundant in meaningful information and events. This implies summarizing the world and regional experience, analyzing successes and achievements, revealing difficulties and barriers in transition to SD, and improving the ways to study and disseminate best practices. This, in turn, means permanently bringing new content to existing courses.

Teaching this cycle of disciplines requires a special approach in which theoretical matters are not only understood but also comprehended; on this basis students develop their outlooks and personal attitudes. Without being convinced and deeply “involved” in the SD philosophy and ethics they cannot be conductors of these ideas in life.

Active personal attitudes of students are promoted through the use of interactive methods, such as business games, training, role games, and “brain storms”. Students are active in preparing and conducting classes: they seek information about the latest achievements in the SD and Local Agenda-21 spheres and make presentations on relevant subjects and latest events.

Sustainability ideas in education and research activities of students

Sustainability issues are among the subjects of undergraduate and graduate theses in ecology; up to 20 % of students at the Department choose these matters for their research and diploma works. Two graduates are proceeding with the initiated researches on SD issues in the framework of their post-graduate study at the Department.

Final-year students and graduates of the Department have an opportunity to participate in training programs suggested by foreign universities, in particular, those of Finland, Holland, and the USA.

Students and post-graduate students of the Department take an active part in and make presentations at international, Russian, and regional conferences and seminars on SD topics.

Graduates of the Department keep certain positions in various bodies within St. Petersburg Administration, involved with spatial planning, power engineering, transport, and socioeconomic development. They actively influence the incorporation of SD principles into strategic planning for SPb.

Along with training programs for students, the Department elaborates education programs for environmental practitioners. Based on its Curriculum, the Department devised a second higher education program. In this framework, thirty individuals (mainly Principal Ecologists of district administrations and school teachers) have got degrees in ecology, certified by state diplomas.

The program for training ecology experts able to adequately participate in efforts to achieve the goals of SD, needs further improvement. This implies more extensive use of interactive methods and increased attention to generation of environmental awareness and outlook of students, ecological ethics, civil responsibility, as well as to ecologization of behaviors and life styles, enlarged humanitarian component in special disciplines, and a stronger focus on synthesis of social, ecological, and economic aspects in solving the problems of the environment and development.

To be successful, ESD requires, i.a., an interdisciplinary field of communication, practical interaction, and implementation of joint initiatives and projects for experts in various fields, involved in elaborating and teaching various ESD aspects. The space for such interaction was provided by the Center for Cooperation in Sustainable Development and Environmental Management, established at SPSU.

- Creating and teaching the new philosophy of development, based on the concept of SD, which we consider essential for all university students. Such lecture courses would promote the new consciousness and world view for future specialists and citizens of the XXI century.
- Integrating SD principles into the training of specialists in various fields for the relevant sectors of society (e.g., sustainable mobility, energy, spatial planning, etc.).
- Devising special interdisciplinary (interfaculty) educational programs for the training of specialists in SD. A new type of specialists able of holistic, strategic thinking and taking systems intersectoral decisions is needed for the development and implementation of long-term action plans on and management of transition to SD.

The article discusses the practical experience of St. Petersburg State University (SPSU) in:

1. implementing educational programs and curricula, based on SD ideas and principles, oriented on ecologists with various specializations (for ten years);
2. modifying the functions and roles of the main actors of educational process, thereby changing the traditional views of its methods, tools, and technologies;
3. engaging informal education like debate clubs, public associations and organizations, project activities, and participation of business and administration in the Local Agenda-21 process.

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Center for Cooperation in Sustainable Development and Environmental Management between the Saint-Petersburg State University and Beahrs Environmental Leadership Program, University of California, Berkeley

The Center for Cooperation in SD and environmental management (EM) between two universities, the SPSU and the University of California, Berkeley (UCB), offers a space for interdisciplinary and interfaculty interaction, as mentioned above. Teachers and experts from 13 faculties, who are professionally engaged in the environmental protection and SD sphere, represent the SPSU in this Center. The partner from the UCB is the Beahrs Environmental Leadership Program of the College of Natural Resources, University of California, Berkeley (USA).

Center for Cooperation in Sustainable Development and Environmental Management: Mission and Goals.

The Center for Cooperation in SD and EM provides the link between scientists, managers, and leaders to ensure sustainable solutions to environmental problems.

The mission of the Center for Cooperation is to provide decision makers in Russia and the CIS with access to quality training and up-to-date information on critical environmental problems and best practices. This will raise the awareness and improve environmental management and policy, thus reducing the risk to resources and population.

The Center for Cooperation in SD and EM is a center of excellence that works to

1. create a university network to organize interdisciplinary SD and EM training in the region;
2. develop SD and EM courses using state-of-the-art interactive methods and case study approaches;
3. adapt best practices from other regions to environmental needs and conditions of Russia and CIS countries;
4. prepare future environmental professionals and leaders to tackle complex 21st century environmental challenges in the region.

The Center disseminates the methods and approaches of the Beahrs Environmental Leadership Program and other leading scientific and world educational schools to Russian and CIS environmental professionals and faculty. In particular, this concerns the experience with interdisciplinary training, leadership skills-building, and participatory, interactive teaching methods.

The main target groups for the Center are lecturers, students, municipalities, NGOs and schoolchildren. Educators, researchers, postgraduate students, and students of SPSU take part in the activities of the Center for Cooperation on SD and EM. Educational programs for SD implemented in the frames of the Center integrate various sectors, including: science, business, local governments, mass media, high schools, NGOs.

There are teacher's and youth sections in the Center for Cooperation.

The main cooperation activities of the Center include:

- Education: development of master program on SD and EM, development and implementation of the programs for additional professional training
- Exchange programs
- Permanent interdisciplinary seminar
- Interdisciplinary researches
- Projects

The experience with the Center of Cooperation since its foundation (2003) till 2006 was discussed in an article in *Innovative Approaches in Education for Sustainable Development in Saint-Petersburg State University* article (Chernikova, 2006). Here, we discuss the experience developed in 2006-2007.

Education: Innovative approaches in ESD

Innovative methods in ESD received further development at the *Innovative Approaches in Education for Sustainable Development* international expert meeting (September 25-27, 2006). The Meeting was focused on preparation of a draft *Sustainable Development and Environmental Management* master program in compliance with the Bologna requirements and those set by the 3rd generation Federal State Educational Standards of Higher Professional Education (FSES HPE).

The agenda of the Meeting comprised the following items:

- Develop a Competence model for Sustainable Development and Environmental Management master program graduates
- Analyze the draft Curriculum; reveal missing elements
- Design Curriculum based on the Competence model
- Identify pre-conditions to successful implementation of educational program
- Produce recommendations for improvement of the Sustainable Development and Environmental Management master program in the future.

The Meeting gathered teachers, staff, and students from the SPSU, as well as people from high schools of Russia and Belarus, administration, and public organizations, who represented the interests of employers of the future master program graduates.

Along with discussing the innovative approaches and interactive methods, the Meeting participants gained a practical experience of assuming new roles and functions in the educational process through interactive methods: role games, brain storms, small groups, etc. This being so, the Meeting was a tool of improving the qualifications of teachers and staff.

The Meeting itself was an illustrative example of how efficient the innovative methods can be in obtaining high-quality educational products.

The Seminar identified the following main competences of the master program graduates:

- Interdisciplinary, systems, holistic strategic thinking and taking systems intersectoral decisions
- Problem solving capacity for complex problems in an uncertain context
- Critical reflection about the graduate's own competencies and results and transfer to adequate solutions
- Being able to communicate about the graduate's own research and solutions to problems with specialists and non-specialists
- Skills and ability for coordination of a team and for good leadership
- Creativity and original thinking leading to insight and knowledge development
- Capacity for innovative thinking

Results:

The Meeting participants asserted that innovative interactive methods were helpful in preparation of the draft *Sustainable Development and Environmental Management* master program during the Meeting.

They emphasized the need in special training programs for high school teachers to be able to efficiently incorporate innovative methods into current and future educational programs.

In March 2007, the Academic Council of the Faculty of Geography/Geoecology approved the *Sustainable Development and Environmental Management* master program to be implemented since 2008.

Development and implementation of programs for additional professional training

Through networking, the Center of Cooperation developed and initiated approbation of the *Innovative Methods in the Work of High School Teachers* short-term advanced training program. As already mentioned, the *Innovative Approaches in Education for Sustainable Development* expert meeting emphasized an urgent need in such program.

Leading experts from the SPSU and the Center of Cooperation, as well as teaching staff from the Geography/Geoecology Faculty, took part in the elaboration and discussion of the program.

What the program aims at is that high school teachers:

- be aware of basic principles of education in the context of the Bologna Process and the 3rd generation FSES HPE; compare the educational systems worldwide;
- acquire knowledge and skills needed for integrating innovative methods into high school practice;
- get acquainted with up-to-date techniques to organize the educational process around the competence model of high school graduates; generate skills needed for devising a competence model;
- be guided by methodical recommendations (to be developed in the framework of the program) related to educational process reforming to satisfy the teaching staff requirements of FSES HPE.

Results:

The opinions expressed by Seminar participants can be summarized as follows. The Seminar discussed the urgently needed modern high school reforms (the Bologna Process, Competence approach, credit-modular system, state-of-the-art in students' independent work, etc.). In a brief period, the participants learned about many tendencies in higher professional education. A fairly busy work schedule was not an obstacle to high productivity of the Seminar work in all three days. This is due to excellent choice of methods for presentation of materials and pedagogic techniques by Seminar organizers (interactive methods; brain-storming and role games; discussion and formulation of creative decisions in small groups etc., followed by presentation and discussion of the results).

Such seminars provide an active space to achieve mutual understanding and interaction among teachers and Heads of different departments and faculties, experts from different professional fields, and individuals having different life, teaching, and educational experiences».

Exchange programs

Supported by the Kettering Foundation, the Center of Cooperation initiated a new line of cooperation with the aim to study the Civil forum method. In April 2007, this method was introduced to lecturers, scientists, practitioners, and students at the permanent interdisciplinary seminar by Igor Nagdasev, Director of Civil Education Center, and Ekaterina Luk'yanova, Representative of the Center of Cooperation (now participating in a training program at the Kettering Foundation in Dayton, Ohio, USA).

Results:

The seminar participants expressed the opinion that the Civil forum technique is promising for the Center of Cooperation in discussing the problems of transition to SD with communities. Supported

by the Kettering Foundation, the Center will send its participants from three faculties to study the Civil forum organization experience at the Deliberate Democracy Workshop, meeting of individuals from a number of countries who are deeply involved in work with communities (July, 2007). The interest in the Civil forum method was also expressed by the Youth section of the Center of Cooperation, LATeam student's organization. This method will be studied in more detail during the summer ecological school to be held in the framework of the *Valaam Island is Our Common Home* project (see *Projects* below).

Projects

Since 2006, the Center of Cooperation has extended interaction with the Republic of Karelia to assist the Valaam Island in solving its development problems.

The Valaam Island is a pearl of Russia, a holy place famous for its Savoir Transfiguration Monastery founded in the first half of the X century. Every year thousands of pilgrims come to Valaam from all over Russia and abroad to venerate this Russia's sacred possession. Situated in the northern part of the Lake Ladoga in the Republic of Karelia, 22 km away from the mainland, the island has about 250 inhabitants. The Valaam Island is registered with the Sortavala Urban Settlement Municipality.

In 2006, experts of the Center of Cooperation organized seminars on the Valaam Island to discuss the pressing issues of its development, among which the following were prioritized:

- interaction and cooperation among organizations of Valaam (island) and the Municipality (mainland),
- young people's adaptation to life on mainland during their high-school time;
- environmental problems (waste; water contamination),
- electricity supply failures,
- local business development, etc.

An initiative group comprised of people from the Pensioners' Council and other public organizations of the island, as well as from its businesses, school, kindergarten, nature park, timber enterprise, church and archeological museum, and monastery, identified at these seminars they urgently needed activities to promote the transition to SD. These include the construction of a play and sports ground for children; establishing a pottery training center for children and young people of the island to study traditional crafts and develop their creative abilities; development of ecotourism; public services and waste disposal; energy supply; and a School of Leadership for SD. These undertakings will be promoted in the framework of the *Valaam Island is Our Common Home* project developed by the island inhabitant in collaboration with the Municipality and the Center of Cooperation. Supported by the Fund for Sustainable Development and The United States Agency for International Development (USAID), the project started in May, 2007.

The Project participants from the Center of Cooperation are SPSU teachers and Center experts from cities of Korolev (Moscow Oblast), Novomoskovsk (Tula Oblast) and other towns and cities of Russia, as well as One's Own Business Club (a partner organization of businessmen from Russian Federation regions), and the Youth section of the Center of Cooperation, LATeam.

We consider this experience important for incorporating modern innovative approaches into regulation of regional development based on SD principles via engaging the university potential; initiating intersectoral cooperation and integrating new organizational institutes with a view to regions' transition to SD; and providing the Island inhabitants, students, and young people with opportunity to gain experience in the implementation of SD ideas and development of key competences.

Results:

Even in the project development stage, the Valaam Island enjoyed substantial benefits. These include the initiated dialogue among all relevant actors and consolidation of citizens and municipality; increased trust, having organizations united around socially significant projects, and more active social life; enhanced tolerance, cooperation, and mutual understanding as pre-conditions to less intense societal strains and conflicts and motivation for cooperation among various sectors and ages in mixed groups. All this is imperative for the transition to SD.

The youth section

The Youth Section of the Center for Cooperation is the space for students, postgraduate students, and educators to cooperate with the partner NGO's, municipalities, and research organizations on preparation and implementation of a nonformal literacy training program for young people, schoolchildren, and the population (with parents and families involved through interaction with schoolchildren).

In 2006, the Youth section initiated a new activity, cooperation with the Lomonosov Raion of the Leningrad Oblast. This agricultural raion urgently needs highly-qualified personnel, as well as innovative ideas and projects, to solve its social, economic, and environmental problems. The Department of Extra-Curriculum Work of SPSU initiated establishing a students' testing plot on the basis of the Raion Administration. In its framework, 7 students and master students examined the problems and needs of the raion and suggested the following research and project activities:

- Normative documentation: analyze household waste disposal and surface water contamination regulations.
- System of sustainable development indicators: test the suitability of the SPb system for the Lomonosov raion.
- Self-government in schools: propose a body to take the responsibility for economic, ecological, and other initiatives undertaken by schoolchildren and educational institutions in schools and settlements.
- Education for SD: propose educational games and events to spread healthy lifestyles and careful attitude to resources among schoolchildren.
- Tourism: propose routes, as well as popularization ways for sites possessing unique architectural heritage.

Many of these projects were integrated into students' undergraduate theses for assisting the raion on a voluntary basis. Students' supervisors provided consultancy and assistance in the development of the projects.

To facilitate implementation of the project work, a special training event was organized by the Department of Extra-Curricular Work of SPSU for students to acquire the project management skills.

Results:

Students have gained an experience of performing real-life tasks in local circumstances of an agricultural raion and acquired the skills they need to apply within specific regional contexts the problem-solving knowledge, skills, and competences they acquired. Schools and Administration of the Lomonosov raion have enriched their activities with up-to-date approaches to solving the problems of transition to SD.

Conclusion

The transition to SD requires ecologization of all activities and implementation of SD principles in all key sectors of society. Universities are engaged in training specialists of different profiles for these sectors, which makes reasonable incorporation of SD and environmental safety course(s) in all

faculties. These courses should focus on generating the outlook of future specialists and citizens of the 21st century, taking into account their professional orientation.

Preparation and implementation of long-term action plans on transition to SD (national, regional, and local Agenda-21) and management of this process require new type of specialists capable of broad strategic thinking and taking systems intersectoral decisions. Devising interdisciplinary (interfaculty) education programs with the focus on training such specialists in the SD sphere is an urgent problem faced by universities.

The ESD should be organized in such a way that the trainees be encouraged to realize the sustainable development principles and change their world vision, value system, and behavior, i.e., to actively promote SD ideas.

To reach these goals, society needs to develop a new culture of educational process, which implies:

- achieving the holistic interdisciplinary thinking
- organizing mixed training groups
- providing new functions and roles of main actors in the educational process
- modifying the organization of educational institutions
- widely applying innovative educational technologies and training methods.

Innovative methods of education provide students both with new professional knowledge and skills and an opportunity for active participation and raising the awareness of sustainability.

The development and effective integration of innovative educational approaches in St. Petersburg State University is achieved via new institutional structures and interdisciplinary scientific-educational associations and centers.

Implementation of projects enables the intersectoral cooperation and dissemination of information on the principles and experience of integration of SD ideas, as well as raising the awareness and more active involvement of various stakeholders in realization of SD ideas. The project activities enable problemsolving in the social, ecological, and economic aspects of development in specific local situations.

References

Chernikova S.A. (2005), "Influence of Teaching Methods on the Efficiency of Education for Sustainable Development", in *Sustainable Development and Environmental Management*, Troyan, V.N. and Dement'ev, I.A., issue 1, Proceedings of International Conference, St. Petersburg State University, VVM, St. Petersburg, pp. 104-112.

Chernikova S.A. (2006), "Innovative approaches in education for sustainable development in Saint-Petersburg State University", LEAL FILHO, W., Wals, A. van der Bour, W. (eds) (2000) *Integrating Concepts of Sustainability in Education for Agriculture and Sustainable Development*. ISBN 3-631-36425-3. Peter Lang Scientific Publishers, Frankfurt.

Dmitriev, V.V. and Voropaeva, G.M. (2003), "Sustainable Development Idea in the Program for Training Specialists in Ecology at the Department of Environmental Safety and Sustainable Regional Development", in Kasimov, N.S. and Tikunov, V.S. (Eds.), *Education for Sustainable Development: Proceedings of the "Education for Sustainable Development" Russian Workshop*, Madzhenta, Smolensk, pp. 60-72.

Voropaeva G.M. Sustainable development ideas in the program of training of experts in ecology at the Department of Environmental Safety and Regional Sustainable Development. Role of Saint Petersburg high school in implementation of the sustainable development concept. Ed. by Brodskii, A.K., SPb, 2003, pp. 11-18, 176 pp.

The Contribution of Forest Cadastre's Teaching in the Development of Environmental Conscience

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Abstract

This work refers to the investigation of Forestry students' opinion with respect to how much the teaching of Forest Cadastre develops environmental conscience. The research was carried out in the School of Forestry and Natural Environment of the Aristotle University of Thessaloniki and in the Department of Forestry and Management of the Environment and Natural Resources of the Democritus University of Thrace in N. Orestiada. Data were collected by heads of selected students of the above-mentioned schools through personal interviews and by using a questionnaire.

Both male and female have the same participation percentage in the research. Their participation in the course reveal no positive predisposed persons towards environmental protection issues, along with meetings' and seminars' attendance relating to environmental education. Furthermore, in accordance with their evaluation the course met their expectations concerning the organization, course's content and accompanying activities of the teaching. Pupils gain excellent impression and participate with great enthusiasm from the teaching process according to their answers.

Keywords:

Environmental conscience, Forest Cadastre, natural environment.

Introduction

The moto of a viable development is without any doubt one of the most popular in our age. Having respect for the environment is a criterion in many countries as to its development. As the zoologist

Matt Ridley said “Supporting environmental pollution today is considered as bad as Devil worshipping in the 13th century”.

It makes one wonder whether the belief of showing indifference towards environmental issues and overexploitation of natural resources is a new trend that used to exist in the past as well.

Recent research on prehistoric periods has shown that ecological disasters have been an integral part of man’s evolutionary course. Floods and droughts were anomalies that occurred in the past as well. But the frequency, range and size of these natural disasters have increased dramatically thus led to economic disasters as well. Adding thoughtless industrial growth without any planning at all for the last decades has given a final shot to the natural environment, already burdened by an industrial revolution which started two centuries ago. However, the quality and quantity of human intervention in the second half of the 20th century have been decisive for a permanent wide range disjunction in the environment, but also creating the idea of “environmental conscience”.

With the term “environmental conscience” we try to explain the configuration of a human behavior that will respect and protect nature and have as main goal the development of a man-based ecological conscience.

It is considered today, based on an abundance of data, that those situations and experiences concerning the environment at a pre-school and elementary school age influence the future behavior of any individual as an adult considerably. It is, therefore, considered that the acquisition of many and mostly pleasant personal direct experiences with plants and flora could lead to respecting nature and could contribute positively in the creation of an environmental conscience. That is to say in man’s ability to recognize the need of coexisting harmoniously with the natural environment, as well as the need to respect every life form on the planet. The presence of natural green zones has a positive effect on people in many ways: psychologically, spiritually, culturally, and also in his labor as well as physically (from a health point of view)

The main reason for the current situation and impasse that has been created is the lack of an essential build-up and environmental policy, as well as correct urban planning based on the protection of the environment.

Social concerns and reactions and active attendance of everyone interested, that is to say all the citizens, constitute necessary conditions and are levers of pressure. Without these levers it is impossible to make a correct environmental and political planning to protect nature. Specific knowledge in combination with technical and scientific training in order to deal with such issues is also vitally important. This fact has made us realize the imminent need to lay down and update the Cadastre for Greece, since it is the only country in the European Union without one, and along with Albania the only countries in the European Continent without one. Part of the National Cadastre is the Forest Cadastre. The continuous briefing with precise facts for the Cadastre can only be made by using methods of utility for environmental issues and also of the technology used to protect the environment to come. If the results of this project are taken seriously into consideration, then the quality of the generations to come will be affected in a positive manner.

All states worldwide have spent time by approaching cadastre from an economic and budgetary point of view. One cannot comprehend any sort of economic growth of a country without a proper land planning policy, distribution of land according to its different uses, proper investigation of the full potential and exploitation of natural resources, and finally, without having any means of control over trespassers of public property (Drosos, 2000).

If we want to give a modern definition of the word of Cadastre, we could use the one given by Doukas (2004); Cadastre is a public and detailed census of land, which the location limits, value and legal status as well as any liable information is given about every property. This information in form can be used for the exercise of rational policy and for administrative, economic, technical and developmental activities of the state.

The need for having a Cadastre presented itself ever since private ownership emerged, that is to say from the first stages of dissolution of private communities. The Cadastre as a means of given

information and a background of any state policy, accompanies the majority of modern societies (Papastavrou, 1986).

Historical testimonies and facts have proven that it has been applied as a rudimentary institution for the last 6000 years. With the passing of time each state has supplemented it with more elements, according to its needs and level of culture.

As mentioned above, the Cadastre can fully observe the diachronic phenomenon of the devalorization of the natural environment, since it is a dynamic recording system of land. As it appears, this phenomenon in Greece follows the same direction as many other developing countries around the world.

The rapid devalorization of the natural environment sets the most possible situation to the generations to come that will eventually lead to the total destruction of Greece's natural resources. It is obvious that fresher air with a smaller amount of ozone in its composition is needed by trees and people alike. Wherever forest areas are left to die on purpose or without it one can see an increase in respiratory illnesses.

Greece is not only the cradle of western civilization and philosophy. It is also the land of mythology and physical sciences.

The philosopher Aristotle (383-323 B.C.) was the first to make detailed recordings of natural phenomena as well as any known living creature and was also the first to report the first major physical or environmental disasters.

His complaints about the extended deforestation of Attica 2300 years ago can only be described as impressive. He also made the assumption that this was the cause for many disasters and land slider.

Any actions taken in favor or against the forest are going to have an effect for our Homeland and for our grand-children and great grand-children. It takes one hundred years for a coniferous tree to grow before it is ripe for being out. It takes 250 years for an oak. The mistakes which we are making now with our frivolous and poorly planned actions will not be able to be restored. The reforestation of burnt neglected trespassed areas is moving at an alarmingly slow rate (reforestation 10-20%).

The tendency for large-scale deforestation occurring in our country is particularly threatening in the last few years. If this is added to the lack of any environmental education – and conscience- then we have a very gloomy picture of the future.

The course of forest cadastre has a main goal, to develop a dynamic, which in cooperation with other courses taught in the Department of Forestry and Management of the Environment and Natural Resources, will become a basic tool for developing an environmental conscience, always using scientific, but still simple and decisive ways.

The aim of this paper is to highlight the importance of teaching Forest Cadastre as a methodological tool in the stages and phases of developing a program for Environmental Education, serving the aims and objectives in order to create citizens capable of participating actively in the sustainable development of the state.

Methodology

The research was carried out with the application of personal interviews via questionnaires. An interview is the best way for statistical data collection (Kiohos, 1993). The students of the School of Forestry and Natural Environment of the Aristotelian University of Thessaloniki and the students of the Department of Forestry and Management of Environment and Natural Resources of the Democritus University of Thrace in N. Orestiada formed the research sample. The applied sampling method was simple random sampling, due to its simplicity and the fact that it requires less possible knowledge about the population, compared to any other method (Freese, 1984; Asteris, 1985; Matis, 1988; Damianos, 1999; Kalamatianos, 2000).

“Population” under investigation is the total of the students from the third year and above of the Department of Forestry and Management of Environment and Natural Resources of Democritus University of Thrace in N. Orestiada - because the course of Forest Cadastre is taught in the spring semester of the third year (6th semester) and by the School in Thessaloniki to all the students that choose this elective course. Simple random sampling presupposes the existence of a full catalogue (sampling frame) of the population data without deficiencies or reiterations (Filiats et al., 2000). The applied sampling frame was the students’ list of course, because 100% of the students are included in them.

The students’ list use forms, a classic case for using a group of people instead of persons, as a sampling unit. This happens because in some cases it is more convenient and less expensive (Matis, 1988). The process for the member (student) selection (from the lists - random selected sample) was, therefore, organized this way in order not to always select the same member (Filiats et al., 2000).

The estimation of the population’s proportion which is also the objective estimation of the real population proportion p , is rendered from the formula relation:

$$\bar{p} = \frac{\sum_{i=1}^n p_i}{n}$$

The typical error of the population s_p proportion estimation, without the finite population correction, due to the fact that both the sampling fraction and the confidence interval are small, is rendered from given formulas relations:

$$s_p = \sqrt{\frac{\bar{p} \times (1 - \bar{p})}{n - 1}} \qquad p = \bar{p} \pm t \times s_p$$

where $t =$ is the rate of STUDENT’s distribution for the probability $(1-\alpha) = 95\%$ and $n-1$ degrees of freedom.

Household use forms a classic case for using a group of people instead of persons as a sampling unit. This happens because in some cases it is more convenient and less expensive (Matis, 1988). The procedure for the member selection (from the random selected household) was therefore organized this way in order not to select always the same member (Filiats et al., 2000).

The size of the sample was estimated using formulas of simple random sampling (Freese, 1984; Matis, 1989; Kalamatianos, 2000). Even if simple random sampling without replacement was used, the finite population correction can be ignored because the size of sample n is small concerning the size of population N (Freese, 1984; Pagano and Gauvreau, 1996). In order to calculate the size of sample, a pilot sampling in a sample of 50 individuals was held, for both the School of A.U.TH. and the Department of D.U.TH.

Because variables refer to proportions, the determination of the total size of the sample is given from the following formula:

$$n = \frac{t^2 \times \bar{p} \times (1 - \bar{p})}{e^2} = \frac{1,96^2 \times 0,5 \times (1 - 0,5)}{0,05^2} = 384,16$$

where $t =$ is the rate of STUDENT’s distribution for the probability $(1-\alpha) = 95\%$ and $n-1$ degrees of freedom. Because the sample’s size is big (n is bigger than 50) rate t is taken from the probability tables of normal distribution for the desired probability. In fact for the 95% probability rate t is 1,96 (Matis, 1988).

p = proportion estimation.

e = maximum acceptable difference between sampling medium and unknown population medium. We accept that it is 0,05% namely 5%.

In order to estimate the sample's size we had to carry out a pilot sampling, using a sample size of 50 people. Thereby for every variable the actual population proportion was estimated on the basis of the calculated sample's size for each one of those.

The sample's persons are then traced precisely (that is full name and registration number) with the aid of random numbers taken from tables of random numbers. To the selected persons personal interviews were carried out, separately for each one. If we did not find someone or he refused to give us an interview we made two more efforts to get his viewpoint. If this was impossible, then we continued, by the same procedure to the selection of new sampling units. The collection data was carried out in 2007 and for their analysis the Excel of Microsoft was applied.

Results

Analysis of Questionnaires

The following results were obtained from the analysis of the questionnaires:

- a) In the question that was placed to them whether they knew the meaning of environmental conscience, the results were 66% yes and 33% no. Those who did not know the meaning, asked to be informed about it and the areas that it affects and further more what goals it serves (Figure 1).

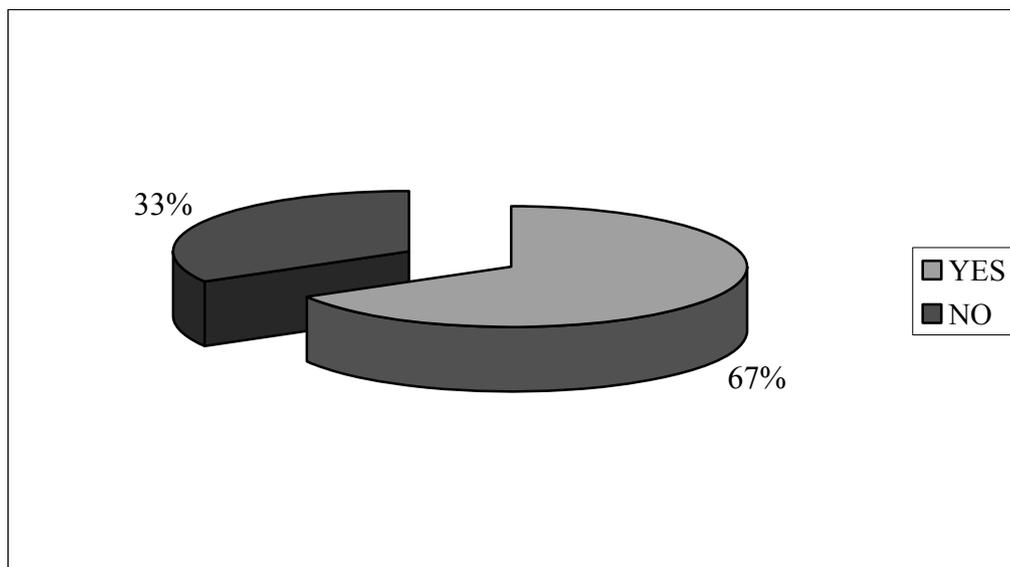


Figure 1.

- b) The question was then concluded by asking of whether they could render a definition of the term Environmental Conscience as close as they could. As one observed 78% could give a proper definition, or a similar one, contrary to the other 22% who could not define this term, or gave one with many inaccuracies (Figure 2).

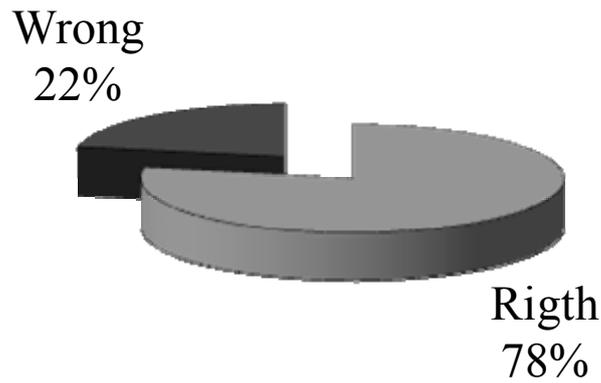


Figure 2.

- c) The following question was if the course of forest cadastre was covered in full by the contents of the lessons and the accompanying activities. The majority of the students said they were fully satisfied (Figure 3).

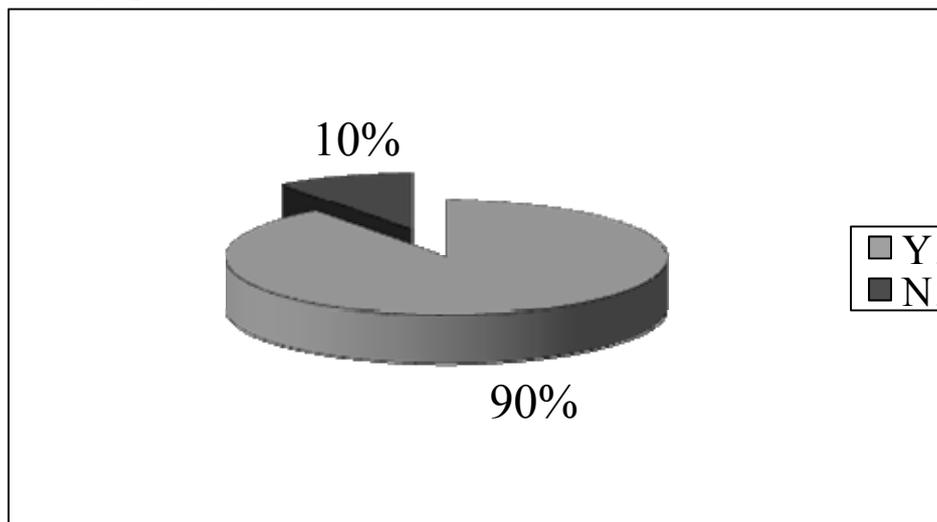


Figure 3.

- d) In the accompanying question following the one above, the students were asked what would make the course better. 98% answered that they would like more field exercises.
- e) When the students asked if the course of Forest Cadastre helped them to have a better comprehension of environmental issues, they all answered yes (Figure 4).

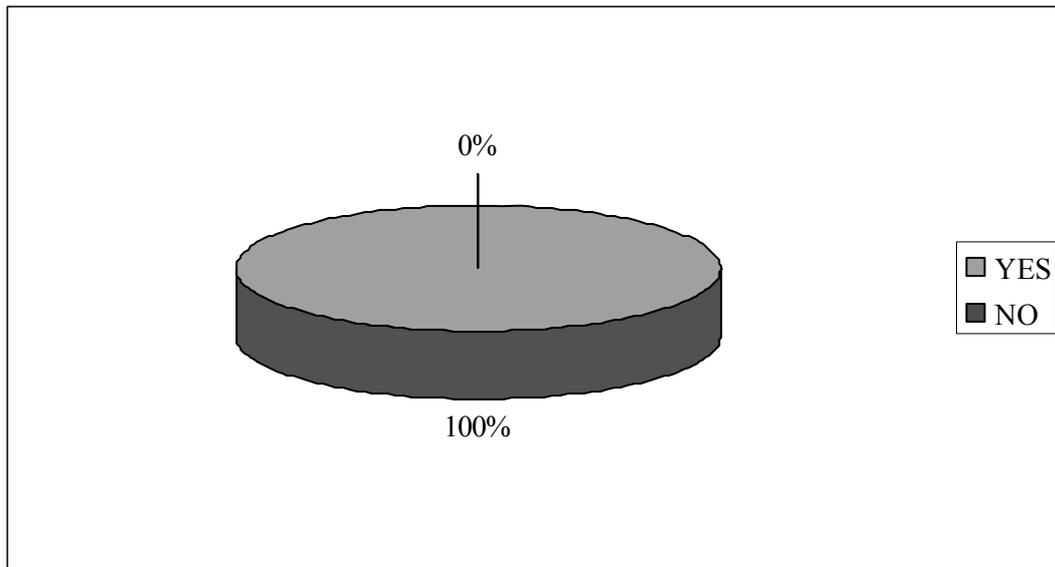


Figure 4.

- f) The next question was directed to choose who did not believe that Forest Cadastre could help them, and they were asked why. This question does not have a reason to exist, since all the students replied affirmatively in the previous question.
- g) Another question that was asked was to name the most important environmental issue. Here the students replied: a) illegal building, b) trespassing public forests and c) the degradation of environment with all the consequences in the mental and bodily health of citizens (Figure 5).

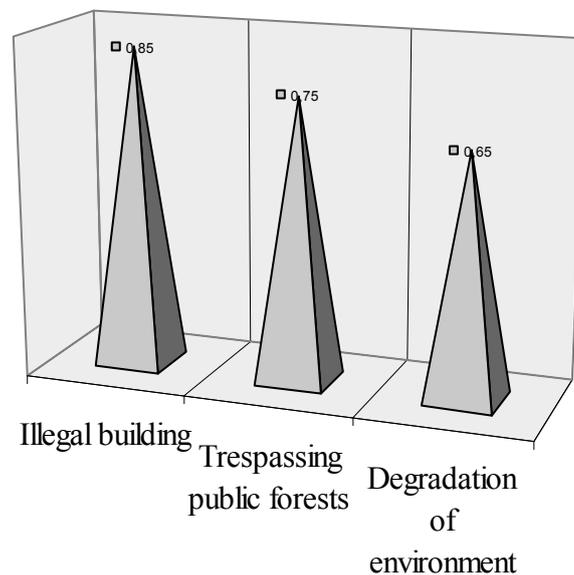


Figure 5.

- h) For the course of the problem on issues such as mentioned above, results have shown that 70%, that is to say the overwhelming majority of students believe that they will improve, a 20% believe that they will remain the same and the rest 10% that they will become worse (Figure 6).

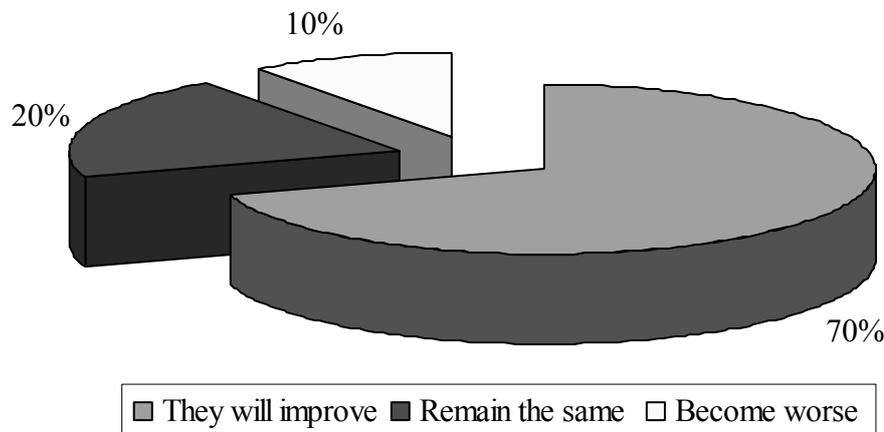


Figure 6.

Discussion-Conclusions

Both sexes have the same attendance in the research. Their attendance in the course does not predispose individuals to be positive on issues concerning the protection of the environment. Also, according to their evaluation the course reached their expectations and more specifically regarding the organization, the context of the program and the activities that accompany the program. The students, according to their tutor acquire from this an excellent impression and participate with great enthusiasm.

The students participate in an attractive and flexible way in the process of a project (in this case, an environmental issue or problem) and combine it with practical experience (provided that it exists), team work, sentimental contribution, and scientific search and observation, while being led towards a fertile method of understanding an issue-problem.

The ideal picture of perception of the environment, via the course of Forest Cadastre and the proposals for the confrontation of environmental problems, constitute a large number of “if” that make a conventional (virtual) reality that is based on life itself, its problems and its facts. This magical “If”, according to Stanislavski, is the stimulus for inner physical energy and attitudes towards life. The students learn to analyze problems and develop environmental conscience and responsibility. They also learn to interpret human behavior, situations and problems while at the same time they create their own proposals, behaviors and attitudes towards problems.

Students will be able to:

- a. predict change over time (both ‘natural’ and disturbed change) of resource, system, or environment in terms of its whole and parts.
- b. characterize a resource, environment, or system using appropriate technology.
- c. synthesize information into comprehensive solutions incorporating various perspectives.
- d. analyze the resource, environment, or system using appropriate technology.
- e. think logically, critically, and creatively – inductively, deductively, like a natural resource scientist, manager, engineer, and social scientist.

- f. describe issues verbally and in writing.
- g. think with a 'systems' perspective.
- h. think and behave like a reflective practitioner respecting all perspectives.

Students will be effective at:

- a. information literacy, i.e. locating, comprehending, organizing, characterizing credibility of, and legally/ethically used information.
- b. structured problem solving, i.e., solving "problems" comprehensively including problem definition, solution strategy development and application, and assessing validity and reliability.
- c. awareness of major natural resource issues and various perspectives of our global community.
- d. communication
- e. formally present ideas and information orally and in writing to a variety of audiences
- f. describe issues and opinions verbally and in writing.
- g. respectful of social interaction as individuals and within and among groups.
- h. computer literacy.
- i. managing and completing projects independently and as a team, and with an appreciation of time constraints.

Students will develop:

- a. a goal oriented approach to professional activities.
- b. an interdependent work ethic.
- c. positive, respectful and ethical attitudes.
- d. self-esteem and desire to push the limit of their ability.
- e. willingness to take responsibility.
- f. willingness to accept challenges and strive for success.
- g. understanding of the importance of innovative thinking and approaches in environmental issues.
- h. flexibility and adaptability.

A more realistic image of human nature that would recognize the fact that people try to maximize its usefulness, would have better results. In that case, of course, the target of ecological questioning would not be the awakening of an "environmental conscience", but the setting of rules, which on the one side would award any efforts made to save the environment and on the other side impose sanctions to the ones that impose any destruction.

The long-term experience gained from teaching Forest Cadastre and also the (limited) application of these programmes, due to political choices, the forest or generally the national cadastre or thematic Networks that were addressed to students and citizens of different social classes, as well as the recording of opinions of the groups above, reveal precious, interesting and also essential contribution, integration and exploitation of the forest cadastre (in a globally accepted scientific way) and particularly the techniques of forest cadastre as a methodological tool and means for the dynamic take-off of an environmental team, the success of a programme and at the same time the understanding and realisation of relations, interactions and environmental issues, contributing substantially towards responsible ecological behaviours in the direction of viable development.

Also, the teaching of Forest Cadastre contributes substantially to regulations and policies for:

Environmental impact assessment, town planning and land planning design, design and management of emergency situations, development and estimation of land ownership, support of taxation and demographic analysis and observing statistical data.

Finally, having a cadastre helps in the long run in a series of wider social objectives, such as: the increase of farming productivity, protection of the environment, sustainable development and social justice.

References

- Asteris, K. I., 1985. Forest Biometry. Volume One. Thessaloniki. Aristotle University of Thessaloniki.
- Damianos, X. X., 1999. Sampling Methodology: Techniques and Applications. Third Printing. Aethra Publications.
- Doukas, A.- K. G., 2004. Forest and Agricultural Cadastre. Giaxoudis Publications. Thessaloniki.
- Freese F., Translation – Editing Karteris M. A., 1984. Forest Sampling Data. Thessaloniki.
- Kalamatianos, A. G., 2000. Social Statistics, One-Dimensional Analysis' Methods. «The Economic» Publications. Athens.
- Kiohos, P. A., 1993. Statistics. “Interbooks” Publications. Athens.
- Matis, K. G., 1988. Forest Sampling. Thessaloniki.
- Matis, K. G., 1988. Forest Biometry. I. Statistic. Thessaloniki. Aristotle University of Thessaloniki Publications.
- Pagano, M. and Gauvreau, K., 2000. Principles of Biostatistics. Ellin Publications.
- Papastavrou, A. C., 1986. Forest Policy I. Thessaloniki. Aristotle University of Thessaloniki Publications.
- Philiass, B., Pappas, P., Antonopoulos, M., Zarnaris, O., Maganara, I., Meimaris, M., Nikolakopoulos, H., Papachristos, E., Perantzakis, I., Samson, E. and Psihogios, E., 2000. Introduction in the Methodology and Techniques of Social Researches, Gutenberg Social Library. Athens.

Sustainable development in social sciences: A case of public administration

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Abstract

In Lithuania, university courses related to sustainable development (SD) traditionally are offered by the faculties/departments of science and technology and much less by departments of social sciences. However, SD calls for a comprehensive change in the way society operates. In this context it is important to develop relevant competences of public servants, business representatives, pedagogues, journalists, etc. On the other hand, a particular course is not enough to provide a space for a wide spectrum of knowledge, skills and attitudes necessary to integrate SD principles into professional activities.

A master study program of Management and Administration for Sustainable Development at the Mykolas Romeris University was designed to meet challenges of the governance for SD in Lithuania, i.e. new-emerging tendencies in socio-economic development, cross-sectoral strategic planning, management of inter-institutional programmes, science-policy interaction, integrated communication and public participation methods, etc. A research for the clarification of competences needed for civil servants at various levels (state, municipal/local, and regional) to implement innovative SD principles was carried out.

The methodological findings in introducing public administration master study program as well as insights for the future are presented in the paper.

Keywords:

Governance, education for sustainable development, holistic approach, action competence.

Introduction

The national strategy for sustainable development in Lithuania was adopted by the Government in 2003. It mirrors the main provisions of *Agenda 21* (UN, 1992), *A European Union Strategy for Sustainable Development* (European Commission, 2002), as well as the national priorities.

Sustainable development (SD) is a meta-policy of particularly broad and cross-cutting scope. As a governmental choice, SD strategy is guiding the development of numerous more specific strategies. The main elements of national SD strategy, as defined by the OECD, are presented in Box 1 (Lafferty, W.M., 2004). Similarly, among the Policy Guiding Principles of the *Renewed EU Sustainable Development Strategy* (Council of the European Union, 2006), the policy integration, promotion and protection of fundamental human rights, open and democratic society, involvement of citizens, business and social partners are indicated. Education and training are considered as cross-cutting factors in developing competences needed for active participation in societal and professional activities, meeting challenges of a rapidly changing world, and life-long learning.

Since 2004, *Lithuanian Strategy for Sustainable Development* (The Government of the Republic of Lithuania, 2003) is included into the amended *Methodology of Strategic Planning* (The Government of the Republic of Lithuania, 2002, amended in 2004), as the long-term strategic planning document to be integrated in the sectoral strategies and lower-order programmes. The development of education and science represents an integral part of the *Lithuanian Strategy for Sustainable Development* aiming “to develop the intellectual potential of the society so that knowledge and science may become a principal force ensuring sustainable implementation of economic, social and environmental objectives”.

The exceptional role of SD as an overarching policy calls for changing of the ‘traditional’ governing mechanisms (including institutions, procedures, policy instruments, etc.) in order to carry out the new-emerging functions. Cross-cutting measures, such as research, education and training, in the context of SD are crucial for understanding the new trends and the driving factors in order to fill the gap between science, policy-making and implementation.

Public administration plays a key role in providing the policy and management basis for achieving SD objectives. Ambitious tasks thus require new competences of civil servants at various levels (state, municipal/local, and regional) to ensure policy coherence in implementing of innovative principles. Particularly, universities, as agents for change, should review the corresponding study programmes and competences of students to be developed taking into account a perspective of SD and its dynamic character.

In Lithuania, university courses related to SD usually are offered by the faculties/departments of science and technology and much less by departments of social sciences. However, SD calls for a comprehensive change in the way society operates. In this context it is important to develop relevant competences of civil servants, business representatives, pedagogues, journalists, etc. On the other hand, a particular course not always is enough to provide a space for a wide spectrum of knowledge, skills and attitudes necessary to integrate SD principles into professional activities.

The following findings in introducing master study program of Management and Administration for Sustainable Development at Mykolas Romeris University reflect methodological characteristics of the process rather than final results.

Box 1. Elements of a national sustainable development strategy

1. Integration of economic, social and environmental objectives and balance across sectors, territories and generations.
2. Broad participation and effective partnership.
3. Country ownership and commitment.
4. Developing capacity and enabling environment.
5. Focus on outcomes and means of implementation.

(Lafferty, W.M., 2004)

Governance for sustainable development in Lithuania

To analyze a situation in respect with the governance for SD is not an easy task due to the complexity of SD policy and related multiple administrative functions. One of the ways would be to select a specific sustainability-related problem which reflects the characteristic features of the wide-ranging issue. A successful opportunity to carry out a comprehensive analysis was the project “National Capacity Self-Assessment (NCSA) for Global Environmental Management” (Galkute, L. (Ed.), 2006a). It was executed by the Ministry of Environment in the period of 2004-2006 and implemented by the group of experts involving variety of governmental institutions as well as non-governmental organizations.

The above mentioned project belongs to a programme initiated by the Global Environment Facility in partnership with the United Nations Development Programme (UNDP) and United Nations Environment Programme (UNEP). Since 2001, more than 150 developing countries and economies in transition were engaged in the NCSA initiative using a common methodology for assessing current situation and planning capacity development measures (UNDP, 2005). The aim of the programme is to assist countries in defining capacity needs to implement 3 conventions (so-called *Rio Conventions*): UN Convention on Biological Diversity, UN Convention to Combat Desertification, and UN Framework Convention on Climate Change. If implemented effectively, these treaties will contribute significantly to achieving the goals of SD and conservation of the planet’s natural resources for future generations. It should be also noticed that requirements of *Rio Conventions* are in the list of priorities formulated in the *Lithuanian Strategy for Sustainable Development*.

The preconditions for the effective implementation of the conventions in Lithuania according to the NSCA methodology were assessed on systemic, institutional and individual levels. At the systemic level the overall policy, economic, regulatory, and accountability frameworks, institutional set up and financial resources available were evaluated. At the institutional level the attention was concentrated on structures, responsibilities, accountabilities and reporting lines, procedures as well as the cross-sectoral co-ordination, collaboration and information management. At the individual level demands for developing skills and professional knowledge were assessed. The following methods were used: desk study, questionnaires, case studies, workshops/mini-workshops, stakeholder consultations, and individual interviews.

Five interrelated problematic areas as estimated by the assessment are as follows (Galkute, L., 2006b):

- distribution of the convention requirements and their implementation measures into sectoral strategies without ensuring of systemic approach and an integrative monitoring;

- insufficient cross-sectoral (inter-institutional) co-ordination and co-operation not taking into account a mutual interdependence of *Rio Conventions*;
- applied scientific research is not sufficiently used in formulating strategy provisions and developing cross-sectoral programmes as well as in planning the implementation measures;
- lack of an attention to the topical problems of the inter-institutional planning and co-ordination as well as to the horizontal issues of SD within the in-service training system of civil servants;
- lack of consistent education and informing on SD issues, general public is not encouraged to take an active part in the discussion and implementation of SD provisions in their sphere of influence.

Capacity constraints, particularly related to the “sectoralisation” of policies and administration of programmes, have been recognised by the NCSA as a main obstacle to SD in many countries, not only in Lithuania.

From the point of view of public administration, in order to fulfil requirements of *Rio Conventions*, and objectives of SD in broader scope, new cross-sectoral strategic planning models must be developed and introduced; inter-connections among different public administration institutions should be established and improved; public involvement, co-operation with business and social partners as well as with scientific institutions should be strengthened.

At the individual level, the necessary action competence includes skills to: mobilize information and knowledge to identify problems (analytical skills); conceptualize, formulate and implement policies, legislations, strategies and programmes; monitor/evaluate the achievements and make reasonable adjustments in actions; involve public in decision-making and build consensus among all stakeholders; and provide information for general public.

The importance of the above mentioned skills was confirmed by interviews (56 respondents in total) with the officials directly involved in the implementation of the *Rio Conventions* at the Ministry of Agriculture, the Ministry of Economy, the Ministry of Environment, and the Ministry of Transport and Communications as well as their subordinate institutions and municipalities. In the interviews also was stressed the need of specific knowledge related with the *Rio Conventions* which is necessary for strategic planning and foresights in a corresponding area. The wish for more efficient collaboration with relevant research groups was expressed by majority of the respondents.

In the broader scope, it should be noticed, that the status of the inter-institutional programmes since 2004 is defined in the *Methodology of Strategic Planning* and there is a space for developing of cross-sectoral co-ordination patterns. In the *Strategy for Public Administration Development until 2010* (The Government of the Republic of Lithuania, 2004), there are objectives compatible with the governance for SD, i.e. to improve the strategic result-oriented management, to involve the community representatives in decision-making, and to ensure inter-institutional co-operation. Certainly, education and systemic in-service training of civil servants are recognized by the strategy as the most important factors.

On the other hand, among the more than 200 in-service training programmes for civil servants co-ordinated by the Civil Service Department at the Ministry of Interior, there are no programmes on the topics of SD policy and new-emerging tendencies in socio-economic development, cross-sectoral strategic planning, management of inter-institutional programmes, science-policy interaction, management of innovations, integrated communication and public participation methods, etc. The development of relevant learning modules in order to fill this gap should be considered by university departments of social sciences.

Exploring an innovative approach

A master study program of Management and Administration for Sustainable Development was designed to meet challenges of the governance for SD in Lithuania. It is oriented on the development of action competence as determined by the *UNECE Strategy for Education for Sustainable Development* (UNECE, 2005) and co-ordinated with the provisions of the Bologna process, particularly with the *Dublin descriptors for Master stage*, as presented in Box 2 (Bologna Working Group on Qualifications Framework, 2005), built on the following elements: knowledge and understanding; applying knowledge and understanding; making judgments; communication skills; and learning skills.

The learning outcomes in education for sustainable development (ESD) according to the *Indicators for Education for Sustainable Development* (UNECE, 2006) include:

- Systemic thinking, understanding complexity of problems and phenomena, an understanding of cross-sectoral and interdisciplinary interrelationships, a holistic approach.
- Future-oriented and creative thinking; problem-setting and identification of areas for research and innovation.
- Initiating and managing change; decision-making, including in situations of uncertainty; dealing with crises and risks.
- Participation in democratic decision making; negotiation and consensus building; identifying stakeholders and their interests and values.
- Collaboration and working in team; distributing responsibilities (subsidiarity).

The ESD competences fit well with the Dublin descriptors and reflect some specific features which are essential in implementing SD policy. In this respect the transformative function of education (Sterling, S., 2001) – to encourage change towards a fairer society and better world seems to be much important. The ESD competences also are in good correlation with the *Recommendation of the European Parliament and of the Council on Key Competences for Lifelong Learning* (Council of the European Union, 2005) and mark an advanced level in their development.

Lithuanian legal acts for higher education refer to a dual aim of the master studies. There are master studies that are oriented to develop in-depth research competences in preparing for career of a scientist as well as study programs oriented to enhance skills for developing and implementing innovations in particular professional area. The latter version was chosen in the case of Management and Administration for Sustainable Development.

After the investigation of courses and study programs related to SD of different European universities and relevant publications during the preparatory stage, it became clear that there is no common method for ESD in higher education. Nevertheless, there are some principles to be implemented, i.e. concentration on competences as learning outcomes combining knowledge, skills, attitudes and actions; emphasizing a transformative role of learning; creating ‘enabling environments’ for personal development of students and encouraging their involvement and self-directed initiatives in the learning process.

Study program of Management and Administration for Sustainable Development was introduced in 2006. It is targeted to practitioners who are working in public administration sector. It is delivered in a distance learning mode and consists of 60 credits (90 ECTS) including 23 credits allocated for research in the selected topic.

The key themes for SD as indicated in the *UNECE Strategy for Education for Sustainable Development* were chosen as a framework in defining contents of the modules within the program. They include: poverty alleviation, citizenship, peace, ethics, responsibility in local and global contexts, democracy and governance, justice, security, human rights, health, gender equity, cultural diversity, rural and urban development, economy, production and consumption patterns, corporate responsibility, environmental protection, natural resource management and biological and landscape diversity. Addressing such diverse themes in ESD requires a holistic approach.

The main topics are consolidated into 4 modules and supported by ‘cross-cutting’ modules such as strategic management, integrated communication, innovation and research policy as well as methodology for social research. Students also can choose between optional courses (environmental health, risk and disaster management, eco-industry, etc.)

In order to achieve the defined objectives teachers are looking for contemporary, real-life situations in various areas of development, encouraging students to investigate problems and solutions, finding ways to apply in practice the knowledge and skills obtained, considering various opinions and values.

In 2006 Mykolas Romeris University joined a project “Interdisciplinary Master in Sustainable Development” (DARNA) in co-operation with the Institute of Educational Studies at Kaunas Technological University and the Institute of Journalism at Vilnius University. A research for the clarification of competences needed for the corresponding professionals was carried out; some results related with public administration sector are presented below. Action research is envisioned as the main methodology of the program aiming to integrate action and reflection, so that the knowledge developed in the inquiry process is directly relevant to the issues being studied. Prior to the development/revision of the curricula and materials for 3 interrelated master study programs, a training of teachers on SD/ESD issues will be organized.

Box 2. Dublin descriptors for Master stage

1. Have knowledge and skills that provide a basis for originality in development and application of ideas often within a research context.
2. Be able to apply their knowledge solving problems in new or unfamiliar environments employing multidisciplinary knowledge.
3. Have the ability to integrate knowledge and handle complexity, make judgements with incomplete information – within boundaries of professional ethics.
4. Be able to communicate their conclusions and the knowledge clearly and unambiguously to both specialist and non-specialist audiences.
5. Be able to continue to study in a self-directed manner and autonomously.

(Bologna Working Group on Qualifications Framework, 2005)

Lessons learnt and future implications

Process of implementing a SD study program brings a valuable experience and, at the same time, a lot of questions and challenges for the future.

A questionnaire for students was developed in May 2007 to know their opinion regarding the first year of the master studies. The majority of students expressed their appreciation because the clear links between the theory and real-life situations/case studies in the most of the disciplines involved, and a possibility to choose the topic for master theses according their professional interests and problems to be solved at the workplace, in particular. The positive reaction by some employers was also mentioned emphasizing their expectations to use results of research and recommendations by students in improving performance of the institution. Sharing of experiences in peer groups and flexible consultations with teachers were mentioned as an advantage.

The group of lecturers implementing the SD master study program at the Mykolas Romeris University are representatives of different departments: Department of Political Sciences, Department of Environmental Policy and Management, Department of Economics, and Department of Strategic Management and leading practitioners. Although the program covers the main issues and approaches of SD, it seems to be more multidisciplinary, rather than interdisciplinary. To ensure a holistic approach in implementing the study program, teachers should collaborate more in developing a shared understanding on SD concepts and principles to be integrated in their courses, as well as to decide about the methodology in achieving learning outcomes of entire study program.

Taking into account that teaching methods are essential in competence-oriented studies, the importance of educational skills of university teachers should be particularly highlighted. They need to be equipped by effective teaching methods as well as instruments for the evaluation of the teaching/learning process. Another challenge is to implement methods for the assessment of students' achievements in correspondence with their competences under consideration. A series of specific workshops on interactive teaching methods are planned in Mykolas Romeris University in order to fill this gap. Seminars and round-table discussions on innovative practice of sustainable development at the local, national, regional and global level in order to stay up-to-date are also much desirable.

Certainly, for the further improvement of the study program not only self-evaluation but also investigation of a current situation in public institutions regarding sustainable development aspects and consultations with social partners are important. It was interesting to know what changes occurred during 3 years after the endorsement of *the Lithuanian Strategy for Sustainable Development*.

The survey was initiated by the Mykolas Romeris University to investigate an understanding of SD paradigm and the needs of related competencies in their professional work. The survey was carried out in co-operation with the public opinion and market research company "Spinter" in January-February 2007 within the above mentioned project DARNA of 3 universities.

Face-to-face standardized interview method was used for data collection when the interviewer directly communicates with the respondent in accordance with the prepared questionnaire. Three target groups were involved in the survey: 1) representatives of public administration; 2) teachers representing different levels of education; 3) journalists of broadcast media as well as of press and the Internet.

Quota sampling method according to type of institution and location criteria was used, so the tendencies obtained by the survey could be considered as representative. Among 300 respondents from public administration sector there were 26% representatives of the ministries, 36% representatives of municipalities and 38% from other public institutions. According to the location criteria, 47% of the respondents were from Vilnius (a capital city), 18% – from other 4 biggest cities, 35% – from provincial district centres.

It is important to underline, that SD came into professional agenda. Nearly 20% of the respondents indicated that they always take into account the principles of SD, sometimes – 50.3% of the respondents mostly representing ministries and municipalities. Figure 1 shows the main factors in motivating to attend trainings related with SD (3 answers were possible). The majority of civil servants claimed that the interest in training is determined by the expectation “staying up-to-date” within the processes in society, the next factors were “public interest” and “changes in national policy”, i.e. 37.0% and 30.7%, respectively.

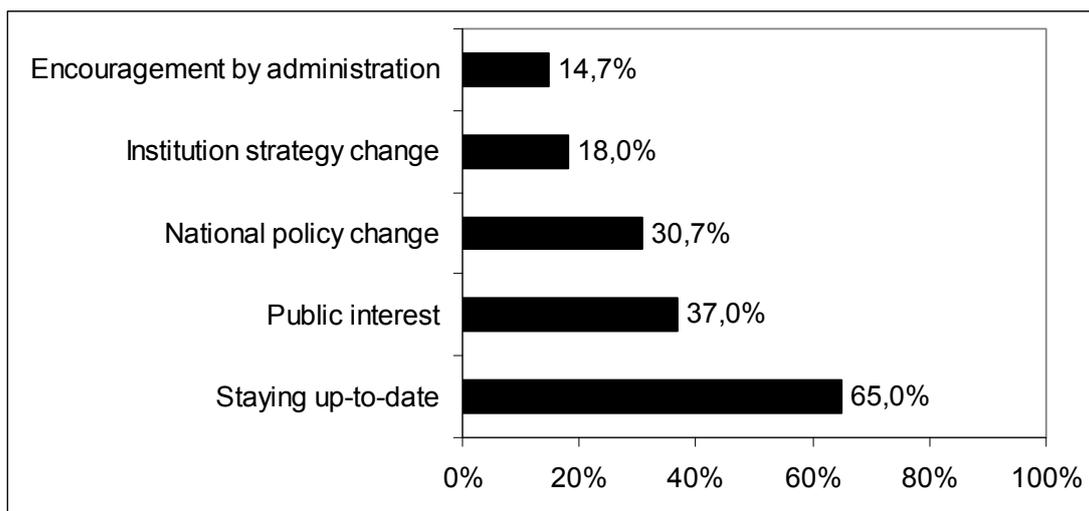


Fig. 1. The main factors motivating civil servants to attend trainings related with sustainable development

Results regarding the action competences which will be important in future (3 answers possible) are presented by Figure 2. One can see that “collaboration/team working” as well as “negotiation and consensus building” skills are indicated as the most important (necessary) by 76.3% and 61.0% of the respondents, respectively. “Identification of research and innovation areas” is less recognized by civil servants probably because the previous domination of environmental sciences and technologies and less attention to socio-economic research for SD.

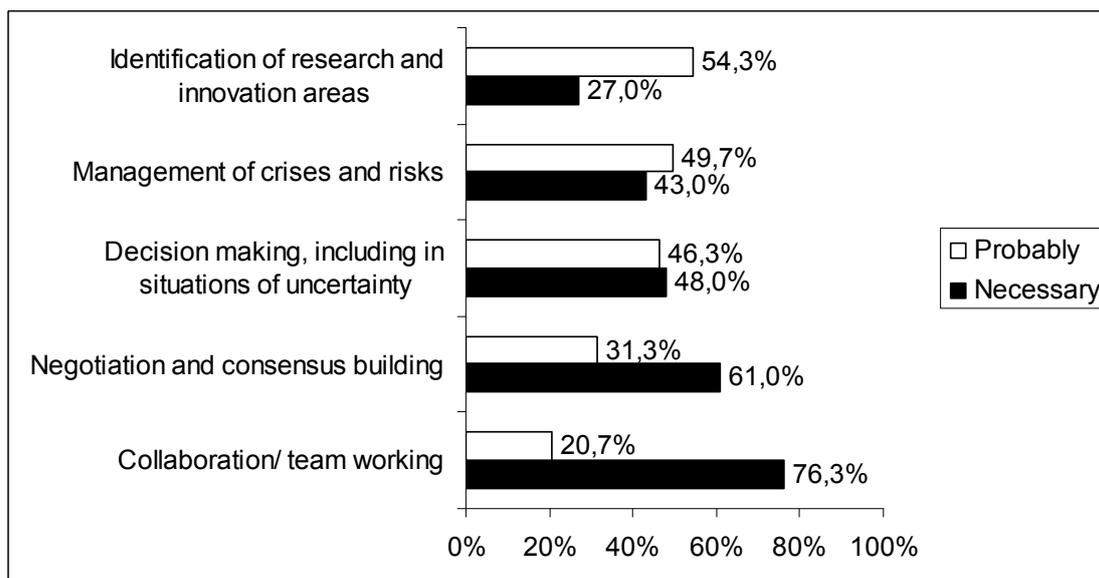


Fig. 2. Competences to be important in future

In addition to the survey, expert interviews were organized to discuss problems and perspectives for educating professionals in public administration involving top management of the ministries and experts in the area of SD.

The key message could be defined as a shift from specific knowledge to transferable skills and the motivation of continuous self-directed learning. All competences as defined in Dublin descriptors and/or in the guidelines by the UNECE were recognized as important ones in implementing SD principles. Particularly, a set of skills which is important for the development and implementation of projects and programmes was indicated including teamwork in multicultural and dynamic environment, result-oriented planning and monitoring as well as communication and presentation skills. The common suggestion for the improvement of study process at the university was to implement more interactive methods and explore complex real-life situations leading to an interdisciplinary approach and systemic thinking.

In this context should be mentioned also more general conclusions of the analytical report on competencies of graduates of master's studies (Public Policy and Management Institute, 2006) prepared by the Public Policy and Management Institute. According to the representative employer survey within Public Administration and Public Services sectors, the most valuable seems to be a competence of "research and analysis" indicated by 40.8% of respondents and 38.8% of respondents were for "initiative in decision-making, leadership".

Civil servants mostly lack analytical skills, rather than administrative knowledge. They have to acquire problem solving competences, while knowledge of the administrative proves is not that important, it changes fast and may be acquired easily at the workplace. Due to European integration and globalization processes they also need a broad understanding of the public administration context, capacities to communicate and cooperate with various institutions including international organizations.

All the above listed findings will be useful for the future revision and improvement of the study modules.

Conclusions

Although the experience of Mykolas Romeris University in implementing the program of Management and Administration for Sustainable Development is quite limited in time, the analysis of the process makes it possible to reveal the following insights.

In line with the policy provisions and existing situation, composition and research interests of the teacher team is essential in defining ways to achieve the learning outcomes of a study program. The effect of synergy by the co-operation of different departments (and different universities!) having specific academic cultures and experiences brings an added value to the process leading towards holistic approach and interdisciplinarity.

The implementation of an innovative study program at the same time stimulates learning of teachers and the development of university as learning organization. As it is emphasized in the *UNECE Strategy for Education for Sustainable Development*, there is a need to consider the evolving meaning of SD. This statement also could be equally transposed in the context of education. Action research in various contexts seems to be a powerful tool in improving quality of study process. The emerging team for interdisciplinary research seems to be the next step.

The paradigm of sustainable development provides a concrete context and background for joining various educational tasks. It implies analysis of complex and controversial situations, case studies and foresights for implementing sustainability principles at different levels, active participation of students considering different attitudes and values, etc. Altogether these factors create a unique environment for the development of competences which are essential both for professional carriers and initiation of social change.

In a broader scope of the Bologna process, the sustainability issues bring in the study process potential to implement the provisions by London Communique (2007) regarding learning outcomes that ensure the personal development of students in order to contribute to a sustainable and democratic knowledge-based society.

References

Bologna Working Group on Qualifications Framework (2005), "Report on a Framework for Qualifications of the European Higher Education Area", Copenhagen.

Council of the European Union (2005), "Recommendation of the European Parliament and of the Council on Key Competences for Lifelong Learning", 2005/0221(COD), Brussels.

Council of the European Union (2006), "Renewed EU sustainable development strategy", 10117/06, Brussels.

European Commission (2002), "A European Union strategy for sustainable development", European Communities, Belgium

Galkute, L. (Ed.) (2006a), National Capacity Self-Assessment for Global Environmental Management, Publishing House "Daigai", Vilnius.

Galkute, L. (2006b), "Cross-cutting assessment report and recommendations for priority actions for the implementation of 3 Rio Conventions", in: Galkute, L. (Ed.), National Capacity Self-Assessment for Global Environmental Management, Publishing House "Daigai", Vilnius, pp. 83-114.

Lafferty W.M. (2004), "Introduction: form and function in governance for sustainable development", in: Lafferty W.M. (Ed.), Governance for Sustainable Development, Edward Elgar, Cheltenham, UK, Northampton, MA, USA, pp. 1-31.

London Communique (2007) "Towards the European Higher Education Area: responding to challenges in a globalized world", London.

Public Policy and Management Institute (2006), "Competencies of graduates of master's studies and the needs of Lithuanian economy", Vilnius.

Sterling, S. (2001). Sustainable Education. UK: Green Books Ltd.

The Government of the Republic of Lithuania (2002, amended in 2004), "Methodology of strategic planning", Resolution No 827 of the Government of the Republic of Lithuania, Vilnius.

The Government of the Republic of Lithuania (2003), "The Lithuanian strategy for sustainable development", Resolution No 1160 of the Government of the Republic of Lithuania, Vilnius.

The Government of the Republic of Lithuania (2004), "Strategy for public administration development until 2010", Resolution No 488 of the Government of the Republic of Lithuania, Vilnius.

UN (1992), "Agenda 21: Programme of action for sustainable development", UN Department of Public Information, New York.

UNDP (2005), National Capacity Self-Assessment Resource Kit, UNDP-GEF, New York; for up-to-date information: <http://ncsa.undp.org/>.

UNECE (2005), "UNECE strategy for education for sustainable development" (adopted at the High-level meeting in Vilnius, 17-18 March).

UNECE (2006), "Indicators for education for sustainable development. Reporting format".

Ideals and modern tools to achieve sustainability in higher education

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Abstract

Higher education is responsible for all improvements which are expected to take place on all education levels and this work tackles two important issues the one being the definition of education and its ideals and the other one is the use of modern technology tools to promote such ideals and achieve sustainability. To define education two related philosophical structures are analyzed the one being Plato's definition of education and the other being Aristotle's midway of virtue. These two structures provide definitions and ideals to be used as foundations to build sustainability in higher education. Modern technology from there on could be used to help higher education in educating people who will be based on strong ideals, will develop adequate scientific depth and they will try being smarter than the machines. This can be achieved by using together modern technology and science so that the one supports and advances the other with a critical role to be played by the ability of the educator to develop elementary educational software modules.

Keywords:

Education, sustainability, virtue, wrong/right boundaries

Introduction

Education is meaningful if and only if is capable to make a clear distinction between wrong and right so that to help people acquire and use knowledge correctly and not in the wrong way. This part of education which is the foundation part needs support and development based on ideals and it is discussed in the first part of this work.

Sustainability is a popular term in modern times which is approached in many ways but most important it requires a well balanced person with education to be able to conceive a well balanced sustainable plan and furthermore to be able to make the effort to support the materialization of such a plan. The second part of his work provides a balanced model for teaching higher education courses having equilibrium between the unlimited depth of scientific knowledge and the analysis / synthesis and applications of structures for sustainable development maintaining always motives and challenges for the student and the instructor particularly by using high technology.

Education ideals

Ideals are provided by two philosophical structures which are chosen as foundation for education and may be considered to have similar or higher value for human sciences as Newton's Law in physics. Both of these structures have diachronic validity and global acceptance and will be analyzed using mathematics.

Plato in his book "The Republic" defines education as: "*the therapy of the spirit ...and as, when the body is sick, it needs medical treatment, when the spirit is sick, it needs education*". Consequently, Human spirit structure is defined by Plato as: "*...human spirit consists of three components or three*

states that analytically are: logic, desire, and anger". Plato completes the definition of education by defining healthy spirit as follows: "... logic keeps control over and balance between desire and anger". To clarify the meanings of control and balance, Plato gives the following example: Compares spirit with a car pulled up by two horses - a blind horse representing desire and a crazy horse representing anger - and the coachman - being the logic - who keeps control over and maintains a balance between these two horses in order to move the car to the correct way (which is the way of virtue, Hatzopoulos J. N., 2004)..

This example about healthy human spirit as a mathematical structure (see Figure 1) can be expressed by a rectangular triangle where the hypotenuse is logic and the two other sides represent desire and anger. A mathematical relation of healthy spirit can be established by Pythagoras's theorem. This structure of human spirit resembles also a three

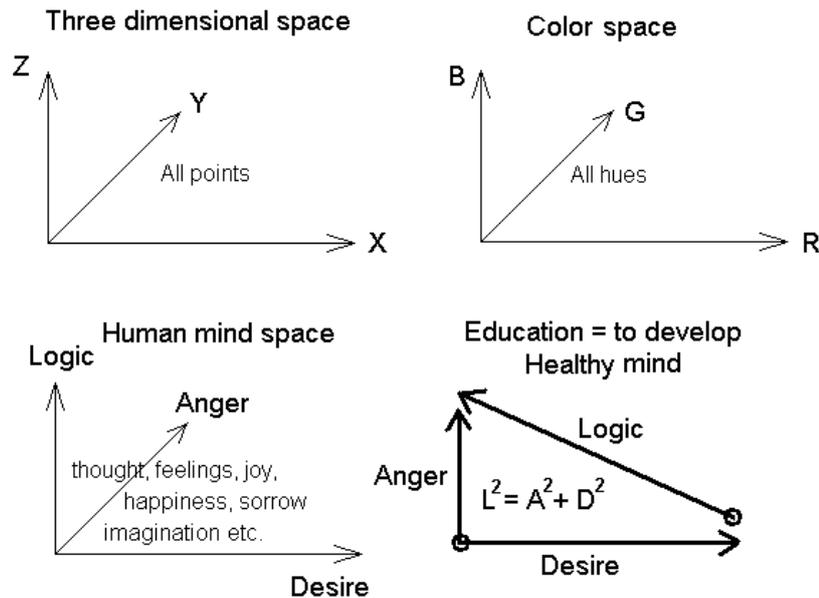


Figure 1. A mathematical analysis of the structure of education as an effort to balance the states (components) of human mind.

dimensional coordinate system where the three coordinates (X, Y, Z) can express the position of all points in the three dimensional space. Similarly three components (R, G, B) of primary colors are needed to express all color hues. As shown in Figure 1, the same thing could happen with Plato's three components of human spirit where all states of human mind (feelings, joy, happiness, sorrow, imagination, etc.) can be expressed by these three components.

It is important to notice that the modern definition of education which is related to the production and transfer of knowledge without any philosophical foundation creates a controversy and does not help a person to focus and direct most actions in the correct (sustainable development) direction.

Virtue ideally represents correct human action and as a structure is defined and analyzed in all its extent and in all its depth by Aristotle in his work *The Nikomachean Ethics*. According to Aristotle, *Virtue* is: *mesotita* (a midway) and is to be found in midway, in between two extreme actions or "badness". Aristotle then gives the following example in order to clarify the structure of virtue: If bravery is a virtue then the brave person is to be found in midway, between the provocative and the coward person, ...and when one is brave, then the coward will call him provocative because he is beyond coward's capacity, while the provocative will call him coward because he is beneath provocative's capacity... Accordingly, one could characterize thrifty as a virtue that is to be found in midway between stinginess and overspending and the stingy will call the thrift as overspender while the overspender will call the thrift as stingy.

Aristotle also defines the person of virtue as *the one who is trying to be a person of virtue* which means that virtue is the effort to maintain actions within the midway and which allows extreme actions under certain conditions as is for example, self defence. The important idea about this structure is that it is completely fitted within human dimensions.

Mathematical analysis – boundaries of wrong / right

Examining more carefully the example that Aristotle gives about the brave person, who is a person of virtue, then he/she will be considered by the coward as provocative, which means that the coward, believing that he/she is a person of virtue, underestimates virtue and therefore mathematically this can be considered as committing an error with a negative sign. On the contrary, the provocative considers the person of virtue as coward and accordingly overestimates virtue hence he/she mathematically can be considered as committing an error with positive sign. It is evident that humans, by their own nature make errors because the human brain is anatomically based on neurons and such systems are not absolutely correct. For example, if one walks over a flat road and meet a small obstacle like a rock having the size of a football, then the way one rises the foot to pass over the obstacle is different each time one walks over. There is an optimum way to pass over the obstacle with minimum energy (zero error) which can be approximated with practice but it will never be followed exactly. There is a lower limit and an upper limit to rise the foot to pass the obstacle with optimum energy (correct, virtue) without having a false step. Finally there are many cases outside these limits where it takes place a false step (negative and positive error). How bad the false step is depends on the damage caused to this person (absolute value of error). It must be noted that, repeating an effort, neurons are trained and constantly improve their performance but they never become perfect. This example may help to define precisely the boundaries of wrong and right where wrong occurs by a false step and right occurs with the effort for optimum energy.

Having this analysis in mind, then human error structure can be expressed mathematically as follows (Hatzopoulos, 2004): We may establish an axis X (See Figure 2), consisting of three straight line segments:

- (a) The segment on the left called “Error on the left (M_L)”, measures the degree of error or badness of a human being and shows the amount of underestimation of virtue (negative error);

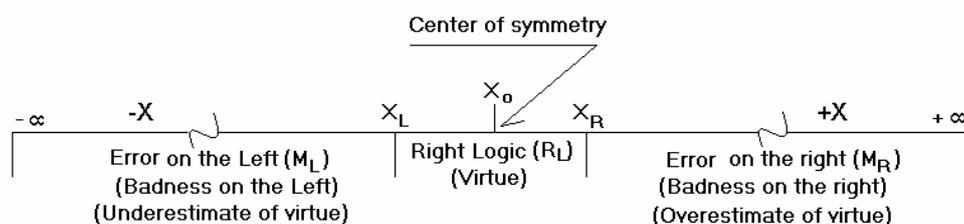


Figure 2. Structural elements ordered along X axis (Hatzopoulos, 2004).

- (b) The intermediate segment in the middle called “Right Logic (R_L)” or virtue (correct).
- (c) The segment on the right called “Error on the Right (M_R)”, measures the degree of error or badness of a human being and shows the amount of overestimation of virtue (positive error).
- (d) The location X_0 with zero error we call *Supreme Being* location because no human being is considered as having zero error.

As shown in Figure 2, this distribution of human error is symmetric with respect to the central point X_0 of zero error in the intermediate segment of virtue. However, human error is expanded from point X_L to minus infinity and from point X_R to plus infinity. If humans would be able to estimate precisely their error they would choose a specific location along the X-axis. Notice that many times people estimate such a location as are the political parties, community clubs and their followers. It

must also be noted that the estimation of location of boundaries of midway of virtue has to be subjective in order to stay within human dimensions and, therefore, requires a wider consensus (stochastic model) because each individual may have a different opinion on the subject and such a consensus may be valid only if there is a minimum bias in expressing such opinion. Minimum bias may be considered if the voters have an education whose effort is to develop a healthy mind as defined by Plato. Such matters about the influence of bias are discussed in detail by (Hatzopoulos, 2004). Consensus means democratic procedures and voting which are philosophically founded as an effort to define the mid way of virtue.

It is important to understand that since any human action includes an error (X) it means that this action to a certain degree is correct (Y) so that wrong (X) and right (Y) coexist within such action. If wrong and right are to be quantized and related to each other, then they must be inverse proportional quantities. A simple function to express this is as follows:

$$Y = 1/X \quad (1)$$

Where (X) is the wrong or error and (Y) is the correct or right.

From Equation (1) it is evident that:

$$\text{for } |X| \rightarrow 0 \text{ then } Y \rightarrow \text{infinity.} \quad (2)$$

Since X_L , X_R are located on the common boundary between wrong and right, then both variables X and Y must have exactly the same value (Hatzopoulos, 2006, pp. 328) on this common boundary. However, we look for a value in X-axis where:

$$\text{For boundary } X_R : X = Y \text{ and for boundary } X_L : -X = -Y \quad (3)$$

Applying the boundary condition (3) on Equation (1) we have:

$$X = 1/X \text{ or, } X^2 = 1 \text{ or, } X = \pm 1 \quad (4)$$

This determines precisely the borders of midway of virtue (Hatzopoulos, 2004) as having values:

$$X_L = -1, \text{ and } X_R = +1 \quad (5)$$

Considering that such borders are defined by voting and the probability density function of human error is $f(x)$ then as a stochastic model may be chosen the *Gaussian standard normal distribution* ($\mu = 0, \sigma = \pm 1$ Hatzopoulos, 2004).

The Aristotelian midway of virtue has a universal validity, for example, taking into consideration the orbit of the earth around the sun, one may observe that the earth will never follow exactly the same path and there is a midway where orbits of the earth must occur in order to have equilibrium. If the earth gets off such bounds towards the inside, then the earth may collide with the sun, if the earth gets off such bounds towards the outside, then the earth may get lost in space. This example defines also precisely the boundaries of wrong and right where wrong occurs when the earth tends to collide with the sun (negative error) or tends to get lost in space (positive error) while right occurs within the midway of orbits which follows until now.

Supreme Being

As indicated by Relation (2), Supreme Being has a virtue with magnitude approaching at infinity and, consequently, it is not possible for this Being to have even a minimal badness at all times. Consequently, if we accept that Supreme Being has any of human weaknesses at any time, we immediately depart from the location $X=0$ and thus we have not just one but numerous such beings like human beings. Putting on the same diagram shown in Figure 3 both the error function X and the correct

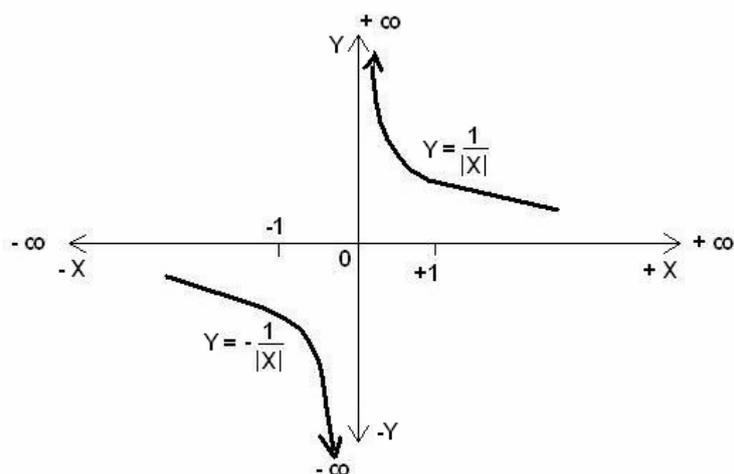


Figure 3. Virtue for the Supreme Being ranges from minus infinity to plus infinity.

(virtue) function $Y = 1/X$ (Y - axis is perpendicular to X - axis) one may notice that if X takes values from -1 towards zero, then Y moves towards minus infinity. On the other hand, if X takes values from $+1$ towards zero, then Y moves towards plus infinity. This indicates that Supreme Being is found in one single location of the X axis and has a virtue which covers all values in universe from minus infinity to plus infinity. This is one and unique location because if departing even with a small amount from location zero, say $0 + e$, or, $0 - e$, where e is a very small number, then there are many beings in such location with human weaknesses and not a supreme being.

This analysis reveals the existence of an absolute harmony and perfection in universe which is something that some people are trying to locate without success and they get lost by searching because such perfection is beyond human dimensions. However, using mathematics one may observe that it is possible to locate harmony and perfection even in an ideal state.

Didactics

According to the previous analysis mathematics were used to describe philosophical structures of Plato and Aristotle about education. Therefore, mathematics is a valuable tool of human mind to perform analysis and synthesis of simple or complicated structures (James Franklin, 1995). Consequently, it must be realized that taking out mathematics from any course in higher education the scientific analysis to be performed could be incomplete. This is very important for those they want to improve didactics. Looking at student's status one may see that about a 20-30% are talented students in mathematics and they understand and learn theories right away and therefore for those students there is no problem. The majority of students 70-80% need more help to understand mathematics. A didactics method which could help such students is to use application examples from every day's life (Hoyles, C. and Noss, R. 2003) and such a method is known as the R.E. Gross problem solving method (Gross R. E., Zeleny L. D., 1958). A complete example of this method is given by Manolas E., 2006. The R.E. Gross method if combined with computer programming to obtain quick results on complicated application problems could improve didactics and could also help students to advance (in being smarter than the machine) into the new technology era.

Working on students at University level one may be the recipient of all problems students have from elementary school to the high school and lykeio (senior high school) in mathematics. Trying to decode the problems students have in this area it is evident that wrong didactics is followed and perhaps the problem can be located at the following practice by most educators in mathematics:

1. They do not realize that mathematics is the science of structures (James Franklin, 1995) and as such is a tool of human mind.

2. Because of attitude #1, they do not orient their didactics towards applications to create motives to the students but instead they spend their time on theories which for the talented students there is no problem but for most of the students it does not make sense and they miss the substance creating gaps which generate opposite feelings and hatredness about mathematics.
3. Many mathematicians particularly the good ones do not have experience about applications of mathematics and they usually do not like applications.
4. Computer programming in a simple computer language, Visual basic for example, is not present in curricula of elementary and secondary education schools.

Pedagogy as a science must be able to adapt itself at least in cosmogonic changes when they take place. Since the decade of 1980 and afterwards a cosmogonic change took place which brought in the foreground an amazing human invention tool and this is the personal computer. The fact that this tool was evolved to a personal use from a team of young men that manufactured the Apple computer (Leigh Kimmel, 1998), shows how big can be an offer to humanity by an insignificant team of people when they know how to use their free mind. The IBM Company which was a colossus in computers at that time was waiting to evaluate the development of the Apple computer in order to make its own move. Despite the IBM PC movement and Microsoft which developed the IBM PC operating system, the team of young men that made the Apple went ahead to accomplish the manufacture of Apple Macintosh whose characteristics Microsoft managed to reach ten years later and never up to today was able to exceed it.

The right use of information technology presupposes good knowledge of the computer and its capacities and over all the ability to develop software. The correct pedagogic process could adopt as an objective that *whoever is educated to use the computer as a tool is always more intelligent than the computer*. This objective could drop the myth about computers and help students with the power of knowledge to use the computer as an effective tool in all scientific fields and in all kinds of activities. The largest advantage of computer as a pedagogic tool is that in any subject or problem or work can give fast results and in this way creates motives in students to study with higher attention the scientific bases. If students have the ability to develop software, then they can study each piece of scientific work or research by testing it in the computer and in this way they obtain an essential confidence that they know this scientific part of the study or research. Young people must understand the example of the team which developed the Apple computer and they must realize that any moment they decide to move ahead, they can also take initiatives using their free mind putting objectives and standards thus helping themselves and the society.

If those issues are taken seriously into consideration then it is anticipated to have improvement to the current situation. An ideal improvement could be to obtain a percentage of 60-70% of students to understand and learn mathematics and science. It must be noted that probability between $\sigma = -1$ and $\sigma = +1$ in standard normal distribution is within this percentage range.

A complete education model

The ideals of education as developed provide the necessary foundation to build sustainability. However, sustainability starts from the inside of a person and has to do with the internal balance which is maintained by the effort to develop a healthy mind and the effort to follow the midway of virtue. This effort helps the person to clearly identify the boundaries of wrong and right and focus most of mind energy to perform correct actions (sustainability is assumed as a correct action). It must be noted that if boundaries of wrong and right are not clearly defined then there is a danger that half of mind energy may go to the wrong way and the other half may go to the correct way with null or negative results. One such example is if a group of people are educated to exterminate another group of people and reversely.

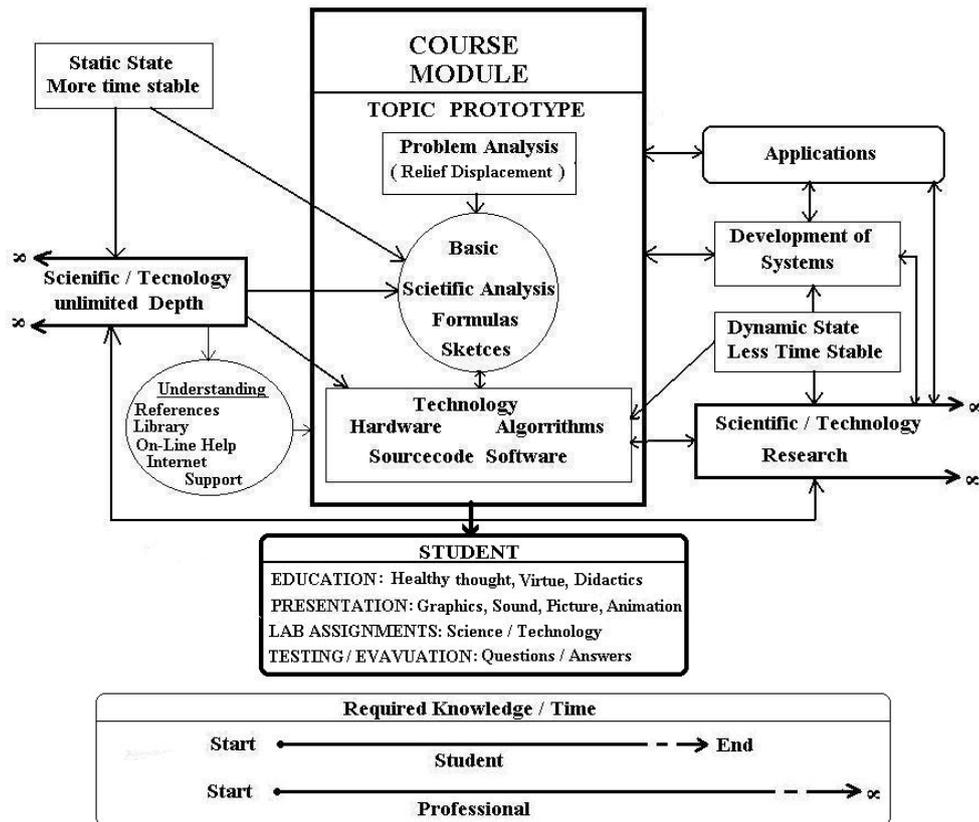


Figure 4. The course model.

The next step is to build on these foundations a higher education by creating a balance between the unlimited depth of scientific knowledge, and the applications. Notice that applications together with technological developments (on sustainable development) are supported by these scientific bases. Also scientific bases are supported by mathematics and therefore didactic issues discussed about mathematics must be taken into consideration. At the same time there must be given motives to the students to follow the rapid developments in science and technology and help them to build an internal confidence that they are smarter than the machine. To achieve these goals educational material such as a course model is proposed in an effort to put some elementary standards and also to integrate science and technology together with education into a balanced configuration shown in Figure 4. However, the key in student education are the lab assignments which are designed to cover application examples and to use modern technology (computer programming) to understand science. Science itself, as discussed in didactics, may be boring, technology therefore is able through educational software to provide quick answers to complicated scientific problems and this creates motives for the student to study the scientific aspects of the problem (Hatzopoulos, 2005).

In Figure 4 there is the course module at the center, the scientific knowledge of unlimited depth on the left and the applications on the right. All of these are interconnected in a balanced way to provide education to the student and training to the professional. The course is subdivided into topics and each topic is covered in a class session.

Each topic has a prototype composed of the part of problem analysis; the part of basic scientific analysis; and the technology part (see Figure 4). The part of basic scientific analysis, which is a more time stable part, is connected through links to an almost unlimited number of scientific sources and the student has the choice to select and study at the necessary depth. The technology part uses the scientific bases to develop appropriate educational software, which illustrates how existing systems work, and it proves that the scientific bases are correct. This part is more dynamic

and less time stable. The technology part is very important particularly for next generations because there is a tendency for younger people to treat existing systems as black boxes. They do not have enough help if they ask questions related to the software, and because they are generally discouraged to get involved with the inside structure of such systems they lose interest on the scientific part the system is based on. The technology part is connected through links to an almost unlimited number of research depth, and software development sources and students have the choice to select, study and practice at the necessary level.

The course module is connected to existing systems and some of them may require an appropriate license to run by the student. Important links to the course module are potential applications. A variety of application projects will enhance the usefulness of the topic in a divergent manner. The more application projects exist, the more people from specialized applications will attend the course, and the more technology and data will be useful.

In Figure 4 is also shown the time a student needs to finish the course while time for a professional is open ended.

This course model as discussed above, gives emphasis to the educational software. This software must be composed of simple modules applied directly to the scientific aspects of the course topics. The software development process has been advanced over the last decade and continues its advancing course with increased speed. This helps the developer by providing an almost unlimited number of tools, although some times it creates confusion because of the proliferation of such tools and facilities. The *object oriented open source software development* at present is the dominant approach to modern application problems and helps to develop a project with reusable code thus minimizing the source code development. The software development for educational purposes in a course topic, as stated earlier, is important to test the scientific procedures and make sure they work thus creating motives to study science at a greater depth. Such software can be based on any programming processor. It must be clear that the purpose of such a course is not to train students on software development but to help them understand the scientific bases of the course topic and the way existing systems function and work from the inside. An advanced course, however, oriented towards the applications must use professionally developed software. A complete example based on this analysis is given by (Hatzopoulos, 2005).

Conclusions

This work through practical examples explaining the structure of human mind and searching for ideals within human dimensions (Plato: The Republic, Aristotle: The Nikomachean Ethics) managed to provide a clear definition of education and to precisely lay down the boundaries of wrong and right. A proposed definition of education could be: *“the effort to develop a healthy mind to those who try to follow the midway of virtue”*. A proposed model for the boundaries of wrong and right could be for human error the *Gaussian standard normal distribution* ($\mu = 0, \sigma = \pm 1$) with the right (midway of virtue) being within the error boundaries from minus one to plus one and the wrong (badness) being outside these error boundaries. This effort using mathematics to locate such boundaries helped to found philosophically the democratic procedures as the ones used to define the midway of virtue and also through the *Supreme Being* definition to locate the absolute truth and absolute harmony in Universe. Such proposed ideals are within human dimensions and could have a diachronic value and a global acceptance.

This work revealed the importance of mathematics in sustainable education proving that the analysis of a structure without the use of mathematics could be incomplete and in conclusion it is suggested that mathematics must be considered and used as: *a valuable tool of human mind to perform analysis and synthesis of simple or complicated structures*. Mathematics thus help to *define unknown elements of a structure based on their functional dependence on other known elements*. Didactics on mathematics (Hoyles, C. and Noss, R. 2003) must be given more emphasis targeting to

a 70% student understanding of mathematics and taking into consideration that most good mathematicians do not like applications and therefore do not have same good performance as teachers.

Sustainability in higher education led to the development of a prototype for course modules based on elementary standards where modern technology is used to create motives to the students and study science at any desirable depth (Hatzopoulos, 2005). Didactics thus can be significantly improved using application case examples based on every day's practice (Hoyles, C. and Noss, R. 2003) and following an evolved E.R. Gross (Gross R.E. et al, 1958, Manolas E., 2006) problem solving model with the addition of computer programming. Ability for software development by instructors and students for educational purposes could significantly improve sustainability in higher education especially if relevant courses are introduced in primary and secondary schools.

References

Aristotle: The Nikomachean Ethics.

James Franklin, 1995 (Interview) Philosophy, Mathematics and Structure, (*Philosopher* 1 (2) (Winter, 1995), 31-38), [HTUhttp://www.maths.unsw.edu.au/~jim/interview.html](http://www.maths.unsw.edu.au/~jim/interview.html)UT

R. E. Gross., Zeleny L. D., Editors. Educating, Citizens for Democracy: Curriculum and, Instruction in Secondary Social Studies. New York: Oxford University Press; 1958. pp.341-367.

Hatzopoulos J. N., 2004, "Practical Philosophy of Thought and Virtue"
The Bases to Develop a Philosophical Thought by the Ordinary Citizen, ISBN 1-58112-505-4, Universal Publishers, 106 pages.

Hatzopoulos J. N., 2005, "Distant learning on Geospatial Information Science and Technology"
Proceedings of the ASPRS 2005 Annual Conference March 7-11 2005 Baltimore. Maryland, USA.

Hatzopoulos J. N., 2006, "Topographia" (in Greek) V. Giourdas Publishing Co., 900 pp.

Hoyles, C. and Noss, R. (2003) 'What can digital technologies take from and bring to research in mathematics education?' In A.J. Bishop, M.A. Clements, C. Keitel, J. Kilpatrick and F.K.S. Leung (eds), Second International Handbook of Mathematics Education, pp.323-349. Dordrecht: Kluwer Academic Publishers.

Leigh Kimmel, 1998, "Apple Computer, Inc.: A History",

<http://www.geocities.com/athens/3682/applehistory.html>

Manolas Evangelos, 2006, Designing a sustainable society: An Application of the Richard E. Gross Problem-Solving Model, Proceedings of the 2006 Naxos International Conference on Sustainable Management and Development of Mountainous and Island Areas.

Plato: The Republic.

Challenges and obstacles for the practical implementation of sustainable development in higher education

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Abstract

Education for sustainable development can be defined as the learning which needs to maintain and improve our quality of life and the quality of life for future generations to come. The educational role of universities in the implementation of sustainable development is especially important. The most important challenge for universities is to adjust their structure for new expectations in the 21st century, and at the same time implement the concept of sustainable development. Sustainability is a key area of development for the higher education sector and it is important to consider how best to embed it into learning and teaching strategies and curricula. That can be done by creating a new kind of a global unlimited network.

Keywords:

Sustainable development, Higher education, Globalization

Introduction

We are living in a globalizing world, where everything is connected. To understand the dynamics of globalization and its implication for the university, the educational role of the universities should be underlined. Since globalization is seen as the process, that refers to increasing integration of economies around the world, particularly through trade and financial flow, a very important point might be missed. Globalization refers also to movement of people (labour) and knowledge (technology) across international borders.

There is also a broader cultural, political and environmental dimension of globalization. On the other hand globalization has also a grim face, the world becomes more and more unsustainable and that creates new challenges for the university community, and calls for the practical implementation of sustainable development in higher education.

The 21st century, will undoubtedly change the structure of society, and turn out to be a century of knowledge-based society, where knowledge is the most wanted good. Those changes in the social structure from a capital society to a society based on knowledge can be illustrated by table I.

Table I Different types of society

Type of society	Type of economy	Type of culture
Industrial society	Industry	Mass
Postindustrial society	Service ¹	Multimedia and individualized
Society based on knowledge	Knowledge and data	Virtual

Those changes would not be possible without the Internet, which is changing the world we live in. It is a change no less significant than the Industrial Revolution in the 18th and 19th century. Over the last two decades, information technologies and the Internet have been transforming the way companies do business, the way students learn, the way scientists carry out research and the way in which governments provide services to their citizens and *vice versa*.

Knowledge-based society and higher education

The foundations of the new emerging society can be best described as based on knowledge. The change of society from industrial through postindustrial to a society based on knowledge is an evolutionary process. Already since the 60^s of the 20th century a considerable change in the employment structure first in the economy of the USA and then in European countries has been observed. The employment in traditional productive and processing branches of economies have lost battle with the employment in service, administration and research sectors.

According to A. & H. Toffler (1996) knowledge is a substitute for all production factors and social progress. A. Pawłowski claims that a society based on knowledge is characterized by openness and intellectual courage, this type of society believes in its abilities and uses them in an innovative way².

Since knowledge is not only indispensable for modern society and its production processes, but also for sustaining social conditions, for keeping social coherence and integration, and as at the same time knowledge is the primary source of problems and conflicts of modern society, the term knowledge society seems to be appropriate to describe the ways of life being born in modern society.

Taking into account social history and the theory of evolution, we may state that the purpose of the phylogeny of human societies itself was the preparation for this information society. According to J. Koziński not only defensive or conservative activities are written in human nature, but also continuous aspirations to move above their achievements. Those acts of transgression, this continuous movement ahead enables people to create new material and symbolic value(s), to develop science, technology, art and religion (Koziński, 1998; 2002). Through their ability to create symbols, humans can emancipate themselves from natural determinations, and can therefore create a world, which they are capable of using and controlling.

A society based on knowledge demands the reevaluation of many paradigms connected with the role of education in the development of culture, ideas and technology. According to many scholars achieving intellectual success in future is going to be based on the use of an inter-disciplinary and holistic approach to science. A society based on knowledge also means, that knowledge becomes more and more a desirable good.

This increasing demand for knowledge creates a challenge for universities and other equivalent institutions of Higher Education, especially in the field of sustainable development. In the past 10 years in the Polish educational system there have been revolutionary changes. An enormous

¹ According to D. Bell the number of employees producing services and information is an indicator for the informational character of a society.

² Available http://forumakad.pl/archiwum/2004/12/16-za-w_strone_spoleczenstwa_wiedzy.htm.

increase of students' population was possible, due to the development of private undergraduate schools and afternoon or weekend study systems (table II).

Table II Higher Education institutions in Poland based on data of the Central Statistical Office (Source: <http://www.stat.gov.pl>)

Study system	2005/06 schools	2004/05	2005/06	2003/04	2004/05
		students		graduates	
		In thous.			
Total	445	1926,1	1953,8	384,0	391,5
Study: day	X	923,1	950,0	143,3	156,8
evening	X	66,0	59,0	15,0	12,4
weekend	X	913,5	920,4	219,3	213,7
extramural	X	23,5	24,4	6,4	8,6

Still, despite of growing number of higher education institutions in Poland there is a lack of the standardization of the educational program for sustainable development. Education must be reoriented to include the changes needed to promote sustainable development. Education for sustainable development must be attentive to developments and reforms in education, particularly Education For All (EFA) the Millennium Development Goals and the goals of the International Literacy Decade and *vice versa*.

Higher Education and the Challenges of Sustainability

Sustainability is a key area of development for the higher education sector and it is important to consider how best to embed it into learning and teaching strategies and curricula (IUCN, WWF, UNEP, 1991).

Education for Sustainable Development can be defined as the learning which needs to maintain and improve our quality of life and the quality of life for future generations to come. It is about equipping individuals, communities, groups, businesses and government to live and act sustainable as well as giving them an understanding of the environmental, social and economic issues involved (Bor *et al.*, 1999; Borys, 2006). It is about preparing for the world in which we will live in the next century, and making sure we are not found wanting³.

The development of education is an active learning process, founded on values of solidarity, equality, inclusion and co-operation. It enables people to move from the basic awareness of international development priorities and sustainable human development, through understanding of the causes and effects of global issues, to personal involvement and informed action⁴.

According to chapter 36 of Agenda 21 education, the raising of public awareness and training are linked virtually to all areas in Agenda 21, and even more closely to the ones connected with meeting basic needs, capacity-building, data and information, science, and the role of major groups. The program areas described in chapter 36 are: reorienting education towards sustainable development, increasing public awareness, promoting training (Johnson, 1993).

³ UK Sustainable Development Education Panel, Available <http://www.defra.gov.uk/environment/sustainable/educpanel/index.htm>.

⁴ This definition has been approved by the DE Forum during the 2004 annual meeting and endorsed by CONCORD during the General Assembly of November 2004.

The Johannesburg Summit broadened the vision of sustainable development and re-affirmed the educational objectives of the Millennium Development Goals and the Education for All. The Summit proposed the Decade of Education for Sustainable Development and the United Nations General Assembly in its 57th Session in December 2002, proclaimed the Decade of Education for Sustainable Development for the period 2005 – 2014.

Objectives and strategies of the United Nations Decade of Education for Sustainable Development⁵

The United Nations Decade of Education for Sustainable Development is a complex and far-reaching undertaking. The environmental, social, and economic implications are enormous and touch many aspects of life of the world's population. The overall goal of the DESD is to integrate the principles, values, and practices of sustainable development into all aspects of education and learning. This educational effort will encourage changes in behaviour that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations.

The overall goal of the DESD is to integrate the values inherent in sustainable development into all aspects of learning to encourage changes in behavior that allow for a more sustainable and just society for all.

The primary goal for the DESD is laid out in the United Nations General Assembly resolution 59/237 in which the General Assembly “*encourages Governments to consider the inclusion ... of measures to implement the Decade in their respective education systems and strategies and, where appropriate, national development plans*”. Furthermore, the General Assembly “*invites Governments to promote public awareness of and wider participation in the Decade, inter alia, through cooperation with and initiatives engaging civil society and other relevant stakeholders, especially at the beginning of the Decade*”.

Within the broad goals established by the General Assembly, subgoals for the DESD at the national level are to:

- Provide an opportunity for refining and promoting the vision of and transition to sustainable development – through all forms of education, public awareness and training.
- Give an enhanced profile to the important role of education and learning in sustainable development.

The objectives for the DESD are to:

- facilitate networking, linkages, exchange and interaction among stakeholders in ESD;
- foster an increased quality of teaching and learning in education for sustainable development;
- help countries make progress towards and attain the millennium development goals through ESD efforts;
- provide countries with new opportunities to incorporate ESD into education reform efforts.

Recognizing that how sustainable development, and related educational processes are attained will vary from context to context, these objectives will share the key tasks for UNESCO to perform in support of Member States through its role as lead agency of the Decade. UNESCO's leadership role and, in fact, the task of Member States are also defined by the four major thrusts of education for sustainable development:

⁵ http://portal.unesco.org/education/en/ev.php-URL_ID=23295&URL_DO=DO_TOPIC&URL_SECTION=201.html

- improving access to quality basic education;
- reorienting existing education programmes;
- developing public understanding and awareness.
- providing training.

The global consultation to prepare the International Implementation Scheme led to identifying the following seven strategies as essential for moving forward with creating regional, national, and sub-national implementation strategies and plans. All seven should be thoughtfully incorporated into the initial process to create an implementation plan, and again all seven should be part of any implementation plan. Through incorporating these strategies, such as public consultation, organizers will discover that many educational programmes related to education reform, corporate training, and public information campaigns already exist. The DESD is in part about integrating and coordinating the activities from these various existing efforts in the three spheres of sustainable development and the four thrusts into the overall ESD plan.

While the range of activities will vary widely, stakeholders can apply the following seven strategies both in their own institutional frameworks and in the networks and alliances in which they function:

- vision-building and advocacy;
- consultation and ownership;
- partnership and networks;
- capacity-building and training;
- research and innovation;
- use of Information and Communication Technologies (ICTs);
- monitoring and evaluation.

The main challenges of sustainable education are:

- To integrate sustainable science and education,
- To strengthen co-ordination and collaboration between different levels of education for sustainable development,
- To transform information and knowledge gaps between different parts of the world.

That creates new challenges for the university communities, and brings us to few fundamental questions such as:

- How to implement sustainable development within and outside universities?
- What is the role and place of the universities in a globalizing world?
- Who will be the new actors on the higher education world scene?
- How can universities come across new challenges and expectations in the 21st century?
- Will universities - through a dynamic and salutary hybridization – be able to meet those challenges or will they be marginalized by the arrival of new, more effective actors?
- What are the limits of the transfer of knowledge?
- How should universities transfer knowledge to society and at the same time implement sustainable development?
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Conclusions

The most important challenge for universities is to adjust their structure for new expectations in the 21st century, and at the same time implement sustainable development. That can be done by creating

a new kind of a global unlimited network, which would enable information flow and movement of people. To fulfill this mission there is a need for:

- Unification of education systems for all universities which are in the network, where sustainable development will be included in syllabi
- Capacity of students and tutors' exchange (programs like Socrates, Leonardo da Vinci), that would help in creating new relations among academics around the world, and at the same time give opportunities for cultural equity.
- Unification of students evaluation system for all universities which are in the network (like ECTS)

So universities will have to face the challenges of an enormous technological progress, and significant demand for knowledge and, at the same time, still implement the concept of sustainable development. To fulfill this target, a multi- and inter-disciplinary as well as holistic approach is required. Sustainable development is a challenge for universities, and in this context the Decade on Education for Sustainable Development is especially important.

References

Bor, W., van den Holen, P. and Wals, A. (Eds) (1999), *The Concept of Sustainability in Higher Education*, FAO, Rome.

Borys, T. (ed.) (2006), *Edukacja dla zrównoważonego rozwoju*, Wydawnictwo Ekonomia i Środowisko, Jelenia Góra – Białystok.

IUCN, WWF, UNEP (1991), *Caring for the Earth*, Oxford University Press, Oxford.

Johnson, S.P. (1993), *The Earth Summit, The United Nations Conference on Environment and Development (UNCED)*, Graham/Trotman-Martinus Nihoff, London-Dordrecht-Boston.

Kozielecki, J. (1998), *Człowiek wielowymiarowy*, Wydawnictwo Akademickie „Żak”, Warszawa.

Kozielecki, J. (2002), *Transgresja i kultura*, Wydawnictwo Akademickie „Żak”, Warszawa.

Toffler, A. & H. (1996), *The Three Wave*, Wyd. Zysk i Ska, Poznań.

The impact of higher education on environmental beliefs and practices

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Abstract

The present research is based on the opinions of 46 Greek kindergarten teachers who attended an in-service environmental education training course in the Early Childhood Department at the Aristotle University of Thessaloniki and aims to investigate their environmental attitudes, values and actions.

The present research combines both qualitative and quantitative methods of data analysis and the data were collected by semi-structured questionnaires.

The basic results show that participants tend to suggest a wide variety of proenvironmental actions, the most frequent of which are recycling and cleanness. Sensitization and consciousness of environmental problems appear to be the major motives of the proposed action. The subjects of the research hold non-anthropocentric beliefs about human-nature relation and they support an emotional- ethical treatment of animals based on sympathy. Most of the participants consider that the training course helped them develop environmental values. However, there were no other experiences during their studying years in the university. The proposed technique for strengthening environmental action refer mostly to educational action and especially to visits to real environments, experiential learning as well as to political – citizenship action.

Finally, we suggest ways to improve the course based on an integration of teachers' opinions about it, combined with recent research findings on what constitutes an effective model of engaging adults with environmental education content, methodology and rationale, as well as ways to explore and try to dispute the anthropocentric worldview of nature towards an ecocentric approach through educational values and methods.

Keywords:

Environmental ethics, higher environmental education, environmental action, course impact, values education strategies, anthropocentrism, ecocentrism

Introduction

This article aims at presenting the results of a research work about environmental values and actions of 46 Greek kindergarten teachers who attended an in-service environmental education-training course in the Early Childhood Department at the Aristotle University of Thessaloniki.

The main goal of the research is to ascertain teachers' possible engagement in proenvironmental actions after their training course, to explore their possible intentions prior to the training and to gauge the direct influence of the training course on their attitudes and actions concerning the environment. Furthermore, this research also intends to examine the anthropocentrism/ecocentrism bifurcation in teachers' minds and to measure the course's impact on it. Last but not least, this essay aims at registering teachers' suggestions for possible educational techniques that would strengthen the formation of environmentally friendly attitudes.

Environmental education and environmental ethics: values and actions

As the founder of social ecology, Murray Bookchin, supported that all ecological problems have their roots in social problems (Bookchin, 1989: 39). In order to solve social problems we must discuss, decide and highlight values concerning our relation with the environment. Environmental problems raise crucial questions about what we, as humans, value, our place in nature and the kind of world in which we might flourish (Des Jardins, 1997: 5). Environmental ethics, as a field of applied ethics, comes as a philosophical answer to the today's environmental problem in a way that addresses the ethical responsibilities of humans towards nature.

From a psychological point of view, attitudes and values constitute one of the crucial parameters that define consciousness and behaviour (Hogg & Vaughan, 1995). Although the relationship between attitudes and behaviour is not direct (Taylor et al., 1994), it seems that the one reinforces the other (Myers, 1999). Thus, when the sustainable behaviour becomes the desired goal, some of the related values that are at scope are solidarity (Sosa, 1996), social justice, tolerance, participation, democracy, autonomy (Halstead, 1996) and responsibility (Flogaitis, 2005). The transition from the anthropocentric-technocentric worldview to an ecocentric paradigm is also supported (Dunlap & Van Liere, 1984).

From the early 1970, when environmental ethics was born, one of the most important issues was the anthropocentric world view. Philosophers such as Aldo Leopold (1949) and Baird Callicott (1989) condemned the anthropocentric philosophy as the main reason for the nowadays environmental problems. From Francis Bacon to 20th century our culture and our science, as Holmes Rolston III points out, have originated in the face of oppositional nature (Rolston, 1988: 22). In anthropocentric ethics only human beings have moral value, thus humans have no direct responsibilities towards nature (Des Jardins, 1997: 10). In this human-centered ethics neither the species as a whole, nor the individual parts of this whole are morally considerable. Of course, it is important to notice that when talking about species we mean animals or plants. Only the happiness and unhappiness of humans is morally considerable (Elliot, 1993: 286). Thus, animals and plants have an instrumental value for the sake of human beings.

On the contrary, some philosophers underlined the need to extend the moral community in order to change our world view and to approach nature. For Leopold, nature (including both human and non human world) constitutes a community. According to his theory, called *Land Ethic*, every part of this community is equally worth (Leopold, 1949). Paul Taylor proposed a much stronger biocentric theory based on the inherent worth of all life. He insists that all living things are *teleological centers of life* and that's why they have inherent value (Taylor, 1986).

Furthermore, there are philosophers who refuse to recognise intrinsic value to non-animals. Intrinsic value is the value that individuals have independent of their goodness or usefulness to others (Gruen, 1993: 346). Peter Singer, most known from his pioneer book *Animal Liberation*, proposed

that in the tradition of classical utilitarianism, one must take into consideration every being who can suffer (Singer, 1975). In a recent work, he moved from the classical to a modern version of utilitarianism, called *preference utilitarianism* and claimed that we ought to protect every non-human animal that is a *person*. According to Singer, *person* is every rational and self-conscious being (Singer, 1993).

Tom Regan supports a right based defense of animals. Unlike Immanuel Kant, who was asserting that inherent value lies on autonomous life, Regan accepts the inherent value of non human animals and believes that the best way to protect this value are rights. For him, only *subjects of life* have inherent value. *Subjects of life* are beings who are self-conscious, capable of having beliefs and desires, beings that can conceive the future and entertain goals (Regan, 1983). More recently, some philosophers, who were influenced by eco-feminism, rejected the utilitarian and right-based theory about the ethical treatment of animals, and proposed an ethic based on sympathy. In contrary to the rationalistic philosophy, advocates of sympathy focus to an ethics based on emotion, especially on the feelings of sympathy and compassion (Donovan, 1996).

From a pedagogical point of view, the way values are formed in an educational setting is of a great interest since it reflects certain choices and values (Huckle, 1980, Fien, 1993, Sterling, 1993, 1996, 2002, Bowers, 2002). Especially the degree teachers encourage their students to adopt specific values is at focus (Oulton et al., 2004) while the latter are involved in critical thinking about the dilemmas caused by the contrasting values that are lying in environmental issues.

When adults are the target group, the strategies should focus on issues' analysis (Ramsey et al., 1989), values' clarification (Harshman, 1978-79), critical thinking, decision-making skills (Kirschenbaum, 1995, Caduto, 1985) and also citizenship skills, such as ecomanagement (physical practice), consumerism, persuasion of other people, political and legal action as well as the combination of all the above (Volk, 1998). Persuasion is supposed to be an indirect way of action in contrast to the rest categories that are considered as direct since they are meant to address specific environmental problems (Jensen, 2002).

Methodology and Results

The current research represents a positivistic approach. For the data collection questionnaires were distributed to the subjects during the last day of their training course. The questionnaires included five semi-structured and two multiple-choice questions. The results were analysed through categorisation based on content analysis and their proenvironmental actions as well as the relevant motives were examined. Furthermore, we investigated their perceptions concerning the natural environment and the animals. The third group of questions studies the course's impact and other experiences at university, as well as the participants' proposals for strengthening environmental action.

1. Referred proenvironmental actions

The striking majority of the research subjects (44 to 46) mentioned that they are indeed acting proenvironmentally. When they were asked to describe their actions they reported the following: the overwhelming majority of the participants appeared to support recycling and cleanness to be the best solutions, whilst a lower percentage of the people examined, suggested that minimum consumption of natural resources and products, boycott of technologies hostile to the environment, avoidance of using cars and awareness, would be the measures taken in order to protect the environment. A general attitude of respect towards nature is also met. The least often categories mentioned are the following: consumption of biological products, tree planting, preservation of endangered species, use of alternative energy sources and financial support of NGO (see Figure 1).

2. Motive for action –non action

When asked to explain the motives of their proenvironmental actions the subjects of the research pointed mainly at “Sensitization – love – respect for nature” as well as “Consciousness” (through media and friends). Moreover, concern for environmental problems such as pollution, sustainability, personal responsibility and “Quality of life” (aesthetic criteria) appear to be other essential motives (see Figure 2).

3. Perception of natural environment

The majority of the participants (n.38) adopt the perception of sustainable management of the natural environment. The hard anthropocentric options gather very few choices (n. 2), as well as the belief that nature is for human use (n.3) (see Figure 3).

4. Perception of animals

Regarding to the perception of animals most of the participants (n.28) believe that they have an ethical value and, consequently, that animals deserve human respect. Fewer subjects (n.16) accept the idea of using animals on certain conditions (see Figure 4).

5. Recognition of the course’s impact

Thirty eight subjects of the sample recognised the course’s impact on their attitudes and values positively attributing this mainly to the information they received, the sensitization that was cultured during the course (n.26) and the acquisition of a deeper understanding (n.9). Nevertheless, eight subjects denied any impact of the course since they argued that they had already developed environmental attitudes and values when they entered the course (see Table I).

6. More influences from the university

Most of the subjects (n.40) supported the fact that during the course there were no other relevant influences from the university. Six people mentioned that they had the chance to attend environmental seminars and conferences (n.2), visit the library (n.1) and study children literature (n.1) as well. Finally, it has been mentioned that discussions among the participants have influenced them (n.2).

7. Proposals for the strengthening of the environmental action

The majority of the proposals centered on the practice of visiting natural settings or environmental education centers. These visits are differentiated from the field trips and experiential learning according to subjects’ reports. Participation in programs, seminar attendance, more teaching hours, the existence of external collaborators, as well as formation of studying groups, constitute another group of proposals. Watching movies and sensitization are also proposed. Dealing with environmental matters, organising and taking part in voluntary environmental groups as well as applying everyday life practices seem to be the rest of the subjects’ proposals (see Figure 5).

Conclusions

In a closer look of the proenvironmental actions mentioned above, we realise that they are grouped in three categories. The first is ecomanagement; fifty choices concern “recycling”, “cleanness” and “tree-planting”. Thirty five choices coming from “consumption of biological products”, “minimum consumption of natural resources and products”, “boycott of technologies hostile to the

environment” and “avoidance of using cars”, constitute the second group, that of consumerism action. The third group is related to an ethical and affective option since it includes “awareness”, “general attitude of respect towards nature” and “preservation of endangered species” and gathers twenty-one choices.

Persuasion and legal action are not mentioned at all, whereas political action is represented by a unique choice as “financial support of NGO”. It seems that it is easier to adopt a personal attitude such as ecomanagement and consumerism than an energetic political thesis. This may be related to the probably external locus of control of the subjects. A person’s self-concept and self-esteem are especially important with regard to prosocial behavior (Staub, 1984) as well as to proenvironmental behavior.

Concerning the motives behind the actions mentioned, they are grouped as affective (sensitization, love, respect), cognitive (awareness of problems, consciousness, sustainability) and personal (responsibility, quality of life). Affective motives appear to be the most frequent. Consequently, this points out the fact that information, awareness and knowledge need the support of emotion in order to lead to action (Omdahl, 1995). This is the case of empathy as a significant motive base for prosocial activism along with moral cognition (Hoffman, 1989).

According to human’s perception of nature it is notable that environmental ethicists are not the only specialists in human- nature and human- animal relations. The anthropologists are also preoccupied with these relations in a more specific context. Fortunately, they draw the same conclusion: man controls over animality and this is a part of an inclusive ideology of the human mastery of nature whose roots lie in the tradition of Western thought (Ingold, 1994: 11). None the less, from the answers in question 3 we can argue that there is a reject of the strong anthropocentric view. We can search for this shift from anthropocentrism to non anthropocentricism in two main reasons: the environmental problems and the influence of environmental education. Firstly, environmental problems show that we must redefine our relation with nature. If we continue to consider nature as a cellar of goods we will face a more difficult problem in the future. In addition, environmental education focuses on other beings helping students develop their perspective. Decentralised from the anthropocentric point of view, students come to realise the existence of other animals and also care for their well being. This is an ability obtained from the very early preschool years (Baldwin, et al., 2003, Charney, 1992).

However, there is still an important conclusion: the rejection of the anthropocentric view, which man has from the 17th century, constitutes an open field to redefine our action through nature. The main goal of environmental ethicists was to refute the strong anthropocentric view as the first step to solve environmental problems. And this seems to be possible under the influence of environmental education.

Maybe the most impressive part of the answers obtained was their beliefs about animals. As mentioned above, most of participants reckon that animals have ethical value and that’s why we must, as human beings, respect them. The matter of the ethical treatment of animals, strictly related to the anthropocentric-ecocentric issue, underlines once more the non anthropocentric beliefs. Yet, if we combine the data from questions 2, 3 and 4 we can conclude that participants tend to approach nature in an emotional way. It is interesting that most of the participants explain their motives of action with regard to sensitization, love and respect for nature. It seems that people don’t base their beliefs in abstract philosophical theories. This is a realistic point that shows why the *sympathy view* for the ethical treatment of animals could be the most suitable theory to promote the ideal human-non human animal relation. Furthermore, ethics of care, the theory mostly related to sympathy based ethics, would be a valuable guide for the set of issues that environmental ethics deals with.

The recognition of the course's impact on students' environmental attitudes and values seems to be compatible with its contents.¹ Issues of sustainability as well as the study of values in environmental education and in environmental ethics constituted significant parts of the course. The way these issues were approached resulted in the formation of environmental values. Except for the above course the subjects of the research had no other opportunity to live and share relevant experiences during their studying years but the discussions among them. The role of the social context in values' formation is lately underlined (Hogg & Terry, 2000).

The subjects' propositions for strengthening environmental action refer to educational action (Smith-Sebasto & D' Costa, 1995) as well as to citizenship activism. They need a more experiential learning environment (Dewey, 1998) that is open to the external community and offers various meaningful opportunities to deal with environmental matters. They also propose the organisation of a vivid community that acts voluntarily reminding of the *Just Community* approach of Kohlberg (1985). Furthermore, some of them recognise the role of watching movies and sensitization (Iozzi, 1989).

Propositions

We propose that higher education should strengthen the internal locus of control of the students so that they can feel confident enough to engage into the real political arena, to participate and make decisions about environmental issues. After all, this is the kind of citizen that environmental education pointed at from its early beginnings.

Moreover, even though students are adults it is important to address to their affective, cognitive and personal motivation, since it is obvious that knowledge is insufficient on its own to provoke action. Additionally, environmental ethicists should take into serious consideration the general tendency that appears to exist among the citizens to focus on emotional theories for the ethical treatment of animals, rather than strictly rationalistic ones.

It also seems that higher education courses must take into account the need to discuss environmental values and also to find ways to incorporate them into their thematic. Except for the specific courses, higher education departments should be organized as sustainable units so that the students have the opportunity to experience sustainability in every aspect, and through this personal involvement to develop attitudes and values and proceed to action. It appears that the goal of the experiential learning has not been achieved yet and more efforts should be made at that direction. Finally, we propose the study of Values Education techniques (Caduto, 1985) as well as their incorporation into the didactic methods usually applied.

References

Baldwin, V.G., DaRos-Voseles, D.A. & Swick, K.J., (2003), "Creating a caring community: The University of Arkansas Nursery School Experience", *Early Childhood Education Journal*, Vol. 30 No. 3, pp. 157-162

Bookchin, M. (1989), *Remaking Society*, Black Rose Books, Montreal- New York

Bowers, C.A., (2002), "Towards an Eco-Justice Pedagogy", *Environmental Education Research*, Vol. 8 No. 1, pp. 21-34

¹ **Description of the course** The main interest of the course is focused on environmental education. Especially the subjects of the lectures were about 1. its definitions, 2. its historical progress, 3. the basic texts of environmental education, 4. its goals, 5. its orientation towards education for sustainability (management of renewable and non renewable natural resources, options of sustainable management), 6. values in environmental education, 7. values in environmental ethics (the relation between human and non-human animals), 8. its pedagogical background, 9. its content, 10. its methodology (project), 11. evaluation of the course, 12. visit to an environmental education center

- Caduto, M., (1985), *A Guide on Environmental Values Education*, Unesco -UNEP International Environmental Education Programme, Environmental Education Series, No 13.
- Callicott, B. J. (1989), *In Defense of the Land Ethic, Essays in Environmental Philosophy*, State University of New York Press, Albany
- Charney, R.S., (1992), *Teaching children to care: management in the responsive classroom*, Northeast Foundation for Children, Greenfield, MA
- Des Jardins, J. R. (1997), *Environmental Ethics, An Introduction to Environmental Philosophy*, Wadsworth Publishing Company, Belmont
- Dewey, J. (1998), *Experience and Education*, Kappa Delta, West Lafayette, Indiana (first edition 1938)
- Donovan, J. (1996), "Attention to Suffering: Sympathy as a basis for the ethical treatment of animals", in Donovan, J. & Adams, C.J. (eds.), *Beyond Animal Rights, A Feminist Caring Ethic for the Treatment of Animals*, Continuum, New York, pp. 147-169
- Dunlap, R. & Van Leere, K.D, (1984), "Commitment to the Dominant Social Paradigm and concern for environmental quality", *Social Science Quarterly*, Vol. 65, pp. 1013-1028
- Elliot, R. (1993), "Environmental ethics", in Singer, P. (ed.), *A Companion to Ethics*, Blackwell, Malden, pp. 284-293
- Fien, J., (1993), *Education for the Environment. Critical Curriculum Theorisin and Environmental Education*, Deakin University Press, Geelong
- Flogaitis, E., (2005), *Education for the Environment and Sustainability*, Ellinika Grammata, Athens (in Greek)
- Gruen, L. (1993), "Animals", in Singer, P. (ed.), *A Companion to Ethics*, Blackwell, Malden, pp. 343-353
- Halstead, J.M., (1996), "Liberal Values and Liberal Education", in Halstead, J.M. & Taylor, M.J. (eds.), *Values in Education and Education in Values*, The Falmer Press, London, pp. 17-32
- Harshman, R., (1978-79), "Value Education Processes for an Environmental Education Program", *Journal of Environmental Education*, Vol. 10, pp. 30-34
- Hoffman, M. L., (1989), "Empathy and Prosocial Activism", in Eisenberg, N., Reykowski, J. & Staub, E. (eds.), *Social and Moral Values –Individual and Societal Perspectives*, Lawrence Erlbaum Associates, pp. 65-85
- Hogg, M. A. & Vaughan, G. M., (1995), *Social Psychology, An Introduction*, Prentice Hall, New York
- Hogg, M.A. & Terry, D. J., (eds) (2000), *Attitudes, Behavior and Social Context: the Role of Norms and Group Membership*, Lawrence Elbraum Associates, New Jersey
- Huckle, J., (1980), "Values and the teaching of Geography: Towards a Curriculum Rationale", *Geographical Education*, Vol. 3 No. 4, pp. 533-544

- Ingold, T. (1994), "Introduction", in Ingold, T. (ed.), *What is an Animal?*, Routledge, London & New York, pp. 1-16
- Iozzi, L. A., (1989), "What Research Says to the Educator, Part two: Environmental Education and the Affective Domain", *The Journal of Environmental Education*, Vol. 20 No. 4, pp. 6-13
- Jensen, B.B., (2002), "Knowledge, Action, Pro-Environmental Behavior", *Environmental Education Research*, Vol. 8, No. 3, pp. 325-334
- Kirschenbaum, H., (1995), *100 Ways to Enhance Values and Morality in Schools and Youth Settings*, Allyn and Bacon, Massachusetts
- Kohlberg, L., (1985). "The Just Community Approach to Moral Education in Theory and Practice", in Berkowitz, M. W. & Oser, F. (eds.), *Moral Education: Theory and Application*, Lawrence Erlbaum Associates, New Jersey-London, pp. 27-85
- Leopold, A. (1949), *A Sand County Almanac*, Oxford University Press, Oxford
- Myers, D. G., (1999), *Social Psychology*, Mc Graw-Hill College, New York
- Omdahl, B.L., (1995), *Cognitive Appraisal, Emotion, and Empathy*, Lawrence Erlbaum Associates, New Jersey
- Oulton, Ch., Day, V., Dillon, J. & Grace, M., (2004), "Controversial issues– Teachers' Attitudes and Practices in the Context of Citizenship Education", *Oxford Review of Education*, Vol. 30 No. 4, pp. 489-507
- Ramsey, J.M., Hungerford, H.R., & Trudi, V., (1989), "A Technique for Analyzing Environmental Issues", *The Journal of Environmental Education*, Vol. 21 No. 1, pp. 26-30
- Regan, t. (1983), *The Case for Animal Rights*, University of California Press, Berkeley
- Rolston, H. III (1988), *Environmental Ethics, Duties to and Values in the Natural World*, Temple University Press, Philadelphia
- Singer, P. (1975), *Animal Liberation: A New Ethics for Our Treatment of Animals*. New York, New York Review/Random House
- Singer, P. (1993), *Practical Ethics*, Cambridge University Press, Cambridge
- Smith-Sebasto, N.J. & D' Costa, A., (1995), "Designing a Likert-Type Scale to Predict Environmental Responsible Behavior in Undergraduate Students: A Multi Step Process", *The Journal of Environmental Education*, Vol. 27 No. 1, pp. 14-20
- Sosa, N. (1996), "The ethics of dialogue and the environment. Solidarity as a foundation for environmental ethics", in Callicott, J.B. & Da Rocha, F.J. (eds.), *Earth Summit Ethics, Toward a Reconstructive Postmodern Philosophy of Environmental Education*, State University of New York, Albany, pp. 47-70
- Staub, E., (1984), "Notes toward an Interactionist-Motivational Theory of the Determinants and Development of (Pro) Social Behavior", in Staub, E., Bar-Tal, D., Karylowski, J. & Reykowski, J.

(eds.), *Development and Maintenance of Prosocial Behavior – International Perspectives on Positive Morality*, Plenum Press, New York, pp. 29-49

Sterling, S., (1993), “Environmental Education and Sustainability: A view from holistic ethics”, in Fien, J. (ed.), *Environmental Education, A Pathway to Sustainability*, Deakin University, Victoria, Australia, pp. 69-98

Sterling, S., (1996), “Education in Change”, in Huckle, J. & Sterling, S. (eds), *Education for Sustainability*, Earthscan, London

Sterling, S., (2002), *Sustainable Education*, Schumacher Briefings No 6, Green Books, Bristol

Taylor, P. W. (1986), *Respect for Nature, A Theory of Environmental Ethics*, Princeton University Press, Princeton, New Jersey

Taylor, S., Peplàu, L.A. & Sears, D., (1994), *Social Psychology*, Prentice Hall, New York

Volk, T., (1998), “Integration and Curriculum Design”, in Hungerford, H.R., Bluhm, W.J., Volk, T.L. & Ramsey, J.M. (eds.), *Essential Readings in Environmental Education*, Stipes Publishing L.L.C., Illinois, pp. 125-144

Figure 1

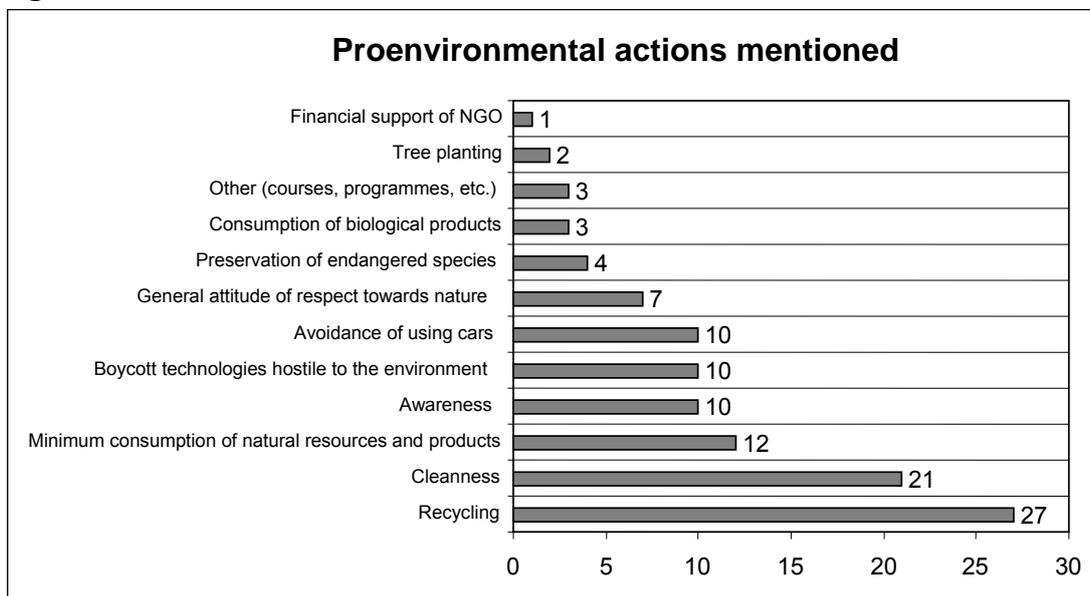


Figure 2

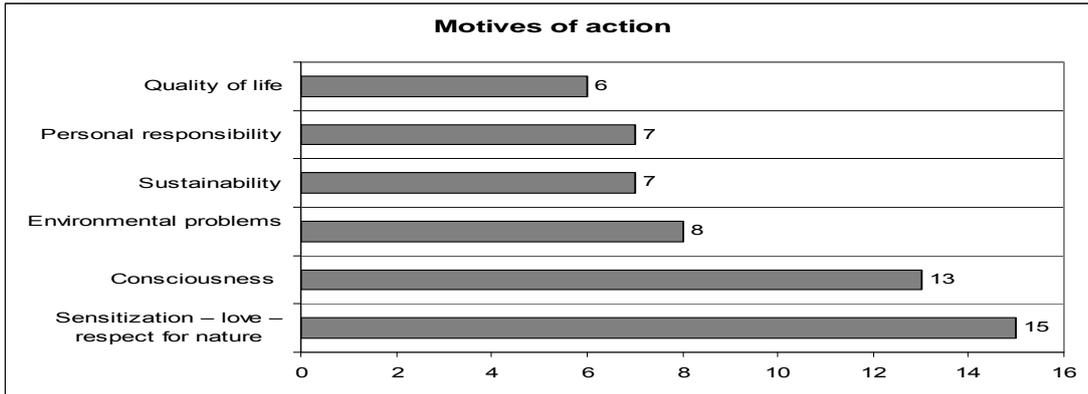


Figure 3

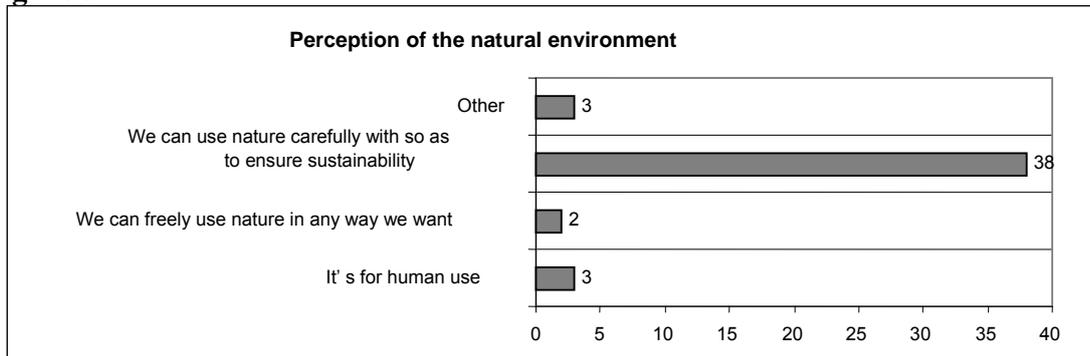


Figure 4

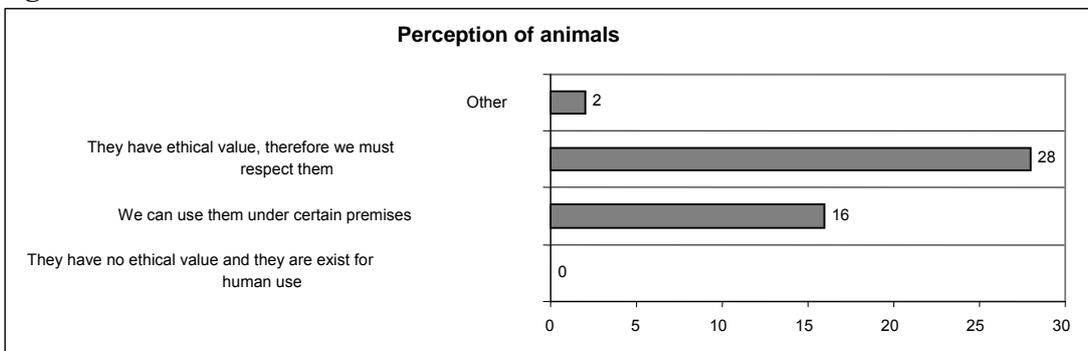


Figure 5

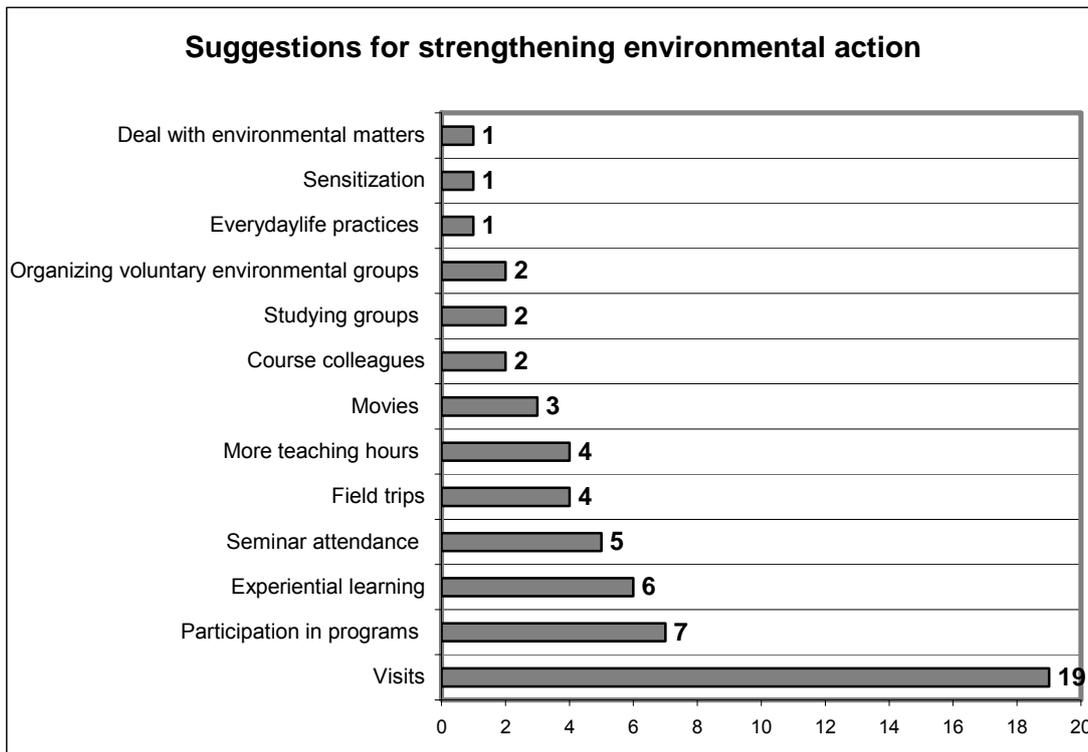


Table I: Reasons of impact – non impact

Impact		Non impact	
Information-Sensitization	26	Pre-developed ideas	7
Deeper knowledge	9	Insufficient information	1
Recognition of the need for general pedagogic change	1		
Personal empowerment- applied knowledge	1		

Study Programmes in Environmental Sciences: Recent Trends in Institutions of Higher Education

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Abstract

The sensitization for environmental issues, the planning of interventions, setting objectives for the environment, its interactive relation with society and the undertaking of tasks based on sustainable development are surely subjects which have given and are still giving rise to much controversy. This paper presents definitions of the meaning of “Environmental Studies”, programmes of studies (in brief) and syllabi (detailed programmes of studies) from foreign University departments of Environmental Science, for the purpose of providing, on the one hand, an easy-to-use guide for anyone. On the other hand, the main reason why we dealt with this particular subject was the comprehension of universal trends for the cognitive subject of Environmental Science, during the training of executives and scientists in sectors directly connected to Environmental Sciences.

Despite our reservations due to the incomplete picture we had, we consider our sample rather satisfactory believing that we came to useful conclusions, which confirm the confusion existing in all the stages of teaching Environmental Sciences either as a basic programme or as part of a more general syllabus

This confusion is mainly due to the difficulty in determining the boundaries of this term. Every University department includes subjects in its programme of studies according to how it determines the boundaries of the subject. In general, it is avoided to approach the environmental problems and issues from a legislative, social and moral point of view. Sensitive issues that have come up are not first priority, while most authorities do not get deeply involved in environmental issues but only superficially.

Key words

Sensitization, environmental issues, undertaking of tasks, interactive relation, society, intervention strategies, definitions of Environmental Studies, programmes of studies, Syllabus

Introduction

In this work we present definitions of Environmental Science, study courses and syllabi from Environmental Science departments of foreign universities. Throughout the investigation and the analysis of conclusions reached, the search for dominant trends concerning education in Environmental Sciences is attempted. We tried to select “reliable” Environmental Science University departments. For American universities we consulted the listing of American Universities which is found in the main web page of MIT and of those present we selected the first 60, whose web pages we investigated and processed. Not all Universities had a department of Environmental Science. Also, some departments did not give enough information on their courses and we, therefore, did not include them in our work. We also found web pages from Australian Universities, some Canadian, British and a Spanish University. Unfortunately we did not have the

fluency of the French or the German language so as to investigate more European Universities. What constitutes part of our intentions was the distinction of study courses according to level wherever something like this was possible due to insufficient information.

We consider that the reader will gain a satisfactory first picture of the situation of definitions, of study courses and of syllabi. Of course, the dynamics that characterize the design of a study programme weakens in some way our work as it is possible that some features of that programme may be modified in the next academic year. The most basic reason why we engaged in this particular object was the comprehension of world trends relating to the knowledge area of Environmental Sciences.

Education and Sustainable Development

Influenced by the UN decade on education for sustainable development 2005 – 2014 we turn to the examination of the relationship of the two important components: sustainable development – education. As it is mentioned in the Greek as well as the international bibliography – literature education for sustainable development came about through discussions related to the relationship between the environment and economic development. In all decisions taken in international conferences for the environment the importance of Education for Sustainable Development is stressed. We have singled out some of the historic references like: the Rio International Conference for the Environment and Development, 1992 (Learning – Social Change – Sustainability). Sensitization, Education, Training are concepts which are referred to in the action plan known as “Agenda 21”. Thessaloniki International Conference 1997 (education is a most important factor for the achievement of Sustainability). Sustainable Development is the central axis for the eradication of poverty and the protection of the environment (International Conference for Sustainable Development, Johannesburg 2002).

Apart from the reference to the importance of education in the achievement of sustainable development there are also questions raised from the bibliography and literature which are open to various interpretations. These refer not only to the definition of the role of education in the advancement of the cause of sustainability, but also in the definition of the term sustainability itself. We turn to these discussions, because through them we can gain some criteria for the grouping of whatever we have found in our search of the prevalent trends in the teaching of Environmental Sciences in University departments.

As far as sustainability is concerned, there are two different but clear approaches open to it. The one trend negotiates concepts like economic activity technology e.t.c. According to this trend **priority must be given to sustainable economic development without aiming at changing the present economic systems. Technology plays a role as far as the development of individual and industrial activities are concerned, so as to turn towards more economic, sustainable choices.** This trend is characterized as “technocentric” or “mild sustainability”.

The second trend which appears **refers to social justice and sets as a precondition the radical change in the development models which support the without restrictions economic conglomeration. This requires changes to social as well as political systems parallel to the renegotiation of the relationship between man and nature.** This trend is characterized as “strong sustainability”.

Moving on to the negotiation of the role of education in sustainability we can distinguish two basic components. The first characterizes **education as a unique means for the development and advancement of a positive stance and behaviors towards the aims of sustainable development. Such aims are recycling, energy saving, and the reduction of water consumption.** According to Bonnett (2002), this **environmental** component has as a starting point those who know and is then targeted to those who do not know and who must learn. An educational practice is considered

successful if it can lead to measurable changes in behavior, i.e. is able to lead to measurable personal behavior change in terms of recycling, energy conservation e.t.c. We could say that this component combines with the technocentric definition of sustainability, since on the one hand we have as our aim the sustainable economic development and on the other hand the term towards aims similar to those of recycling, water conservation e.t.c.

The second component supports that **through education tomorrow's citizens are being prepared, so as to become able to participate in organizations taking part in decision making regarding environmental matters.** Its central aim is **the development of judgement in citizens with the aim of enabling them to deal with specific practical situations.** There is nothing that is predecided. On the contrary, what is aimed at is the development of a critical stance towards issues of sustainability. According to Bonnett this component is characterized as **democratic**. It fits perfectly with the aims of **“strong sustainability”** which supports social justice and radical change in development models which aim at the unrestricted economic conglomeration.

Findings

The turn of the century found the planet facing growing problems and serious dilemmas. The sensitization being attempted for environmental problems, the design of intervention strategies to solve them or to reduce their effect on everyday life, the target definition which must be set, the development of courses of study and of activities, their basic premise being the sustainable development, are certainly areas which have caused and are causing discussions with exchanges of views and opposing positions.

Clearly, our predefined aim is the sensitization concerning environmental problems. The interaction of factors such as society and technology is very intense and constitutes necessary a cognitive contact with all elements involved in the study and solution of an environmental problem. This is made clear by Gallagher who in 1971 recommending a new aim for science supported that:

“For future citizens in a democratic society the understanding of the interdependence of Science, Technology and Society could be so important as the understanding of concepts and processes in the Physical Sciences.”

Within this framework, the STS programme was defined and enabled the birth of a core of teachers who searched for change in the school sciences. The various developments also brought about changes in the curriculum design with an added aim not simply the examination of the interconnections between society, science and the environment but the preparation of citizens who intervene with their knowledge and participation in government and other decision making agencies. With its development and the component Environment added to it, the STSE was formed, through which the acquisition of a complete picture of science, of technology, of society, of the environment and of the interactive frameworks of all the above was attempted.

An STS or STSE programme has **cognitive** aims (necessary knowledge for the study of problems), **academic** aims (knowledge of epistemology and of sociology of science), **personal** aims (understanding of everyday life) and **social aims** (taking of initiative, forming of political activism for the solution of environmental problems both at local as well as at a wider level.

Regarding higher education what is referred to above makes sense if one studies the areas which are involved in the Environmental Sciences Programmes. A great variety of subjects is present, offered at degree level, elements which may be due to, mainly, the ever-changing definitions that are given to the concept of Environmental Science. As we will see further down our attempt to group the definitions given for the term “Environmental Studies” is not easy as these expressions seem to become complicated.

Definitions of Environmental Science

At a first glance the researcher is able to distinguish varying definitions of the term “Environmental Sciences”. Due to this “confusion” we attempted the grouping of definitions, so as to ascertain trends and to justify choices of study areas in study courses. This attempt led to 6 basic categories following personal interpretation which we gave to the data collected from the web pages.

The dominant definition referred to is “**...understanding of natural, biological and chemical environment with the use of data from other Natural and Social Sciences. The ultimate aim being the protection of resources, the rescue of areas and endangered species, and the reduction of the downgrading of quality of life and of natural resources...**”. Also reference is made for “**...involvement and contact of trainees with multiple themes from various scientific fields such as Economics, Philosophy, Ethics, Management...**”. One finds such definition at universities like: Auckland, Calgary, Evansville (Indiana), Florida International, Northern Kentucky, New South Wales, Sydney, Iowa State University of Science and Technology e.t.c.

But again they talk of “**...interactivity of biosphere, of lithosphere, of hydrosphere, of atmosphere... creating a framework for study and for the solution to problems caused by human activity...**”. In this way, the variety of subject matter under consideration is justified and must be taught within the confines of the specific course or in schools that offer this or a similar kind of degree. Looking at the webpage of the University of Ottawa, Lander University of South California, Florida Institute of Technology, all the above are recognized.

Further on we find a definition which talks of “**...the application of the multiple fields of the Physical Sciences in the solution of environmental problems with the ultimate aim being the efficient management of resources and the sustainable development...**” Such references are found in the programmes of the University of Wisconsin, River Falls and Macquary University Sydney.

In other definitions appearing in the programmes of Cornell University, Ithaca, N.Y., University of Newcastle Upon Tyne, University of Nottingham, University of Western Australia, Plattsburg State University of New York reference is made to the examination of “**...the relationship between organizations and their environments...**” while they clearly state their intention for “**...the creation of a holistic approach to the environmental challenges of the 21st century...**”

Elsewhere, mention is made of “**...the solution of environmental problems and the maintenance as well as the revitalization of urban and natural environment...**” while there are references made to ecology as the foundation of Environmental Science based on the definitions given by E. Haeckel and those after him that “**...it is science that studies the interdependences between the animal and plant communities...**”, “**...the study of plants and animals in relation to their environment...**”.

Completing the attempt for a general grouping of definitions that were found, we will refer to the definition of Environmental Sciences as “**...the processes of identifying, understanding responses to challenges that appear and affect the quality of air, soil and water in various ways...**” as well as reference as an aim “**...of maintenance of Biovariety...**” and “**...recreation of those areas that have been influenced to a large degree...**”. This view becomes clear in the definitions given in the programmes of the College of Agriculture and Life Sciences, Virginia Tech and University of Toledo, Ohio.

Study Courses - Syllabi

The above mentioned constitute consistent criteria for the grouping and classification of all the material which was found during the examination of the web pages of University Faculties that had Environmental Studies Departments. Here an attempt will be made to group the data according to the categories mentioned above so as to ensure that the basic trends prevalent during the period of our investigation become understandable. Simply as a further criterion for the grouping of our data, the study levels of “Postgraduate – Undergraduate” will be used. It must, of course, be pointed out that due to the plethora of material it is not possible to set out every detail.

Beginning the examination of the data from the definition of “mild sustainability” and of the “environmentalistic education”, it must be mentioned that, the objects which aim towards a meaningful turn into measurable sustainable economic activities with the use of technological developments are many Subjects like Biology, Chemistry, Geography, Geology, Physics, Statistics, Chemical Engineering, Anthropology, Mathematics, Computer Use (Introduction to Computing and Networks, Computing I, II, Computer Hardware), Meteorology, Microbiology, Marine Ecology, Issues of World Environmental History, Hydrology, Maintenance and Biodiversity, Natural Resources and Ecological Economics, Oceanography, Climatology, Philosophy and Literature, Botany, Corporate Education in the Environmental Sciences, Water Resources, Protected Area Management, Environmental Economy, Economy – Energy – Environment, Energy and Petroleum, Population Growth and Development, Biotechnology, Principles of Geomorphology, Toxicology, Forest and Soil Ecology, Thermodynamics, Bacteriology, Biochemistry, Landscape Ecology, Environmental Studies, Information Technology (I.T.), Ground Sciences, Digital Cartography, Mine Studies, Geotectonics, Applied Mechanics, Management of Revert areas, Agriculture, Chemistry, Map Making, and Electronic Data Control, Beach Management, are only some of the many knowledge fields to be pointed at. In most courses of study they are either grouped into categories that have to be completed with specific grades or in departments comprised solely of Environmental Sciences subjects which make up sub-directions that complement a framework of general education subjects. Not only at undergraduate level but also at postgraduate level apart from the subjects which are taught in the form of lectures, they include a lot of field research in a variety of areas, as well as the compulsory project / thesis on related subjects.

A first observation of the object offered brings up very clearly the term “mild sustainability”, environmentalist education. More specifically, the whole attempt is centered on to the provision of knowledge – more general as well as more specialized- so as to prepare with knowledge enough teaching staff as well as organizational staff with the aim being the turn towards more sustainable behaviors without radical changes in the forms of economic development.

So apart from the contact with the relevant knowledge objectives what is also required are skills in the use of new technologies and the continually new emerging achievements of Science, so that aims such as production and use of renewable sources / forms of energy, water saving e.t.c. can become achievable. In the first place, topics like Environmental Ethics, Society and Environment, Environmental Legislation, Politics, Sociology, Demography, Environmental Sociology, Environmental Policy, Environmental Economics, Social Ecology e.t.c. are present in the endless list of elective subjects without, apart from a very few exceptions, forming a distinct sub – direction or in any case without being seen as objects of special importance, something we would consider to be the case if students were to have these subjects on their compulsory subject list.

Regarding “strong sustainability” and democratic education what is aimed at is the engagement of students in practical problems of local or more general nature in order to prepare as best we can tomorrow’s citizens in decision making processes. Some reference is made to this framework by some syllabi, especially at postgraduate level that make it compulsory for all students to participate in a case study related to a multithematic environmental issue of world or local interest.

Also, in relation to these definitions we found syllabi items that talk about: Nuclear Energy Policy, Biology of Sustainability: Wild Crowd Management, Sustainable Production in tropical forests, Environmental Policy and Management: Government Policy for the agricultural regions of the United States, Urban and non-urban planning, Urban and non-urban Economy, Fiscal and Economic Policy, Environmental Philosophy and Politics, Resource Economics, Economics and Management Planning of Fertile Regions, Environmental Law, Economics and Ethics of Sustainable Development, Environmental Economy and Recourses, Society and Environment, Humanity and Social Sciences: Work Management, Economy of Globalization, Technology, Society and Environment since 1800, Legal Content of Environmental Issues, Women in Science and Mechanics, Recourse Maintenance, Natural Recourse Management, Environmental Policy of Canada, Introduction to Social Ecology. Legal regulatory frameworks in Environmental Management, Biodiversity and Legislation, Economic Policy and Environment in the U.S.A. and in South Asia, Environment Science, Water Resources. Also, in some of the departments under investigation there are subdirections within the Social Sciences: Environmental Planning, Environmental Policy and Economics of Natural Recourses, Contemporary Science and Human Values, or in the Humanities (Environmental Ethics, Environment and Culture, Population and Society, Man and Environment, Political Ecology, Anthropological Demography, Urban Environmental History, Climate – Culture and Climatic History, Environment and Minority Issues etc.

In examining Environmental Sciences programmes at postgraduate level we come across a larger degree of evidence that supports an existence of an aim towards the preparation of future citizens for participatory decision making through institutionalized agencies of local, national and world interest. For example, we refer to the study carried out by a group of postgraduate students and their subsequent publication of their documented report to a session – simulation of the local Upper House of Parliament which related to multithematic issues like use of Genetically Modified Products: at University of Santa Barbara, Donald Bren School of Environmental Science and Management, predicting the reaction of species to climatic change, analyzing Population Viability, Total Landscape Reconstruction programme, Water Recourse Management, e.t.c. Also, special attention is also paid to the economy – management factor aiming at similar subjects through practice they would create a solid fundamental basis on issues of economic and quality Analysis of Policy, which will prove important in issues of recourse management and policy development. Moving further we discover thematic issues pertaining to the practice in the use of tools, data analysis for the solution of problems of environmental structure. The students have at their disposal data on one of the topics and are expected to come up with quality questions pertaining to the criteria set out for decision making, to select and use analytical tools for the inclusion of all the parameters that enter into a problem and to adequately explain the results of its analysis.

While we are all talking about Environmental Policies, about recommendations for solutions and about decision making, we are hardly occupied with the structure, the right, the functional and the ways of decision making by institutions or agencies responsible for them. The preparation and knowledge about their function certainly strengthens ones knowledge base. Participation and successful evaluation, in the subject presuppose three basic elements. First, every student must, with his / her teacher or with other fellow students, participate in at least one case study. Second, everyone who follows the subject must, with the end of the fifth week of lectures, turn to the analysis of a government diagram describing its basic characteristics. Third, the writing up of a paper, after the conclusion of lectures, analyzing a system of policy implementation. In this report, what must, at least, be included is: the system structure, its application, its efficiency and the change it is able to bring about.

A basic element for the classification of all the above mentioned data on the “strong sustainability” side, which identifies itself with democratic education is multiple target setting such as: A.Knowledge upgrading of students on the theme, B.Promotion of the multi-thematic nature of Environmental Problems, C.Practice in group work processes of theme analysis, D.Practice in professional skills: Listening, Communication, Presentation of position, E. Get aquatinted with the

University Community. Under this umbrella we consider that they are leaning towards the second direction.

Conclusions

As a first comment, it must be pointed out that the multiple approaches to the concepts that concern us are somewhat more than obvious rendering the topic / subject of Environmental Sciences, a field of conflict between trends, thus, minimizing, to a large degree, the effectiveness of education around it. Moreover, the aims that are set in the definition of “**strong sustainability**” and of “**democratic education**” seem, at first observation of the “workings” in all the conferences, the Environmental Fora and the meeting of the powerful of the world, that demand multiple economic and political “backpadding” and “readjustment” of the aims which a relatively liberal economy sets.

Certainly, both the attempt to investigate the contents of courses of study, the methodologies, the workshop planning and the ways of evaluation have not been complete though this very brief presentation of a small sample of the Environmental Sciences in Tertiary Education worldwide for many and various reasons. The more basic of those reasons is the absence of references to those Universities whose sites did not include an English version. By and large we consider that from what we have found in them as well, the specific sector had enough interesting elements which confirm trends rather than exhaust the topic which we are not sure it can be done.

As far as the trends are concerned what has been confirmed is what we supported at the beginning for the existence of “confusion” in all teaching stages of the Environmental Sciences either as a basic programme or as a part of a more general course (i.e. Teaching Development), “confusion” which mainly derives from the difficulty which is present in the definition of the term. In the first part 23 University Department definitions were grouped as well as 3 organization definitions. The attempt at grouping was made to try and make clear, first to ourselves, what it is, what it contains and what is the aim of the subject area. Of course, once one moves on to the study of what is contained in the study courses and the syllabi, one realizes easily that every University Department includes in these programmes a variety of subjects depending on how it defines the study area in question. There seems to be a dominant tendency to examine as many sectors as possible, where, workshops, lectures, field research and project papers aim at informing about all those factors that can influence the living and non living environment of a landscape, of an ecosystem.

Another important conclusion that we have come to in our brief pursuit of trying to understand the topic at hand is the fact that, in general, approaches through a legislating, social and ethical perspective of environmental problems and issues are avoided. Sensitive issues that have emerged do not constitute a first priority. Only a few of the departments studied pose issues of legislated regulation, management of resources, of ethics and of values. Even fewer studies have been carried out in such issues. We are somewhat apprehensive in concluding that this is connected to the origin of the Universities studied or it forms part of the identity which each institution stands for. Continuing to maintain our apprehension, our thoughts are guided towards views that we have been hearing for some time now, and which seem to be held and supported by academics and others that finally, the pursuit of most agencies does not enter into deeper issues of Environmental Sciences and remains superficial. An example: we agree that Mineralogy is good but let us find an answer to the question of whether genetically modified products are a curse for the developed world or a blessing for the developing world, so as to enable it to escape from the bonds of famine. Despite our involvement in the analysis of the study programmes of Environmental Sciences, we do not yet feel sufficiently equipped to answer such a question which is a part of a larger list of similar if not harder questions begging for an answer.

Near the end of the introduction we referred to the S.T.S. and S.T.S.E. programmes, aiming to create a substratum for a better approach to the multitude of issues that are related to the framework of Environmental Sciences. What we have concluded is that only through the examination of problems and the implication of the factors of “Society, Environment, Technology and Science”

will all the aims of Education in the Physical Sciences be realized. Moreover, the multiplicity of the aims of Education of Physical Sciences demands not only knowledge and skills but also values and a sense of responsibility as well as the will for participation in the planning which in reversing the course requires “literate” citizens who must possess all of the above underlined qualities. Therefore, the holistic approach is a one way road in order to deal effectively with these issues.

In concluding, we believe that our choice and involvement with such a topic has benefited us knowledge wise as we gained a satisfactory picture of the scientific field “Environmental Sciences” which is developing with growing dynamism and is continuously improving. Moreover, what has been of great benefit to us was the methodology of our research as we did not simply contain ourselves in the collection and distribution of the material, but we attempted, through our definite knowledge imperfections, to qualitatively analyze our data and to extract some preliminary conclusions from them. These conclusions may be useful for future work in this important area of human endeavour.

References

Emberlin J.C. (2002), *Introduction to Ecology*, Typothito Publishing G. Dardanos Athens

Liarakou, G., Flogaitis, E. (2007), *From Environmental Education to Education for Sustainable Development*, Nisos Publishing Athens

Skordoulis, K. (2002), “Environmental Philosophy and Education” Notes

Skordoulis, K., Sotirakou, M. (2005), *Environment: Science and Education*, Leader Books Publishing Athens

Tyler Miller G. Jr. (1996), *Living in the Environment*, 9th Ed Wadsworth Publishing Company, Greek Version ION Publishing

An analysis of the Effectiveness of Environmental Education Centres: The views of local coordinators for environmental education

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Abstract

A growing number of higher education institutions is trying to integrate environmental education within the new orientation towards education for sustainability. The study of the effectiveness and the way formal education is provided can constitute a frame for their teaching, research and extension programs.

The Environmental Education Centres were founded in Greece in 1993 and their main activities are: educating students by carrying out environmental education projects, training educators on environmental education topics, coordinating the environmental education networks and the creation of educational material.

This article refers to the effectiveness of environmental education centres the way it is comprehended by local environmental education coordinators. Conclusions and proposals are discussed with their purpose being the efficacy in delivering education for sustainability in higher education.

The viewpoints of environmental education local coordinators were the object of a Pan-Hellenic research, which has been conducted for this purpose and its results are presented here.

Keywords:

Environmental education, institutional framework, Environmental Education Centers, education for sustainability

1. Introduction

After putting in place the Decade of Education for Sustainable Development (DESD) by the United Nations in December 2002, under the leadership of UNESCO, all levels of formal education tried to integrate the principles, values, and practices of sustainable development into their educational programs. Particular reference should be made to higher education which can contribute to the passage from knowledge and conscience to the necessary participation as a result of long-time effort and every day process (Nikolaou, 2005)

Particular emphasis should be given to the education of teachers. Certainly, the factor of education is not the one that would, alone, give the “solution” to problems related to sustainable development. Other factors such as culture, language, and the values with which each society has developed or can develop in the future should also be taken into consideration. (Kostoula-Makraki & Makrakis, 2006)

Universities need to play an important role in the context of environmental education (EE) and generally in Education for Sustainable Development (ESD). This requires the readjustment of their structures to educational, methodological, and research frames as well to interdisciplinary programs with environmental orientation that should be integrated in their programmes (Katsikis & Zachariou, 2000; Kimionis, 1995)

The study of the effectiveness and the way formal education is provided can constitute a frame for their teaching, research and extension programs.

Environmental education in Greek schools, after the Thessalonica International Conference in 1997, which highlighted the role of education and public awareness for achieving sustainability, has been reoriented to the principles of Education for Sustainable Development (Circular G2/4881/98 M.E.R.A.)

Although environmental education was introduced into Greek Schools more than 25 years ago, it seems that many obstacles still remain, including scepticism on the objectives imposed by the state. There are worries, however, in relation to the existence of the necessary structures, the institutional and legislative frame, and the conditions for its further development and proliferation.

According to recent surveys, mainly during the last decade, important steps towards the promotion of environmental education have been made: e.g. creating the institution of local Coordinators for environmental education in each regional Directorate of Education, integrating environmental education in the curriculum, creating Environmental Education Centres. However, important problems still remain and they generally function as an obstacle to the spreading and application of environmental education programs in schools (Kimionis & Michaelides, 2005).

The Environmental Education Centres were founded in Greece in 1993; their main activities are: educating students by carrying out environmental education projects, training educators on environmental education topics, coordination of environmental education networks and the creation of educational material (Ministerial Decision 57905/Γ2/ 4-6-2002).

But what is the effectiveness of Environmental Education Centres (EECs) on their four main sectors of responsibility given that they are in operation for more than one decade? A first answer to the above question could be given from an analysis of the answers of local coordinators for environmental education, as they result from this Pan-Hellenic research.

2. Methodology

The current research was conducted through a questionnaire, which was sent to all 64 environmental education coordinators in Secondary Education Directorates of Greece, by e-mail or fax, from December 2004 until April 2005. 41 answered, many after repeated phone calls and inquiries. This is by itself remarkable and needs further investigation.

3. Results

From the 41 returned questionnaires 26 (63.4%) were from men and 15 (36.6%) from women.

The highest percentage (51.2%) of Coordinators who answered, have been working as teachers for 20-30 years, while 41.5% have had 10-20 years of teaching. 2.4% have been working 5-10 years and 4.9% have been working 30 years or more.

The duration of service at the position of environmental education coordinators is presented in table I. As that table shows, there is a high percentage of Coordinators with 2 or more periods of service in this position (every period is for a term of 3 years). There is also a percentage continuing to hold this position (14 years of service) from the introduction of the institution of the above responsibility. Consequently, it can be considered that the sample of the people participating in the research possess enough experience on the subjects concerning the course and application of environmental education programs.

Table I: Years of holding the position of Environmental Education Coordinator

years	Frequency	Percent %
<= 2	14	34.1
3 - 5	5	12.2
6 - 8	7	17.1
9 - 11	9	22.0
12 - 14	6	14.6
Total	41	100.0

All of the coordinators have, according to their answers, visited EECs; many of them have visited more than one (table II). They have acquired direct experience during their visits and have shaped personal perceptions for them.

Table II: Number of EECs that Environmental Education Coordinators have visited

Number of EECs	Frequency	Percent %
0	1	2.4
1	3	7.3
2	3	7.3
3	5	12.2
4	5	12.2
5	5	12.2
6	6	14.6
7	5	12.2
8	4	9.8
10	4	9.8
Total	41	100.0

The most frequent reasons, for which they visit EECs, are “to attend training seminars” and “to participate in work meetings in EECs”

Table III: Reasons for which Environmental Education Coordinators visit EECs

	Attendance of training seminars		Attendance of EE projects in EEC with students		work meetings		By interest	
	Frequency	Valid Percent %	Frequency	Valid Percent %	Frequency	Valid Percent %	Frequency	Valid Percent %
No	4	9.8	20	50.0	6	14.6	21	52.5
Yes	37	90.2	20	50.0	35	85.4	19	47.5
Total	41	100.0	40	100.0	41	100.0	40	100.0
no answer	0		1		0		1	
Total	41		41		41		41	

The majority of them consider the existence of EECs necessary (table IV). Indeed, the EECs can function as a supportive mechanism to schools, as well as cover many aspects of application of Environmental Education in Greece.

Table IV: The necessity of the existence of EECs

	Frequency	Percent %	Valid Percent %
Very much	12	29.3	30.0
Very	21	51.2	52.5
A Little	5	12.2	12.5
Very little	1	2.4	2.5
By no means	1	2.4	2.5
Total	40	97.6	100.0
no answer	1	2.4	
Total	41	100.0	

On the contrary, a relatively small percentage considers (table V) that EECs really gave a new impulse to the application of environmental education goals in our country.

Table V: Contribution of EECs to the application of EE programs

Question: Do you believe that the institution of EEC gives new impulse in the application of EE in Greece?			
	Frequency	Percent %	Valid Percent %
Very much	8	19.5	20.5
Very	16	39.0	41.0
A Little	14	34.1	35.9
Very little	1	2.4	2.6
By no means	39	95.1	100.0
Total	2	4.9	
no answer	41	100.0	

The desperation and disappointment of coordinators is reflected intensely in their answers (table VI) to the question regarding the contribution of the state towards the application of environmental education programs.

Table VI: The intention of the state

Do you consider that the state...	Frequency	Percent
encourages the application of Environmental Education	16	39.0
is indifferent for as the application of Environmental Education	18	43.9
impedes the application of Environmental Education	7	17.1
Total	41	100.0

Coordinators consider also that the existing institutional framework is from "a little" to "by no means" sufficient, and therefore they cannot complete the objectives of their mission based on such a frame (table VII). Only 7.3% consider that is "very sufficient" and 2.4% that it is "Very much sufficient", while 2 individuals did not answer.

Table VII: The institutional framework with regard to Environmental Education Coordinators

	Frequency	Percent	Valid Percent
Very much	1	2.4	2.6
Very	3	7.3	7.7
A Little	25	61.0	64.1
Very little	7	17.1	17.9
By no means	3	7.3	7.7
Total	39	95.1	100.0
Missing value	2	4.9	
Total	41	100.0	

The collaboration and the reciprocal support of work of local coordinators for environmental education and EECs constitute a necessary and basic condition for the application of environmental education programs. As it is known these subjects are regulated by the Ministerial Decisions and in the circulars that concern in the operation of the two sides. However, only 59% of Local Coordinators (table VIII) believe that the EECs "support" the local environmental education coordinators in their work, while an important percentage of 30.8% answered "no" and the rest 10.3% avoided answering it, marking "I do not know".

Table VIII: Support of Local Environmental Education Coordinators by EECs

Question: Do you believe that the EEC support the work of EE Coordinators

	Frequency	Percent %	Valid Percent %
Yes	23	56.1	59.0
No	12	29.3	30.8
I don't know	4	9.8	10.3
Total	39	95.1	100.0
no answer	2	4.9	
Total	41	100.0	

On the contrary, a percentage of 82.1% believes that the coordinators support EECs (table IX). It appears that the necessary “reciprocity” does not exist in the support and mutualism between coordinators and EECs, while they have a common aim: the promotion and support of environmental education.

Table IX: Support of EECs by Local Environmental Education Coordinators

Question: Do you believe that the Local Coordinators support the work of EEC?

	Frequency	Percent %	Valid Percent %
Yes	32	78.0	82.1
No	2	4.9	5.1
I don't know	5	12.2	12.8
Total	39	95.1	100.0
no answer	2	2.9	
Total	41	100.0	

In the question: “Do EECs support the work of teachers” the answers, that the coordinators gave, present the results that appear in table X. Even if bigger percentage (40%) was assembled in the answer “A lot”, it would be considered satisfactory. The positive answers (“very” and “too much”) give a percentage of 60%. This means, that an important percentage of coordinators believes that EECs do not support, at least as long as it would be supposed, the work of teachers in environmental education. Those who answered “a little”, “very little” or “by no means” (even though they are fewer) should not be underestimated, as a total of 40% “dispute” the support of school EE teachers by EECs. The state has provided support to EECs and, therefore, expects results from them, as among others, a basic mission of EECs is the support of Environmental Education projects in schools.

Table X: Support of School Teachers by EECs

Question: Do you believe that the EEC support the school EE teachers for currying out the EE projects in their schools?;

	Frequency	Percent %	Valid Percent %
Very much	8	19.5	20.0
Very	16	39.0	40.0
A Little	11	26.8	27.5
Very little	4	9.8	10.0
By no means	1	2.4	2.5
Total	40	97.6	100.0
no answer	1	2.4	
Total	41	100.0	

The percentages from the answers in the three tables as presented above (table VIII, table IX and table X) create an intense scepticism on the operation of EECs and their relationship with the Local Environmental Education Coordinators or with the school teachers. This, however, could be the subject of a separate research. But in the question: “how do the coordinators see the contribution of EECs, regarding the education of visiting students, the training of teachers that participate in their

seminars, the creation of educational material and the co-ordination of EE networks, the answers are not so encouraging (table XI). 57.5% of them consider the contribution of EECs “satisfactory” as far as the education of students is concerned and 42.5%, a not negligible percentage, characterize it as “Mediocre”. For the contribution of EECs a percentage of 53.7% characterize the training of teachers that participate in the seminars as “Mediocre”. 55% characterize the creation of educational material “Mediocre” and the majority (64.1%), consider the contribution of EECs to the co-ordination of EE networks “Mediocre”.

Table XI: The contribution of EECs

Question: How do you see up-to-now contribution of EEC to:								
The education of students that visits them								
Training of teachers that participates in their seminars								
Creation of educational material								
Co-ordination of EE networks								
	Education of students that visits them		Co-ordination of EE networks		Creation of educational material		Training of teachers that participates in their seminars	
	Frequency	Valid Percent %	Frequency	Valid Percent %	Frequency	Valid Percent %	Frequency	Valid Percent %
Sufficient	23	57.5	17	42.5	15	37.5	12	30.8
Mediocre	17	42.5	22	55.0	22	55.0	25	64.1
Poor	0	0.0	1	2.5	3	7.5	2	5.1
Total	40	100.0	40	100.0	40	100.0	39	100.0
no answer	1		1		1		2	
Total	41		41		41		41	

More optimistic percentages exist in the answers to the question: “*In what degree do you consider that the EEC can correspond to their main axes of operation?*” (table XII). For the education of students they range from “A lot” (51.3%) until “Too much” (25.6%), for the training of teachers from “Very” (48.7%) until “Too much” (30.8%). In lower percentages, however, are the answers regarding the response of EECs in the creation of material and in the research on environmental subjects.

Table XII: Response of EECs to their main axes of operation

Question: In who degree you consider that the EEC can correspond in their main axes of operation:								
In the education of students								
In the training of teachers								
In the creation of educational material								
In the research on environmental subjects								
	education of students		training of teachers		creation of educational material		research in environmental subjects	
	Frequency	Valid Percent %	Frequency	Valid Percent %	Frequency	Valid Percent %	Frequency	Valid Percent %
Verv much	10	25.6	12	30.8	10	25.6	8	21.1
Verv	20	51.3	19	48.7	15	38.5	9	23.7
A Little	8	20.5	5	12.8	12	30.8	15	39.5
Very little	1	2.6	3	7.7	2	5.1	4	10.5
Bv no means	0	0	0	0	0	0	2	5.3
Total	39	100.0	39	100.0	39	100.0	38	100.0
no answer	2		2		2		3	
Total	41		41		41		41	

In the question: “*Do you believe that the institutional frame gives the essential basis for the realisation of the work of EECs?*” (table XIII) the positive answers (“Very” 47.1% and “Too much” 11.8%) assemble a percentage of 58.9%. Only 35.3% are reported in the choice “little”. On the contrary, in the corresponding question (table VII): “*is the existing institutional frame sufficient with regard to the local EE coordinators, so that it can execute its mission?*”, most answers were “a Little”. We see, of course, that a differentiation between the answers of these two questions does exist and estimates that the institutional frame of environmental education is more suitable to EECs than to them. These estimations confirm (table VI) that a general institutional problem exists in

environmental education, which creates contradictions and leads to juxtapositions between environmental education coordinators and EECs.

Table XIII: The institutional framework regarding EECs

Question: <i>Do you believe that the institutional frame gives the essential basis for the realisation of the work of EEC?</i>			
	Frequency	Percent %	Valid Percent %
Very much	4	29.3	11.8
Very	16	43.9	47.1
A Little	12	14.6	35.3
Very little	2	4.9	5.9
By no means	0	0	0
Total	34	92.7	100.0
no answer	7	17.1	
Total	41	100.0	

In any case, despite the contestation of the effectiveness of EECs, most coordinators, show in their answers (table XIV) that the existence of EECs is a “positive development” for environmental education in Greece.

Table XIV: EECs as a positive development for EE in Greece

See the existence of EEC as a positive development for the EE in Greece?			
	Frequency	Percent %	Valid Percent %
Very much	12	29.3	31.6
Very	18	43.9	47.4
A Little	6	14.6	15.8
Very little	2	4.9	5.3
By no means	0	0	0
Total	38	92.7	100.0
no answer	3	7.3	
Total	41	100.0	

4. Conclusions

The answers of the local (regional) coordinators show a disappointment and a dispute towards the effectiveness of EECs, at least in certain sectors.

They consider that the existence and operation of EECs are a necessity and that these centres could contribute to the successful application of environmental education programs in Greece. Furthermore, they believe that EECs could respond to their mission and that they constitute a positive turn for environmental education programs.

However, we see that an intense scepticism and contestation exists regarding the up-to-now contribution of EECs to the education of students, the co-ordination of EE networks, the creation of educational material and especially to the training of teachers. They consider that the support of EECs to local coordinators is not as powerful as theirs to the centres.

The institutional framework does not seem sufficient neither to EECs, nor to the coordinators of environmental education.

Further training is one of the most important factors in order to support environmental education programs. Its importance is pointed out by many researchers (Flogaeti, 1993; Kimionis, 1995; Michaelides & Kimionis, 2000b; Michaelides, Kimionis & Charalambidou, 2002).

The upgrading of EECs staff, by choosing them on the basis of strict criteria from special councils, and not from administrative councils, in which personnel of universities will also participate, is most likely to ensure higher quality in the operation of EECs.

Consequently, the reformation of the institutional framework in order to take into account the past experiences in the field of environmental education, the viewpoints of the teachers and of the local Coordinators, as well as that of the staff of EECs, seems necessary.

The connection of the activities of centres with the universities, especially with the pedagogic faculties, but also those whose object is the environment, would be reciprocally beneficial. The universities could use EECs for experimental teaching, but also as a field of research on environmental issues.

The planning and organisation of instructional interdisciplinary programs in the universities and their connection with the environmental education programs offered by the centres would upgrade the quality of education which is offered for purposes of sustainable development.

References

Circular G2/4881/1998, Ministry of Educational & Religion Affairs.

Flogaeti E., 1993, "*Environmental Education*", Athens, Hellinikes Panepistimiakes Ekdoseis, pp.211-230. (in Greek)

Katsikis A., Zachariou A., 2000, "The Contribution of Interdisciplinary Study Programmes of Universities to the upgrade of the Institution of Environmental Education", in: "*Congress Proceedings "Environmental Education in the Content of 21st Century: Prospects and Possibilities*", Papadimitriou V. (ed), Larissa, pp. 181-187.

Kimionis G., "*Geographic Informative Systems as Instructive Tools in the Environmental Education*", Postgraduate Thesis, Department of Primary Education University Crete, Rethymno, 1995. (in Greek)

Kimionis G., Michaelides P., (2005), "Environmental Education in Greek Schools, The Viewpoint of Local Coordinators" in: "*Proceedings of the 2nd International Conference: Hands-on Science – Science in a Changing Education*", Rethymno, pp 196-200.

Kostoula-Makraki N.& Makrakis V., 2006, "*Intercultural and Education for a Sustainable Future*", e-Media, Rethymno. (in Greek)

Michaelides P., Kimionis G., 2000b, "Participation of Students in Optional Programs of Environmental Education Projects", in: "*Congress Proceedings "Environmental Education in the Content of 21st Century: Prospects and Possibilities*", Papadimitriou V. (ed), Larissa, pp. 111-119. (in Greek)

Michaelides P., Kimionis G., Charalambidou F., 2002, "The Participation of Pupils in Environmental Awareness Activities", in "*3rd Pan-Hellenic Congress in Didactics of Natural Sciences and Application of New Technologies in the Education*" Rethymno 9-11/5/2002", pp 108. (in Greek)

Ministerial Decision 57905/Γ2/ 4-6-2002 Ministry of Educational & Religion Affairs.

Nikolaou K., 2005, "Open Higher Education and Environmental Education", in "*Environmental Education*", (ed) Georgopoulos Al., Gutenberg, Athens, pp. 373-389. (in Greek).

International trends in sustainability in higher education: From theory to action

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Abstract

Much has been said and written about the subject issue of sustainable development. Since the earlier days with the publication of “Implementing Sustainable Development at University Level” (Leal Filho, Padgham, MacDermott, 1996) and as documented in more recent publications such as “Teaching Sustainability at Universities: towards curriculum greening” (Leal Filho 2002) or the “Handbook of Sustainability Research” (Leal Filho 2005), there is no paucity of publications tackling this issue on an international basis.

A trend that is nonetheless conspicuous is related to the fact that most of the on-going works, which are documented in the specialised literature, takes place in the circuit Europe-North America-Australasia (see “Sustainability in the Australasian University Context” by Leal Filho and Carpenter, 2006, for example). The north-south gap, which is also seen in other areas (e.g. Shayo, 1986) is clear and this is a first fact that can be mentioned on this review of international trends.

This paper describes some of the international trends related to sustainability in higher education and outlines some of the ways it may be converted from theory to practice.

Keywords:

Sustainability - higher education- universities – theory- action

A further element seen when one reviews the current state of affairs of the sustainability debate at an international level is the fact that it is often defined as perceived as

“The ability of one generation to meet its own needs while not compromising the ability of future generations to meet their needs.” as outlined in “Our Common Future” 20 years ago (WCED 1987). Although this is by no means wrong and the definition summarises what sustainability is all about, the definition is by no means comprehensive. This is for the following reasons:

- sustainability is no longer seen as a vague concept or issue, but as a matter of global and real concern. This degree of evolution has been especially visible in Europe, where the subject matter of sustainable development is one of the scientific issues listed in Europe’s Framework Programmes (FPs). Both in FP6 (2000-2006) and now in FP7 (2007-2013), several hundred million Euros are earmarked to sustainability research, whose topics spread across many (traditional) fields;
- sustainability as an “umbrella” topic has generated many ramifications. The adjective “sustainable” is now applied to a wide range of contexts such as transport (sustainable

transport), energy use or systems among many others. Once special “branch” as one may call the various ramifications, is for example “Sustainable Design”, which is a design approach which creates balanced relationships between buildings, people and their environment, in order to insure their continued existence into the future. “Sustainable Design” as an expression is increasingly being used by the design profession as part of the current movement in the building industry towards providing sustainable practices and products.

- although Universities, Colleges and other tertiary education and research bodies have a role to play in promoting sustainability in areas such as environmental law and policy, the need for cross-disciplinary environmental learning as a means to deliver the WCED definition is often ignored. This requires a shift towards making sustainability and environmental concerns a central theme or at least a cross-cutting aspect of higher education programmes.

Critically speaking, most of the current programmes aimed at introducing sustainability elements in university life, seen from an international perspective, often include one or more of the following elements:

1. Institutional adaptation of current/future site

Factors such as solar orientation, wind patterns, local topography, vegetation, water and soils are evaluated for modernising existing sites or building new ones in terms of both energy use and ecological impact. Oberlin College in the US offers a good example of how much may be achieved by such an approach in planning stages.

2. Use of renewable sources of energy & materials

Renewable resources are ones which will not be depleted over time, including solar light and energy, use of wood harvested from sustainable managed sources and building materials which are manufactured with agricultural products or raw materials in abundant supply.

3. Recycling or reuse of materials & wastes

Examples include use of materials containing recycled products (post consumer or post industrial), salvage and reuse or recycling of demolished building components, harvesting and reuse of rainwater and on-site purification and reuse of sewage or greywater.

4. Integration of building systems

This refers to creating a synergistic relationship between building systems, such as that between the exterior envelope and heating/cooling systems. Much greater energy efficiency can be achieved when these systems are working together, rather than in isolation.

5. Curriculum greening

Introduction of sustainability principles into university teaching, learning and research programmes.

Other items could be added to the above list. But from all above elements, curriculum greening is often the less developed one, for one reason: although it is on the one hand relatively easy to convince administrations about the value of “green buildings”, when it comes to curriculum greening and the incorporation of sustainability elements in teaching and research, things often become a little more complicated. This is nothing out of the ordinary, since the transfer of information from theory to practice in the academic world is not an easy task (Candy and Crebert, 1991). Part of the problem which is specific to sustainability lies on the fact that efforts towards

curriculum greening are often directed by a few enthusiasts member of staff (faculty). In only a handful of universities can one unambiguously affirm that curriculum greening is part of the institutional philosophy. More efforts in this direction are needed.

This state of affairs suggests that what is perhaps needed today is a kind of “modernisation” of the concept of sustainability. In order to yield the impacts and results it intends to, it is important that sustainability be seen as an approach, as a method and as a way of thinking. Indeed, a re-definition of the concept of sustainable development to incorporate these elements in a more conspicuous way may be advisable, so that it may do justice to the challenges of modern times.

Sustainability in university thinking and practice: some problems

It is widely known that the spectrum of activities which universities need to undertake in order to achieve the overall objective of embedding sustainability into university thinking, is wide. Indeed, there are so many variables to be considered and so many matters to be taken into account, that the holistic inclusion of sustainability in university thinking is considered as being too tall an order. It does not need to do so.

Prior to listing what can be done in order to change the current state of affairs, it is useful to look at the problems which have until now hindered progress in respect of implementing sustainability at institutions of higher education. Some of the results of an on-going survey involving a sample of senior members of staff (e.g. Rectors, Vice-Rectors, Deans and Heads of Department in 24 European countries and aimed at assessing changes in respect of the perception of senior university faculty/staff about sustainability, and which draws from the experiences gathered from a previous study undertaken in 1999/2000, are outlined in Table 1. It shows that the common problems are still there, although their frequency has changed.

Table 1- Evolution in the perception of sustainability

Problem stated by interviewees	Frequency of responses 1999/2000	Frequency of responses 2007*
Sustainability is too abstract	37%	23%
Sustainability is too broad a concept	40%	31%
The issue is not important	16%	7%
It bears little links with the curriculum	12%	9%

(*) Stands: January 2007

N= 126

A fundamental problem that is seen and which needs to be urgently tackled is thus a problem of **perception**. Although the surveys performed in 1999/2000 and 2006/2007 document the fact that some marginal improvements in perceptions are seen, it is important that current thinking evolves in order to allow a wider application of sustainability principles into university life and day-to-day practice. In an ideal scenario, which may take many years to be realised, sustainability thinking may evolve in the future in a number of ways, as outlined in Table 2.

Table 2- Possible directions in the evolution of sustainability thinking

Issue	Current state of affairs	Possible trends in the future
Sustainability Emphasis	Predominantly on environmental matters	Balanced focus on environmental, social, economic issues
Participation	In many universities a few players from specific areas	Teams working together
Concrete applicability	Largely seen as a theoretical field	Regarded as a field where concrete action emerges
Links with the curriculum	Perceived as marginal	Regarded as intrinsic to learning
Relevance to human and natural sciences	Predominantly social bias	Balanced emphasis

One can see from the above analysis that human resource development, education and awareness raising of faculty/staff are needed. Furthermore it is important to undertake efforts, perhaps by means of partnerships which have been a proven approach (Pacheco, 2003) aimed at improving coordination, mobilising and strengthening the role of departments and certain courses, promoting intra and inter-institutional cooperation, and sharing experiences.

Conclusions

This paper has tried to demonstrate the fact that, in order to advance the cause of sustainability in higher education, two main elements are needed. Firstly, it is necessary to work towards a modernisation in the ways we define, perceive and act in the field of sustainability. Its ramifications (environmental, social, economic, political) need to be more clearly acknowledged and knowledge about them should be incorporated into university practice. Secondly, sustainability thinking has to move on from a passive, subject-based affair, towards an applied nature, making the connections with what is learned and taught, with a balanced subject emphasis and be complemented with an interdisciplinary context.

A change in thinking is hence needed.

References

Candy, P.C. and Crebert, R.G. (1991) Ivory tower to concrete jungle: the difficult transition from the academy to the workplace as learning environments. *The Journal of Higher Education*, Vol 62, No 5, pp. 570-592.

Leal Filho, W D S, Padgham, J and MacDermott, F D J (eds) (1996) *Implementing Sustainable Development at University Level*. CRE, Geneva.

Leal Filho, W. (ed) (2002) *Teaching Sustainability at Universities: towards curriculum greening*. Peter Lang Scientific Publishers, Frankfurt.

Leal Filho, W. (ed) (2005) *Handbook of Sustainability Research*. Peter Lang Scientific Publishers, Frankfurt.

Leal Filho, W. Carpenter, D. (eds) (2006) *Sustainability in the Australasian University Context*. ISBN 3631552726. Peter Lang Scientific Publishers, Frankfurt.

Pacheco, P.D. (2003) *Partnering Globally: Connecting People, Places, and Ideas for Sustainable Development*. In, 7th International Conference on Technology Policy and Innovation, Monterrey 2003, TEC de Monterrey, Monterrey, MX

Shayo, L.K. (1986) *The transfer of science and technology between developed and developing countries through co-operation of institutions of higher Learning*. In *Higher Education in Europe*, Vol 11, No 3, pp.19- 23.

World Commission on Environment and Development (WCED) (1987) *Our Common Future*. Oxford University Press, Oxford

Ideology, epistemology and pedagogy: Barriers and potential drivers to environmental education for initial teacher education students with focus on the Primary Science National Curriculum for England and Wales

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Abstract

The National Curriculum for England and Wales was influenced in its development by political ideology and epistemological assumptions, which have had significant implications for primary pedagogical practice and experiences of primary pupils. Although environmental education was identified a cross-curricular theme, it has been marginalised in many schools. The paper discusses the reasons for these developments and presents a model of teacher education based on constructivist principles that supports environmental education, with a critique of how the curriculum needs to develop to promote sustainability.

Keywords:

Environmental Education, Sustainability, National Curriculum, Science Education, Political Ideology, Epistemology, Constructivist Pedagogy

Introduction

Environmental protection and sustainability has emerged on the international political agenda with high priority as the damaging effects of human activity on the environment become increasingly evident, as highlighted in the Stern Report (HM Treasury, 2007) and a flow of research and media reports of environmental issues, in particular the progressively evident effects of global warming. Environmental education is clearly important in supporting positive action to maintain the environment, yet it remains an underdeveloped area in primary schools, in spite of it being a cross-curricular theme in the National Curriculum for England and Wales. This paper analyses the factors that may contribute to why this is so, and how this impacts on initial teacher education students. The paper also provides examples of how environmental education can be raised on the agenda for initial teacher education, as evidenced from evaluations of existing courses at the University of Gloucestershire, so that new generations of teachers and students can better prepare society for appropriate environmental action for sustainability.

The development of the National Curriculum as a central feature of the Educational Reform Act of 1988 (ERA, 1988) heralded the most significant period of educational change since the earlier act of 1944 (ERA, 1944), and had major impact on primary schools with the elevation of science to a core subject. The introduction of a legislated centralised curriculum moved educational practice from teacher autonomy through localism (Golby, 1988) with an emphasis on teachers developing integrated approaches to the curriculum in response to their pupils' interests and local needs, to a redirection in focus on a centralised, content driven, subject based curriculum with the core subjects of English, mathematics and science having highest priority. Although teachers may commonly value environmental education as important, under the National Curriculum it has been relatively marginalised, even though it is identified as a cross-curricular theme (Littledyke, 1997). Understanding of the scientific principles underlying environmental issues is an important feature of

environmental education (though it also has cross-curricular, social, ethical and economic aspects), hence harnessing the prioritised primary Science National Curriculum for environmental education is a way of raising the profile of environmental understanding for sustainable action. However, there are evident barriers to promoting underdeveloped environmental education through the Science National Curriculum. These will be analysed and identified through the foci of the influences of ideology underpinning the National Curriculum, the underlying epistemology of science implicit in the National Curriculum, and the resulting common approaches to pedagogy with their impact on environmental education.

For the purposes of this paper, the curriculum can be defined as:

... all those activities designed or encouraged within the school's organisational framework to promoter the intellectual, personal, social and physical development of its pupils. (Morrison and Ridley, 1988, p.2)

Views about the nature and purpose of education (as ideology), and views on the nature of science (as epistemology) influence approaches to teaching (as pedagogy), which influence how pupils experience the curriculum (Figure 1).

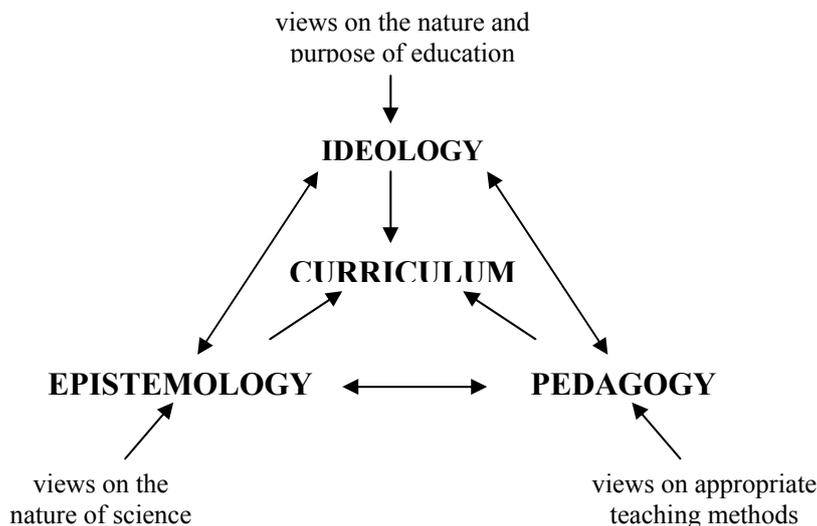


Figure 1. The interplay of ideology, epistemology and pedagogy on the curriculum. (Littledyke, 1996a, p.121)

Consideration of how ideology, epistemology and pedagogy interact within the curriculum is essential to an analysis of how the primary Science National Curriculum has impacted on environmental education. Thus, the ideological and epistemological assumptions of curriculum planners have pedagogical implications for the implementation of the curriculum and these have direct impact on environmental education. This paper will analyse how these factors can provide barriers to environmental education in initial teacher education, while potential drivers to overcome them will be discussed.

The influences of ideology

Political Ideology in the development of the National Curriculum

Ideology as 'that system of beliefs which gives general direction to the educational policies of those who hold beliefs' (Scrimshaw, 1982, p.2) was an important driving feature in the development of the Education Reform Act (ERA, 1988) and the National Curriculum, as discussed by a number of

authors in their critical evaluation of its development and implementation (Lawton and Chitty, 1988; Pring, 1989; Brighouse and Moon, 1990; Coulby and Ward, 1990; Moon, 1990; O’Hear and White, 1993; Taylor and Tytler, 1993; Bell, 1999). Hartnett and Narsh (1990) discuss how the ‘New Right’, aligned in political thinking with the then governmental Conservative Party, was very influential in the development of the Education Reform Act, with an emphasis on free market values associated with the development of globalisation with open economic exchange driven by economic competition. Such free market focus was identified as *neo-liberal thinking* by Levitas (1986) and Demain (1988). In the development of the National Curriculum, political power was enshrined in the Secretary of State through the Education Reform Act to ensure that power was centrally located. Concurrently, free market values were contrived through Local Management of Schools (LMS) to reduce the influence of the Local Education Authorities, placing schools under competition with each other through parental choice based on comparisons of assessment and inspection results presented in spurious league tables of performance. Such parental choice was, however, apparent rather than real for many parents, due to limited access to the most popular schools in areas. Tomlinson characterised these educational developments as based on an ideology founded on ‘the spirit of consumerism, individual, entrepreneurism and competition: the values of the market’ (Tomlinson, 1989, p.275)

A second strand of ‘New Right’ educational thinking was identified as *neo-conservative thinking*, which emphasises tradition, authority, national identity and security (Quicke, 1988). This strand was manifest in education through a National Curriculum for 5-16 year olds founded on ‘forms of knowledge’ as traditional subjects (Hirst, 1974) legislated through defined content in Programmes of Study for planning and assessed by Attainment Targets as defined learning outcomes. This had a significant effect on primary schools, where previous practice had emphasised integration of knowledge with priorities for skills, processes and flexible responses to pupils’ interests, rather than prescribed curriculum content for all pupils to cover.

Consultation with educationalists leading up to the introduction of the National Curriculum was held over short time periods at inconvenient times (for example, over the summer breaks) and working parties for the various subject areas were given restricted, directed agendas to ensure that the Conservative Government’s ‘New Right’ agenda was central to the National Curriculum documents. The net effect was the deprofessionalisation of teachers through removing their previous control over curriculum planning, with surveillance of teacher and school performance through inspection processes applied by the concurrently formed OFSTED (Office for Standards in Education) to guarantee that the legislated curriculum was planned for and taught. Published assessment results through Standardised Assessment Tasks ensured teacher and school accountability through public visibility of school performance.

Knowledge and child centred ideologies

Approaches to science education are directed by whether the main emphasis is on curriculum content or experiences and processes of learning. A knowledge centred curriculum emphasises what should be learnt. This may be based on ‘classical humanist’ traditions, derived from Plato, which advocate an elitist and separate education for a minority giving access to power and privilege (Eliot, 1948), while ‘liberal humanist’ traditions advocate a knowledge based curriculum based on egalitarianism with access to all through a common curriculum (White 1983). Though it has an egalitarian basis founded on ‘liberal humanism’, the National Curriculum has been criticised for being too knowledge centred and based on a focus of economic directives rather than the developmental needs of children (Davis *et al.*, 1993).

In contrast, a child centred or ‘progressive’ ideology emphasises the individual learner, and the curriculum is seen as activity and processes, with emphasis on the quality of learning experiences supporting children’s interests and developmental needs. In such a child centred education, curriculum content is a vehicle for processes of learning rather than a driver of the curriculum. Educationalists espoused a child centred focus before the National Curriculum, as embodied in the

earlier Plowden Report (1967), though child centred education was criticised by the ‘New Right’ in the lead up to the National Curriculum for producing inconsistency and lack of continuity in the curriculum with erratic standards.

Society centred ideologies

In relation to society, two ideologies of education encapsulate opposing trends in science education. ‘Instrumental’, or ‘revisionist’ ideologies emphasise the need to fit people into society through creating a workforce to support economic development (DFES, 1985). To support such economic development in a technologically driven society, science was given high status in the new National Curriculum. In contrast, ‘reconstructionist’ ideology emphasises education as a process of social change, and education is planned for what society ought to be rather than what it is (Scrimshaw, 1983). Teachers become actors of social change through emphasising critical, reflective and active learning, with pupils’ interests and processes of learning emphasised over content, while teachers act as facilitators of learning rather than instructors (Blenkin and Kelly, 1987).

The National Curriculum is underpinned by ‘instrumental’ or ‘revisionist ideology’ in its focus on knowledge content, prescribed planning and objectives based assessment, but how does this correspond with our understanding of the nature of science?

The influences of epistemology

Models of science held by educators can have direct influence on how it is taught (Harlen, 1992; Lakin and Wellington, 1994), hence the model of science implicit in the National Curriculum has influence over how science is taught. The prescriptive, content led Science National Curriculum conveys a model of science as:

- Objective
- Capable of yielding ultimate truths
- Proving things
- Having defined a unique subject matter
- Having unique methods
- Being value free (Harlen, 2000, p.2)

This positivistic model of science is rooted in the Enlightenment model of science that developed in the seventeenth century and has been a dominant part of the rational basis of the so-called modern era (Lyon, 1994), which has been incriminated for environmentally damaging technology through ‘mechanomorphism’, which involves treating nature as a machine (Littleddyke, 1996b). It is also inappropriate as a model of science for the twenty first century, as constructionism has effectively overturned positivism through developments in understanding about how knowledge is constructed. In the constructionist model, knowledge is constructed through individual and social processes, and science involves a process of gathering evidence to produce theories that can be tested for validity, while knowledge can change with new evidence (Crotty, 1998). Developments in postmodern philosophy, including the philosophy of science, complexity theory and science (in particular neurophysiology, and physics) show that, in contrast to the still widely held positivist model, a constructionist model of science conveys science as:

- Generating tentative models, which can be falsified by contradictory evidence rather than absolute truths;
- Producing ideas that are ‘true’ only in that they work in the terms of a particular interest;
- Acknowledging that the formulation of scientific models is a human process, which includes human thought;

- Being non-value free and acknowledging that factors other than rational and empirical ones shape the views of the scientific community;
- Producing ideas that do not exclude other views, ethical, cultural, aesthetic or religious;
- Acknowledging indeterminism and probability for predictions for events, rather than precise determinism;
- Emphasising internal relations and dynamic interactions in complex systems;
- Emphasising interconnectedness of features of the universe, whilst celebrating its diversity;
- Acknowledging downward causality from whole systems to their parts, as well as the upwards and sideways causality of reductionism;
- Acknowledging the possibility of non-local and acausal events, as shown by findings in quantum physics;
- Having social and environmental implications when scientific ideas are applied practically through technology, implying high priority to social and environmental responsibility in the development and application of science. (Littledyke, 1996b, p.203)

The constructionist model of science is more appropriate than a positivist model, as current understanding of science supports it. However, many people, including teachers, hold inappropriate positivist models of science (Claydon *et al.*, 1994) and the National Curriculum itself, with its emphasis on prescribed knowledge, can be regarded as essentially positivist in its assumptions.

The influences of pedagogy

If constructionism is accepted as a more appropriate explanation of knowledge creation than positivism, then pedagogy that emphasises the permanence and objective status of knowledge is inappropriate. Assessment through defined objectives lies at the heart of the National Curriculum, with knowledge to be acquired prescribed as learning outcomes, and strategies to achieve this devised through teaching plans, with success of teaching defined through assessment of children against the objectives. In such an objectives model, teaching methods emphasise instruction, with the teacher as director of learning and pupils as passive recipients of knowledge. After its introduction, the National Curriculum documents became the legislated basis for curriculum planning (NCC, 1990, 1995), and, later, government support materials for teaching science (The Standards Site, 2007) were taken over by the majority of schools and were commonly developed as prescribed instructional worksheets for pupils. Such an approach, whilst giving structure and support for less confident teachers, may not address the interests and developmental learning needs of children, and presents science in a way that scientific knowledge is fixed, with insufficient emphasis on the learner in the processes of investigation. Also, it restricts learning opportunities to the narrowly defined constraints of the prescribed curriculum.

However, constructivist pedagogy is appropriate to a constructionist model of science, as it takes into account the interests, previous experience and developmental needs of children. The constructivist pedagogical sequence, as a series of teaching and learning phases, actively engages the teacher as a facilitator to scaffold children's understanding to help them make scientific sense of observations and experience:

A constructivist view of learning:

ORIENTATION

Arousing children's interest and curiosity

ELICITATION / STRUCTURING

Helping children to find out and clarify what they think

INTERVENTION / RESTRUCTURING

Encouraging children to test their ideas: to extend, develop or replace them

REVIEW

Helping children to recognise the significance of what they have found out

APPLICATION

Helping children to relate what they have learned to their everyday lives

(Ollerenshaw and Ritchie, 1993, p.6)

Constructivist pedagogy has features in common with ‘progressive’ approaches to teaching that were prevalent previous to the National Curriculum in that it is child centred in focus, but it also has a clear role for the teacher to scaffold learning, as well as an acknowledgement of the importance of science skills, processes, attitudes and concepts in learning in making meaningful connections with real life phenomena.

Having discussed how pedagogy is influenced by political ideology and epistemology, how does pedagogy influence environmental education?

Barriers in the National Curriculum to environmental education and drivers to support primary initial teacher education students

A number of authors have discussed how environmental education can be incorporated into initial teacher education programmes, though the implications for science education are not specifically addressed (Inman, 1996; Oulton and Scott, 1997; Oulton and Scott, 1998; Grace and Sharp, 2000; Kapyia and Wahistrom, 2000; McKeown-Ice, 2000; Gayford, 2001; Hopkins, 2001), while Summers *et al.* (2000) provide some of the important background scientific ideas underpinning environmental education for secondary teacher education. Whilst it is not within the scope of this paper to discuss in details of how science education for environmental education can be developed, the science curriculum requires inclusion of the following elements if future adults are to take appropriate choices towards a sustainable society:

- Development of the cognitive domain through linking scientific knowledge and understanding of natural cycles and how application of these to human systems can contribute to sustainability, whilst emphasising interconnections between scientific ideas and their relationship to real life choices that impact on the environment;
- Development of the affective domain through a sense of relationship with the environment to foster aesthetic appreciation and feelings of awe and wonder, supporting motivation for environmental protection;
- Development of environmental ethics through understanding the biological needs of species, ecosystems and the biosphere, associated with empathy with and care for other living things, leading to responsibility for personal actions supporting stewardship for environmental protection;
- Motivation for informed environmental behaviour through critical understanding of the role of the application of science through technology in contributing to or overcoming problematic environmental issues;
- Empowerment in learning, leading to scientifically literate adults who can translate critical understanding of environmental issues into informed action.

As argued in this paper and elsewhere (Littledyke, 1996a, 1996b), the constructionist, postmodern model of science is a more appropriate scientific model than the outmoded positivist, modern

scientific model. Constructivist pedagogy is also suited to address the points listed above to support environmental education. The modern model of science, which is implicit in the National Curriculum, contradicts each of the points above because: scientific knowledge is presented as fragmented concepts that are not explicitly connected with real life contexts; the affective domain is not explicitly addressed within the Science National Curriculum; there is no connection with environmental ethics and environmental action; and, its knowledge centred basis leads readily to transmission models of teaching to passive learners with their associated disempowerment.

In practice, skilful teachers can interpret the Science National Curriculum flexibly, so that constructivist pedagogy is possible; in particular the first of the four attainment targets addresses scientific investigation, which should involve learners asking and answering their own questions about scientific matters. However, initial teacher education students at the University of Gloucester report that, in the main, schools focus on teaching the scientific concepts that dominate the Standard Assessment Tasks mainly through transmission teaching, and government sponsored schemes of work (Standards Site, 2007) are frequently developed as worksheets for pupil activity. Pupil investigations involving following up their own questions and lines of inquiry, associated with constructivist pedagogy, are not common, even though they should be developed through Attainment Target one, Scientific Enquiry. Such transmission methods are evidently driven by the perceived need to 'train' children to answer concept centred questions in Standard Assessment Tasks, which are directly linked to inspection judgements and publication of school and pupil performance. In this process, scientific understanding is not well connected with real life experience and environmental education is not usually linked.

To counter such trends, primary science courses at the University of Gloucester are designed to promote approaches that link with environmental education through the following areas of emphasis:

1. *Professional development as reflective teachers* is encouraged through scaffolding students' own learning and confidence in the concept areas and process skills of science, understanding of children's learning, and linked to pedagogy through identifying appropriate activity to support children's learning.
2. *Metacognition* is fostered through critical reflection on students' own practice, linking theories of learning, relevant science knowledge and constructivist practice.
3. *Meaningful, active learning* is emphasised so that experiences and conceptual development are linked directly to real life contexts, including environmental issues, with implications about appropriate action to support for sustainability.
4. *Constructivist pedagogy* is developed through students' modelling children's constructivist processes in their own learning and through developing constructivist approaches to their teaching.
5. *Assessment* is integrated closely with learning, so that planned activities are carried out and students received suitable feedback on their own development as teachers.

Course organization is designed to achieve the above areas through the following:

6. *Integration* of knowledge areas in science to explicitly connect concepts with environmental issues using constructivist pedagogy is emphasised in year one of the course where the students focus on their own understanding of science. The topics of study include Scientific Enquiry, Agriculture, Biodiversity, Genetics, Health, Transport, Matter and the Home, Energy and Atmosphere. Each topic has explicit links to environmental issues. A CD Rom designed to address common misconceptions and scientific ideas in the context of environmental issues (Ross et al., 2001), and a book linking science and environmental concepts (Littledyke et al., 2001) is used to support the course.
7. *Constructivist pedagogy* applied with children is emphasised and practised in years two and three of the course supported by a course guide (Littledyke et al., 2007) and a book

presenting the philosophical and pedagogical background to constructivism (Littledyke and Huxford, 1998). Subject knowledge is seen as essential background for the students as teachers, but is used as a tool to be drawn on to support children's investigations rather than the driver of the curriculum.

University based activities include the following:

8. *Interactive lectures* where activities are presented as illustrations of concepts and students are encouraged to check their own understanding against common misconceptions. Examples of suitable approaches to teaching are also presented through selected video clips, whilst the course CD Rom is drawn on to support understanding of key concepts through using its constructivist approach. For example, students are questioned about a scientific concept, asked to identify their own response and justify their understanding to a person close by. The tutor then discusses the reasons for common misconceptions and the accepted scientific views, relating them to research findings about children's learning.
9. *Practical workshops* are held where students explore activities linked to conceptual areas and consider suitable learning contexts and pedagogical approaches. These include *investigations* where students investigate their own questions in response to stimuli from real life contexts and teaching episodes where students teach each other through suitable questioning in simulated classroom situations.
10. *Peer support groups* (of about six students in a group) follow directed activities to encourage a social constructivist approach to their own learning, including development of group concept maps to support each other in their understanding of the key concept areas, plus group charts of classroom based activities for key concepts to illustrate progression in learning across the full range of age groups, including the stage above and below their main focus: Foundation Stage and Key Stages 1-3 (ages 3-14). Each peer support group includes a person with greater science background than the other members (e.g. advanced level science), and who acts as a subject leader, similar to the role in schools.
11. *Directed reading* using course guides, a range of other indicative reading and selected texts is used to support learning individually and through discussion in the peer support groups.
12. *On-line formative assessment* to support learning is presented at the beginning of the course through a multiple-choice audit of subject knowledge, linked where appropriate to support understanding of environmental issues. The responses are used as a teaching tool by tutors throughout the course and students retake the audit at the end to check that they have understood the key concepts. Individual action plans are designed and implanted to ensure that problematic areas are addressed through reading, discussions with peer groups and tutors where necessary.
13. *On-line discussion groups* (via WebCT) through the peer support groups identify the key learning points from the construction of concept maps and progression charts by each group (collated in turn by members of the group), and online engagement with other groups is encouraged. Tutors provide summaries of main points on the on-line forum and engage with specific points of discussion and questions where appropriate, so that feed back and interaction is ongoing throughout the course.
14. *Assessment* of university based activity focuses on group presentation and individual analysis of student based investigations in year one. At the end of the course an ungraded portfolio of evidence is submitted to show development of subject knowledge through the on-line audit, and results of the individual action plans. The portfolio also includes the collated concept maps and progression charts of suitable activities for different ages. Evidence of group and individual engagement with on-line discussion groups is available through the collated statistics calculated by the WebCT software package.

School based activities focus on linking subject knowledge, understanding of constructivist pedagogy associated with appropriate activities and teaching through:

15. *Teaching episodes* involve the constructivist sequence with response to elicitation of children's initial ideas, with planning in the context of the School's schemes of work. Teachers in school and school link tutors support the planning and transaction of teaching episodes, with overall judgements of teaching competence assessed against the national teaching standards for initial teacher education.
16. *Assessment of science teaching* is achieved through a graded assignment, which focusses on a critical evaluation of teaching a small group using constructivist pedagogy and assessing how well the children have learnt from the experience. This refers explicitly to the National Curriculum, but the emphasis is on meaningful learning and response to children's ideas to direct the learning process. Real life and environmental contexts are encouraged as the basis for the process.

The National Curriculum is addressed through this integrated approach to the students' learning about science, about how children learn, and constructivist teaching in real life and environmental contexts. However, the commonly observed transmission models of teaching seen in many schools are avoided by providing clear instructions for following the constructivist process alongside clear criteria for tutor assessment of the assignment. Student evaluations and observations of students teaching indicate that the approach achieves good levels of success in developing student confidence as teachers and in positive children's responses. However, students with less confidence (and poorer performance against the assessment criteria) may follow the line of many teachers who feel pushed into inappropriate transmission pedagogy by their perceived pressures of the concept driven National Curriculum and the associated inspection and assessment demands.

Although this course design illustrates how constructivist teaching supporting environmental education can be supported, a widespread change towards raising the profile of environmental education in the National Curriculum is needed before it is addressed in an effective way across schools. This requires a major shift in the political ideology that underpins the 'New Right' thinking in the National Curriculum, and which was taken up uncritically by 'New Labour' when it took office in 1997. The pseudo free market system designed to put schools in competition against each other plus the traditional forms of knowledge approach to the primary curriculum are quite inappropriate epistemologically and pedagogically, and work in opposition to sustainability both in the economic assumptions and in the consequences for children's learning. The new generation of teachers coming through teacher education courses such as the one at the University of Gloucestershire may have a better impact on environmental education than many schools, where it has been largely suppressed through the National Curriculum. However, major political change is now needed to move the emphasis in the primary curriculum towards empowerment in pupil learning with explicit links to environmental contexts. This will involve a change in pupil assessment that emphasises formative, supportive learning process rather than creating hierarchies of failure for many pupils. Also, a change to a formatively supportive inspection system is needed to assist development of schools rather than the present system, which disempowers pupils and contributes to climates of fear. Such changes are essential for environmental education to be raised on schools' agendas so that education for sustainability can become an active part of primary education.

References

- Bell, L. (1999) "Back to the future: The development of educational policy in England", *Journal of Administration*, Vol. 37, No. 3, pp. 200-229
- Blenkin, G.M. and Kelly, A.V. (1987) *The Primary Curriculum: A Process Approach to Curriculum Planning*, 2nd. edition, PCP, London
- Brighouse, T. and Moon, R. (1990) *Managing the National Curriculum*, Longman, Harlow
- Clayden, E., Desforges, C., Mills, C. and Rawson, W. (1994) "Authentic activity and learning", *British Journal of Educational Studies*, Vol 60, pp. 163-173.
- Crotty, M (1998) *The Foundations of Social research: Meaning and Perspective in the Research Process*, Sage publications, London
- Coulby, D. and Ward, S. (1990) *The Primary Core Curriculum: Policy into Practice*, Cassell Educational, London
- Davis, N.T., McCarty, B.J., Shaw, K.L., Sidani-Tabaa, S. (1993) "Transitions from objectivism to constructivism in science education", *International Journal of Science Education*, Vol. 15, pp. 627-636
- Demaine, J. (1988) "Teachers' work, curriculum and the New Right", *British Journal of Sociology of Education*, Vol. 9, pp. 247-264
- DFES (1985) *Better Schools*, HMSO, London
- Education Reform Act (1944) HMSO, London
- Education Reform Act (1988) HMSO, London
- Eliot, T.S. (1948) *Notes Towards the Definition of Culture*, Faber, London
- Golby, M. (1988) "Traditions in Primary Education", in Clarkson, M. (Ed), *Emerging Issues in Primary Education*, Falmer, Lewes
- Grace, M. and Sharp, J. (2000) "Exploring the Actual and Potential Rhetoric-reality Gaps in Environmental Education and their implications for pre-service Teacher Training", *Environmental Education Research*, Vol. 6, No. 4, pp. 331-345
- Harlen, W. (2000) *The Teaching of Science in Primary Schools* (3rd edition), David Fulton, London
- Hartnett, A. and Naish, M. (1990) "The sleep of reason breeds monsters: the birth of a statutory curriculum in England and Wales", *Journal of Curriculum Studies*, Vol. 22, pp. 1-16.
- Hirst, P. (1974) *Knowledge and the Curriculum: A Collection of Philosophical Papers*, Routledge, Keegan and Paul, London
- HM Treasury (2007) *Stern Review on the Economics of Climate Change*, HM Treasury, Cabinet Office, London

- Inman, S. (1996) "Environmental Education within Initial Teacher Education", in Champian, P and Inman, S. (eds.) *Thinking Futures: Making Space for Environmental Education in ITE - A Handbook for Educators*, WWF, Godalming
- Kapyia, M. and Wahistrom, R. (2000) "An Environmental Education Program for Teacher Trainers in Finland", *The Journal of Environmental Education*, Vol. 31, No. 2, pp. 31-37
- Levitas, R. (ed.) (1986) *The Ideology of the New Right*, Polity Press, Oxford
- Littledyke, M. (1996a) "Ideology, Epistemology and Pedagogy and the National Curriculum for Science: the influence on primary science", *Curriculum Studies*, Vol. 4, No. 1, pp. 119-139
- Littledyke, M. (1996b) "Science Education for Environmental Awareness in a Postmodern world", *Environmental Education Research*, Vol. 2, No. 2, pp. 197-214
- Littledyke, M. (1997) "Science education for environmental awareness? Primary teacher perspectives and practices", *British Educational Research Journal*, Vol. 2, pp. 197-214
- Littledyke, M. et al. (2007) *Teaching Primary Science: Course Guide and Study Book*, University of Gloucestershire, Cheltenham
- Littledyke, M. and Huxford, L. (eds) (1998) *Teaching the Primary Curriculum for Constructive Learning*, David Fulton, London
- Littledyke, M. et al. (2000) *Science Knowledge and the Environment: A Guide for Students and Teachers in Primary Education*, David Fulton, London
- McKeown-Ice, R. (2000) Environmental education in the United States: a survey of pre-service teacher education programs", *Journal of Environmental Education Research*, Vol. 32, No. 1, pp. 4-11
- Lyon, D. (1994) *Postmodernity*, Open University Press, Buckingham
- National Curriculum Council (1990, 1995) *National Curriculum for Science*, NCC, York
- O'Hear, P. and White, J. (1993) *Assessing the National Curriculum*, Paul Chapman, London
- Ollerenshaw, C and Ritchie, R. (1993) *Primary Science: Making it Work*, London, David Fulton
- Oulton, C.R. and Scott, W.A.H. (1997) "Linking pre-service and inservice education and environmental education", in Thompson, P. J. (ed.) *Environmental Education for the 21st Century: theory, practice, progress and promise*, Routledge, London
- Oulton, C.R. and Scott, W.A.H. (1998) "A Realistic Model for Educating the Environmentally Educating Teacher", in Palmer, J. (ed.) *Environmental Education in the 21st Century: international and interdisciplinary perspectives*, Peter Lang, New York
- The Plowden Report (1967) *Children and their Primary Schools*, HMSO, London.
- Pring, R. (1989) *The New Curriculum*, Cassell Educational, London

Quicke, J. (1988) "The 'New Right' and education", *British Journal of Educational Studies*, Vol. 26, pp. 5-20.

Ross, K. A. *et al.* (2002) *Science Issues and the National Curriculum: CD-ROM*, University of Gloucestershire, Cheltenham

Scrimshaw, P. (1983) "Educational Ideologies, Unit 2, E204, Purpose and Planning in the Curriculum", Open University Press, Milton Keynes

Summers, M., Kruger, C., Childs, A and Mant, J. (2000) *One Small Step: understanding of the science of environmental issues*, ASE, Hatfield

The Standards Site (2007) *Science Schemes of Work*, www.standards.dfes.gov.uk/schemes2/science (accessed 26 June 2007)

Taylor, T. and Tytler, T. (1993) *A Lesson for us All: The Making of the National Curriculum*, Routledge, London

Tomlinson, J (1989) "The Education Reform Bill - 44 years of progress?" *Journal of Education Policy*, Vol. 4, pp. 275-279

White, P. (1983) *Beyond Domination: An Essay in Political Philosophy of Education*. Routledge Keegan and Paul, London

Making a Difference: Outdoor Education in Early Childhood Education

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Abstract

This paper is based on a small scale research project undertaken at the University of Northampton (UK) involving students studying on the BA (Hons) Early Childhood Studies degree and children and staff from a local urban nursery. The purpose of the project was to explore the benefits of outdoor education with young children and challenge current pedagogical approaches to the teaching of Environmental Education in both the National Curriculum and the Foundation Stage (early years, 3-5 years).

Science and Geography are placed under the umbrella heading of Knowledge and Understanding of the World in the Foundation Stage (3-5 years) Guidance. While the discourse on the Foundation Stage curriculum refers to a play based, cross curricular approach, practice is in fact influenced by the 'pressing down' of the National Curriculum on early years settings, with the result that Knowledge and Understanding of the World is often taught as a content driven, discrete subject. Student teachers' experience of the Primary Curriculum in the University element of their degree courses, to some extent, can unintentionally reflect this pressure. It is however, during their practical school experiences in Foundation Stage settings, that this 'pressing down' effect is most evident as a result of conflicting practitioner perspectives on appropriate teaching strategies. A way forward, to overcome this problem, is to develop collaborative action research projects with local schools and nurseries as a way of disseminating good practice. It is more effective to work with practitioners on collaborative projects rather than attempt to 'instruct' them through our current system of mentor conferences and professional development courses, some of which can be received with resistance.

The context for this study is set within the recent proliferation of health and safety regulations for schools, which has resulted in increasing constraints on practitioners to allow children access to the outside environment, resulting in their lack of confidence in, and alienation from, their natural surroundings. It is argued that children are having the opportunities for taking risks and making meaningful decisions reduced as a result of the 'diminishing outdoors'.

With the current international focus on sustainable development, and the recognition that children need to develop a greater awareness of, and respect for their natural environments, the research project was also set within the context of growing interest in the United Kingdom in Forest School and outdoor education.

The research project set out to investigate the impact of regular weekly access (irrespective of the weather) to the outside, natural environment for a group of 3-4 year olds who did not normally have this opportunity. The responses and reactions of the children were noted and recorded by trained observers, both students and nursery staff, who shared their perceptions in a series of regular meetings.

The benefits for the children's understanding and empathy for their environment were evident in their developing observational skills, increasingly sensitive responses to natural events and phenomena and greater confidence and imagination in their play, with the use of natural materials

rather than manufactured. In addition, the collaborative links between the University and the local nursery had a positive impact on the curriculum and practice in the nursery and a deeper insight into the impact of such experiences on young children's learning for all participants.

Keywords:

Pedagogy, early years curriculum, outdoor education, Forest School, affective education, collaboration.

Outdoor Education and Early Childhood

“The garden is the essential matter. Not the lessons, or the pictures or the talk. The lessons and talk are about things seen and done in the garden, just as the best of all the paintings in the picture galleries are shadows of the originals now available to children of the open air”. (Macmillan, 1930:2)

The notion of outdoor education for the young is not new, indeed James Neill (2004) commenting on the ‘less pre-programmed state’ of the new born human infant refers to the ‘inordinate amount of time’ required for ‘training’ the human young to live in the world and argues that

“it would seem not unreasonable to suggest that early hominids were the originators of outdoor education,... For at least several million years, virtually all of these years of learning and training conducted by hominids and homo sapiens were conducted in the outdoors”. (Neill, 2004:1)

Neill adds that with the advent of permanent dwellings in Western civilisations, it could be argued that the current interest in outdoor education has evolved as a result of ‘large proportions of the lives of some civilizations (being) spent indoors.’ Particularly significant however, in relation to the education and experiences of young children, is his observation that ‘nature has become somewhat fictionalized’. Some children's only experience of the natural world has been through stories about animal characters which have been anthropomorphised.

As a species then, notably in Western societies, we have become increasingly distanced from our natural environment. While, as a result of scientific advances, our understanding of nature has sharpened dramatically, for many populations, our day to day experience has declined and we have been reduced to a theoretical perspective and subsequent loss of relationship with the natural world.

Our children are brought up in societies such as those of Western Europe, in which facilities such as the provision of water, electricity, oil, gas, services such as the telephone, television, and access to the internet are taken for granted. They are part of their everyday existence and as a result children have become distanced from the natural environment. It is hard for our children to understand the implications of global warming and non-sustainable development if they are living in an urban, built environment which is cushioned from the necessity of physically gathering the resources to sustain life.

In addition, many children are experiencing a ‘diminishing outdoors’. Children's opportunities for playing outside are decreasing as a result of changes in parental work practices. A proliferation of supervised vacation and after school programmes, greater organisation of their time at weekends in supervised activities, and a fear for children's safety if they do engage in unsupervised play outside prevents children from accessing the outdoor environment in an informal and self-directed manner.

Davis and Elliott (2003) argue that while education *about* the environment will encourage learning about how natural systems operate and will help children appreciate the complexities and interactions between them, this essentially content driven curriculum is not enough. Education *for* the environment, on the other hand includes the “overtly political dimension that is missing from

other forms of environmental education and is concerned with social action for change”. (p.6) They suggest that children will need to become “transformational learners” in order to effect a change of attitude towards sustainable living. Children will need emotional intelligence, to be critical and reflective thinkers, have the dispositions of curiosity and persistence and need to become active and responsible decision makers who have a “creative imagination to envision a better world and alternative futures” (p5)

Rivkin (1998), reports growing evidence to suggest that environmental values are rooted in early childhood experiences and that if children are to become ‘environmental activists’ and learn that they can ‘make a difference’ it is the early childhood experiences that will make the greatest impact on later values and attitudes.

Currently however, environmental education in early childhood ‘is viewed as marginal and this is not tenable if sustainable societies are to be created.’ Davis & Elliott [4 p9] argue that it is essential for the process of transforming attitudes towards the environment to begin in early childhood education through children’s access, among other things, to outdoor experiences. Reiterating the UNESCO (1997:47) statement on education for a sustainable future: ‘education for sustainable development is simply good education’ they add that ‘good education should be making young people aware of the interdependence of life on Earth in order to live healthily and happily in the present as well as prepare them for living sustainably in the future’. (2003:4)

Outdoor learning also provides teachers and practitioners with the opportunity to fulfil a different role with children, rather than that of instructor or technician. The mutuality of the experience has the potential for a powerful teaching and learning event for all participants. Children and practitioners are, on occasions, able to work together as equals in a shared project.

Through this alternative approach to learning teachers and practitioners are able to explore their roles as “transformational teachers”, educators who have shifted ‘the locus of learning from educator to learner’. (Davis & Elliott, 2003 :9). Such educators recognise the value of learner and teacher working together as co-learners. They recognise the significance of motivation, autonomy and independence and the opportunity for making choices.

In the United Kingdom one of the characteristics of our nursery schools is that they all have an outside play area. This is by no means unique to the United Kingdom and is reflected in early years provision in the USA, Australia and New Zealand, all similarly resourced to the British nursery garden.

In the United Kingdom the origins of the nursery garden lie in the first early nursery schools set up by the McMillan sisters in the early 20th Century. The original motivation for the ‘outdoors’ nature of the McMillan nurseries was health and social rescue; an attempt to improve the health of the slum children who were living in unhealthy and overcrowded conditions. The experiment was highly successful and it convinced the McMillan’s that accessing the outdoor the environment could have a dramatic impact on health and well being. It also became apparent that there was an educational benefit, both as a result of improved health (Margaret McMillan was one of the first educators to make this connection) and the potential of the environment itself.

Other educators, such as Susan Isaacs (1930) were also aware of the power of the natural environment as a context for children’s learning. With the decline of nursery schools throughout the 20th century, however, and the subsequent decrease in outdoor provision, the understanding of its potential as a powerful learning context was also lost.

With the current resurgence of interest in early childhood education in the United Kingdom and the recognition that it is the children whose role as the ‘transformational learners’ [4] will shape the future of the planet, the notion of the centrality of outdoor education is now embedded in the Early Years Foundation Stage documentation of England and the Scottish Curriculum Guidance. (2004)

“All early years providers must have access to an outdoor play area which can benefit the children. If a setting does not have direct access to an outdoor play area then they must make

arrangements for daily opportunities for outdoor play in an appropriate nearby location.”
(DfES, 2007:6)

The mental health benefits of giving children the opportunity to work and play outside is supported by research from a neuroscience perspective,

“Research at Helsinki University has found that young children need outdoor space to achieve optimum brain developmentToo much order in a child’s life has also been found to inhibit some children’s learning” Borradaile, 2006:12)

Resonating with McMillian’s views in the 1920s, research evidence (Borradaile, 2006) also suggests that outdoor learning not only supports emotional and social development but also has a positive impact on academic achievement and is a particularly beneficial learning experience for boys.

Indeed, it has been suggested (Swann, 2001) that a common practice adopted in the United Kingdom of preventing children from accessing outdoor play as a punishment for misbehaviour or uncompleted tasks, is especially damaging for those children showing symptoms of ADHD and may contribute to some of the challenging behaviours presented by such children.

Research by Pelligrini and Davis (1993), reports on the damaging effects of the tendency in some schools in the United States to decrease children’s access to the outside and note that this practice had a negative impact on children’s ability to concentrate as a result of increased restlessness.

Children themselves, when given the opportunity to contribute their views, express a desire for outdoor experiences. In a survey conducted in the United Kingdom by Burke and Grosvenor (2003). 15,000 children were able to articulate their own needs and desires. About the provision of access to an outdoor environment. While wishing for more outdoor space in which swings, slides, roundabouts, tree houses and forts were provided they also included a wish for more natural features; gardens, ponds, animals, and wild life; “a greener, more interesting environment”. (p45)

Evidence from Wilson (1966) also suggests that children, given the opportunities, are responsive and eager to learn about and care for their natural environment.

Forest school

“Forest School is literally that – a school in the forest, It enhances mainstream education, offering a different approach to curriculum delivery, being both enjoyable and child, not content led’...it can result in many positive outcomes relating to inclusive lifelong learning – knowledge and understanding, skills and values and dispositions – in a different, stimulating, enjoyable, healthy and experiential way. The secret of its success is in the synergy between the physical woodland setting and the presentation and ethos behind the activities – the sum is more than the parts.”
(Borradaile, 2006:7)

As a further development to the inclusion of outdoor education in the United Kingdom early years curriculum, Forest School represents an alternative approach to the learning environments which are offered to children within the mainstream curriculum, both in the early years and later years of the primary school. The nature of the educational experience is such that it goes beyond the concept of outdoor play or outdoor education.

Education professionals throughout the United Kingdom are becoming increasingly interested in what Forest School has to offer both, in respect of children’s overall development and the links to environmental education. From a curricular perspective, Forest School offers the opportunity for children’s learning across all subject areas. There are also benefits for health, both physical and mental, awareness of sustainable development and environmental issues and citizenship.

Forest School originated in Sweden during the 1950s as an approach to learning that encouraged children to interact with, and learn about, the natural world. The approach to teaching was well established in Denmark by the 1980s as a pedagogical strategy in early years education. It was noted that the children attending Forest School were socially skilled and able to work collaboratively with their peers. They were also confident in their own capabilities and had high self-esteem. By 2003 the Hungarian Government had demonstrated its commitment to Forest School education by funding a six year programme which ensures that all children, during their primary education years' have the opportunity to attend.

In the United Kingdom this practical approach to environmental education is not entirely new. In 1925, as a response to the 'militaristic approach' of the Scouting movement, Leslie Paul founded the Woodcraft Folk, for which environmentalism is one of its driving philosophies.

In 1995, however, a group of lecturers and early years professionals from the South West of England, who were visiting Denmark, had the opportunity of experiencing Forest School education first hand. They returned with a commitment to apply this approach to early years provision in the United Kingdom. The Forest School movement has since expanded, with an increasing number of early years practitioners accessing training and introducing Forest School education across the United Kingdom.

In addition, as the pedagogical approach develops, it is being increasingly recognised that Forest School experience not only benefits our youngest children but can also be successfully applied to other client groups such as adults with health problems, such as substance abuse, and their families.

The outcomes of Forest School experiences for children are summarised below:

- Self confidence and self belief as a result of children having the freedom, time and space to explore their independence.
- Increased awareness of the consequences of other people's actions and the ability to collaborate with others and engage in co-operative play.
- The development of more sophisticated use of language – both written and oral, prompted by visual and other sensory experiences. Less reluctance of children to engage in meaningful dialogue with adults and peers.
- Motivation to take part in exploratory activities and an ability to focus and concentrate on specific tasks for extended periods of time.
- Development of physical stamina and gross motor skills. Development of fine motor skills and effective use of tools to make structures and objects.
- Respect for the environment and an interest in natural surroundings, making observations and insights into natural phenomena - seasons, light, wildlife and weather. This can be reflected in academic achievement.
- Teachers and leaders gain new insights into children's learning styles and skills, informing planning and assessment. They develop different relationships as children see teachers in a different setting and interact with them in different ways. Mutual trust through coping with the same challenges,
- Teachers gain new skills and experiences which inform their future practice both in indoor and outdoor education. Parents gain new perspectives and change their perceptions about issues such as risk taking and the benefits of being outdoors in any weather.

Source, Borradaile, 2006

Since 2000 over 30 Forest Schools have been established in the UK with an increasing number of smaller local initiatives being developed. One such local initiative was a project set up by the Early Childhood Studies team at the University of Northampton in collaboration with students and staff and children from a local nursery school.

Taking the Swedish view that there is ‘no such thing as bad weather, only bad clothing’ the children were given the opportunity to visit a local country park one day every week, whatever the weather. While some initial reluctance was evident, notably amongst the University students, as the programme progressed it became increasingly evident that the children were gaining a great deal from the experience.

The programme originated from staff development related to the work of Gardner (2000) on ‘multiple intelligences’, and student and staff visits to Denmark and Sweden within a context of the growing national interest in Forest School. It was designed with two objectives – firstly to give children the opportunity to interact regularly with natural surroundings and to raise practitioner and student awareness of the potential of such a learning environment.

The curriculum was ‘child-led’ rather than content led, the ratio of staff to children was one adult to two children and decisions on support material for the children’s experiences were based on a weekly evaluation. Data gathered included written observations, videos and interviews with children, practitioners and parents. The Laever’s (1994) Well Being and Involvement Scales were applied to the observations of the children and recorded scores against the following criteria.

Well Being:

- Openness and receptivity
- Flexibility
- Self confidence and self Esteem
- Assertiveness
- Vitality
- Relaxation and inner peace
- Enjoyment without restraint
- Being in touch with oneself

Involvement:

- Concentration
- Complexity and creativity
- Persistence
- Satisfaction
- Energy
- Facial expression and composure
- Precision
- Verbal expression.

From the data gathered by students and nursery practitioners, it became evident that towards the end of the first stage of the project the children were showing behaviours demonstrating both greater levels of involvement and well being. One notable observation of both students and nursery staff was that the outdoor experience gave some children the opportunity to demonstrate skills and abilities that had hitherto had no outlet in their nursery environment. Observers also noted that their interactions with the children were different and of a higher quality. The opportunities, for example, for ‘sustained shared thinking’ (Dowling, 2005) were greater and children’s conversations, both during their experience and back in the nursery, began to reflect their growing pleasure in, and awareness of, the natural environment. Observers also noted the children’s increasing ability to make decisions for themselves and their decreasing need to be directed by adults as their confidence increased.

The opportunities that such an experience can give children and adults are both powerful and timely. If, as Littledyke (2007) suggests, the “central challenge of environmental education... is

how to encourage and develop in children a sense of relationship with the environment” then it would seem that both outdoor education and Forest School offer educators the opportunities to engage children in experiences that not only reflect developmentally appropriate practice and encourage children to develop their own independent learning paths, but also provide the opportunity for children to build a meaningful relationship with the environment.

Having had the experience of working with a group of urban six year olds who did not understand that flowers were living things. Their only experience of flowers had been either watching their parents plant them in their urban gardens, or arranged in vases, Nabahn and Trimble’s (1994, cited Davies & Elliott, 2003:9) comment, I find especially pertinent.

“opportunities need to be created for children to experience the outdoors, particularly for those growing up in cities. Children need places where they can explore and get dirty, touch living plants, care for and learn about insects, fish, birds, worms and spiders, in order for there to be growth of environmental awareness and responsiveness,”

As has been argued, (Gardner, 1983, Goleman, 1996, Lee, 2005, Littledyke, 2007) the affective domain underpins all learning and while practitioners in early years care and education apply a good understanding of the implications of this to their practice, I would argue that it is not always applied to practitioners themselves in their own learning. One of the successful aspects of the Northampton study was the impact upon the practitioners themselves. After some initial reluctance to engage in the outdoor activities in poor weather conditions, the response became more positive towards the end of the first phase of the project. This significant response did not occur not simply because the practitioners could observe the benefits to the children, their own engagement increased and they began to develop some sense of ownership over the project.

At present, I would suggest that one of the greatest barriers to effective outdoor education is the “biophobic” (Orr, 1993) responses of some practitioners, at any level of education. If educators themselves do not develop, and subsequently model “biophilic” (Wilson, 1984) behaviours then we simply continue to undermine our own intentions. As argued at the beginning of this paper, education about the environment is insufficient, we need to educate for the environment by integrating the cognitive and the affective, at all levels and in all contexts.

While it has been acknowledged that it is our children who will shape the future, it is the current teachers and practitioners who must become the initial agents of change, and it is the teacher educators who have the responsibility to apply this understanding to our students. The most effective way to do this is to pay attention to the affective domain in our own practice. If we wish to ‘make a difference’ it is essential that we fully engage our own students in their learning, on a collaborative basis rather than purely instructional.

Corrie (1999) points out, however, that such models of professional development may prove a ‘problematic construct’ in that some practitioners are unable to see a meaningful connection between University based research and practice. In addition, the ‘lack of shared meanings can silence teachers’ and power relationships can create barriers between University researchers and practitioners. Despite this however, Corrie argues that “better links between university researchers and teacher researchers may add considerably to the knowledge base and change attitudes towards research”. (Ibid:1)

Conclusion

In summary then, outdoor learning opportunities and Forest School both provide an exciting way forward for the development of an environmental sensitivity in our young children. Not only do such experiences have a positive impact on children’s well being, confidence, self esteem, sense of agency, the positive impact on cognitive development and academic achievement has also been

noted (Borradaile, 2006). In addition, outdoor education and Forest School projects offer the opportunity for student education and professional development for practitioners and teachers in a way that is both meaningful and respectful of the contributions of all participants. Early childhood education has a key role to play in the development of a sustainable future, for this role to become instrumental in effecting change, process will be as significant as product. The way education for sustainable living is approached will have an impact on the outcome, both in respect of children's learning and development and the future of the planet.

References

- Borradaile, L., (2006), *Forest School Scotland: An Evaluation*, Scottish Executive, Edinburgh.
- Burke, C. & Grosvenor, I., (2003), *The School I'd Like: Children and young peoples' reflections on an education for the 21st Century*, Routledge Falmer, London.
- Corrie, L., (1999), Contributing to Educational Change as a Teacher-Researcher, *Early Childhood Education*, (2) 29-40.
- Davis, J., & Elliott, S., (2003), Early Childhood Environmental Education, *Early Childhood Australia*.
- Dowling, M., (2005), *Supporting Young Children's Sustained Shared Thinking*, BAECE, London.
- Early Years Foundation Stage Practice Guidance, , (2007), DfES, London.
- Gardner, H., (1983), *Frames of Mind: The Theory of Multiple Intelligences*, Basic, New York.
- Gardner, H., (2000), *Intelligence Reframed: Multiple Intelligences for the 21st Century*, Basic, New York.
- Goleman, D., (1996), *Emotional Intelligence*, Bloomsbury, London.
- Isaacs, S., (1930), *Intellectual Growth in Young Children*, Routledge, London.
- Laevers, F., (1994), *The Leuven Involvement Scale for Young Children*, Centre for Experiential Education, Leuven.
- Lee, Y.P., (2005), Forces shaping the future of teaching and learning of mathematics, *Educational Research for Policy and Practice*, 4, 169 – 179.
- Littledyke, M. (2007) *Science Education for environmental awareness; approaches to integrating cognitive and affective domains*, paper prepared for publication, Cheltenham.
- McMillan, M., (1930), *The Nursery School*, Dent & Sons, London.
- Nabhan, G., & Trimble, S., (1994), *The Geography of Childhood*, Beacon Press, Boston.
- Neill, James, (2004), When did Outdoor Education Begin?
Wilder.com/history/whendidoutdoorededucationbegin.html; retrieved, June 2007
- Orr, D. (1993), Love it or Lose it: the coming of the Biophilia revolution in S.R. Kellert & E. Wilson (Eds) *The Biophilia Hypothesis*, Island Press, Washington, DC.

Pelligrini, A & Davis, (1993) Relations between children's playground and classroom behavior. *British Journal of Educational Psychology*, 62,88-95.

Rivkin, M., (2004), The Schoolyard habitat movement: What is it and why children need it? (1998), *Early Childhood Education Journal*, 25 (1) 61-65.

Scottish Executive, (2004), Curriculum Review Group, *A Curriculum Framework for Children 3-5*.

Swann, R. (2001) Unpublished notes, University of Northampton.

Educating for a sustainable future; A transdisciplinary vision for concerted action, UNESCO, *International Conference on Environment and Society*, 1997, Dec 8-12, Thessaloniki.

Wilson, (1966), Healthy Habitats for Children, *Early Childhood Education*, 28 (4), 235-2381.

Wilson, E., (1984) *Biophilia*, MA Harvard University Press, Cambridge.

Evaluation of the new Cross Thematic Curriculum Framework of Environmental Education in Greek compulsory Education

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Abstract

Since the last school year 2006-7 new Curricula, which were elaborated according to the modern psychopaedagogical theories of learning, have been imported in compulsory education in Greece. At the same time the criteria for writing new school books were also determined, some of which the students were first taught during the school year 2006-7 and the rest of them are to be introduced to schools in the year 2007-8. The infusion of Environmental Education, Cross-cultural Education, Education of Health and generally all modern tendencies of Education were adopted in the philosophy of the new Curricula development.

The investigation of the psychopaedagogical criteria of the new Curricula and specifically the Cross Thematic Curriculum Framework of Environmental Education evokes exceptional interest, in order to detect the degree to which modern epistemological approaches were adopted in the frame of Environmental Education. Specifically, the way of approaching the pedagogic categories-*the teaching object, the objectives of the curriculum of Environmental Education and the role of teacher-* and how their interrelation is modulated according to them was investigated.

The research results point out that the new Cross Thematic Curriculum Framework of Environmental Education that was investigated aims in the educational autonomy of teacher and student, since the growth of interpersonal relations between those involved in the educational process, team teaching-learning and learning about life through life are sought, through an open curriculum that is shaped according to the needs and interests of the students. The afore mentioned objectives are absolutely compatible with those of the Critical Communication Pedagogy, according to which the notions "communication" and "critical" are present, run through all sectors of pedagogic action and constitute - according to the Frankfurt philosophers (Adorno, 1961, Marcuse, 1971 etc.) - the base of human action.

Keywords:

Environmental Education, Education for Sustainable Development, Environment, Cross Thematic Curriculum Framework of Environmental Education, Critical Communication Pedagogy, student autonomy, teacher autonomy

Introduction

One of the most important parameters that play a decisive role in the reform of an educational system is the revision of the Curricula (Vrettos and Kapsalis, 1999: 13). A curriculum should partially or generally be reformed per regular time intervals, so that it is adapted to the facts in the sector of the Sciences of Education and to the requirements that result from the changes that take place in the wider scientific, socio-economic and cultural environment (Vrettos and Kapsalis, 1999·Flouris, 1983· Hatzigeorgiou, 1998).

After about 20 years new Curricula for the Compulsory Education were worked out in Greece. The equivalent school handbooks, that began to be imported progressively in the Greek educational reality from 2006-7, were written based on the criteria for educational material writing as it is defined in the curriculum of each course.

Environmental Education and the Philosophy of new Curricula

Environmental Education virtually covers the third decade of its life after the international conferences in Belgrade and Tbilissi, where its subject-matter, targets, particular characteristics, principles and models of its integration in the educational process were delimited. In the Greek educational reality Environmental Education, regarding education about the environment, through/in/ from the environment and for the environment (Muthoka and Rego, 1985· Alexopoulou and Glavas, 1987: 5-6), is infused¹ in the already taught subjects, reducing them to carriers of Environmental Education (Danassis-Afentakis, 1997: 79). At the same time, during the last years and mainly after the conference in Thessalonica (UNESCO, 1997) E.E. focused on the dimension of a "sustainable development". According to the Brundtland report, which was one of the first official texts that reported on education for sustainable development, E.E. should not be directed almost exclusively to the examination of the viable use of natural resources and ecosystems. On the contrary, it was also recommended that the world socio-economic and political factors, such as the need for action worldwide aiming at the obliteration of poverty, the upgrade of the environment, the achievement of peace and safety as well as the economic development of developing countries, should be co-examined (WCED, 1987).

The way of incorporating E.E. in the older Curricula that existed in the Greek educational reality - up to 2000 in Junior High school and 2006 in Primary school - depended on the psycho-pedagogical principles that shaped the philosophy of their development to a corresponding degree as well. More specifically, the Programs of Study had the form of a curriculum (Loukeris, 2005:61), that is to say they were characterized by a strictly predetermined quadripartite layout of the educational process (objectives-targets, content, methodological approaches, evaluation). They were being developed with distinguishable and explicit "classification" of their content and "entrenchment" of the control (Bernstein, 1991:89) which the schoolteacher and the student possess on the choice, organisation,

¹ The scientific term that was used in the official texts of UNESCO is "infusion" and the precise translation in the Greek is "infusion". For more look. UNESCO – UNEP, a comparative survey of the incorporation of the environmental education into school curricula, 1985, *Environmental Education Series* 17, s. s. 130-2.

stepping and time arrangement of the knowledge that is transmitted and engaged in the pedagogic relation.

Since the last school year (2006-7) new Curricula have been applied in Compulsory Education (Primary school and Junior High school), in which, unlike the older ones, a detachment was attempted from the traditional way of approaching knowledge. It is the new Curricula (A.P.S) which concern every subject in every school class and the Cross Thematic Curricula Framework (D.E.P.P.S) which refers to every subject in all classes at school. The Cross Thematic Curricula Framework of individual subjects influence considerably the way new Curricula are developed. This happens, because the Cross Thematic Curriculum Framework of each subject determines the basic knowledge and activities that are mentioned for all subjects as Interdisciplinary concepts and Interdisciplinary activities, which are infused in the content of the school handbooks and are connected with other more specific or more general ones, in order that the student "conquers the notable knowledge... that can be exploited in the daily life and lead to the personal and social growth" (YPEPTH-PI, 2002b: 769-770).

Focusing our interest in the Cross Thematic Curriculum Framework of Environmental Education, we could define interdisciplinary concepts and activities of environmental nature which aim in the systemic approach of knowledge and which should either be infused in the remaining courses or taken into serious consideration at the materialization of projects on environmental issues in a teaching time that has been forecasted for this aim specifically².

More specifically, we approach the basic information, the concepts, the principles and the processes which have their basic characteristics common in all sectors of sciences, while at the same time they are adapted to the particular nature of each sector as the case may be. For precisely this reason they are called macro-concepts (Matsagouras, 2003: 91) and contribute to the configuration of a complete proposal for an interdisciplinary approach of the environmental knowledge via experiential methodological action³. It is suggested that the system, the interaction, the unit, the total, the change, the space, the time etc are considered to be fundamental concepts of the interdisciplinary approach in Environmental Education and contribute to the configuration of macro-generalisations as a wider benchmark with common characteristics on all scientific fields.

Parallel to the quotation of macro-concepts as a factor for the constitution of factual knowledge, indicative activities are also mentioned under the term macro-skills that contribute to the constitution of procedural knowledge in the Cross Thematic Curriculum Framework of Environmental Education. This procedural knowledge is reported in the processes of thought, learning, communication, collaboration, treatment of primary elements and growth of the critical and creative thought (Matsagouras, 2003: 91), parameters which are considered very important for Environmental Education as well.

According to the above mentioned views, the Cross Thematic Curriculum Framework of each subject and consequently E.E. recommends a frame of planning, an outline of an interdisciplinary approach of knowledge, offers the teacher and the students the facility to detach themselves from past teaching practices and contributes to the reduction of general and vague knowledge,

² "The time of its application in Primary School –as a Flexible Area – varies from 4 hours in the small classes, up to 2 hours in the last two ones, whereas in Junior High school –as a Flexible Area of Innovative Actions – initially time is limited to 2 hours a week." (Alahiotis, 2002: 10). During the application of the program a two-hour continuous activity on the project under discussion is provided, which involves the establishment of teaching periods of 90', with intermediary breaks of 25'.

³ The configuration of a frame of knowledge and dexterities with wider reports concerning the elements that compose a scientific field is a well known strategy and it has also been applied in other cases. A characteristic example for the Natural Sciences is the Analytic Program Project 2061 in the USA, where teams of scientists collaborated, so that they lead to an agreement with regard to the required concepts, knowledge and processes that should be included in the corresponding subjects that are taught in schools (Fensham, 2001).

highlighting only this which is more important for the students to acquire. In other words, what prevails are:

- the authors of the Curricula should be confined to the information that leads the students to the construction of the essential and necessary knowledge, developing their existing experiences, that derive from their daily contact with the facts and
- the students should be taught those meta-cognitive and social skills that are connected with the composition of knowledge and constitute a prerequisite for self-adjusting learning and via life education (Matsagouras, 2003: 164).
- We could say that these observations are absolutely compatible with the pedagogic expectations of the Critical Communication Pedagogy which were ignored or overtaken by occasionally presented reforms, such as:
 1. the growth of interpersonal relations between teacher-student on the basis of respect amongst themselves and fellow feelings and not on the basis of the roles that are dictated by their place in the educational system
 2. the treatment of the student as a single and unique personality and not as an impersonal individual, similar with the other individuals,
 3. the team teaching-learning and not the schoolteacher-centred process
 4. learning about life through life itself, using "open" curricula that will be shaped in accordance to the needs and interests of the students and not "closed" curricula (Kossyvaki and Brouzos, 1996: 277-324).

Aim and methodology of research

Aim and method of research

The aim of our research constitutes the evaluation of the Cross Thematic Curriculum Framework of Environmental Education, which, as it was pointed out earlier, constitutes the theoretical and practical frame that defines the way and the type of environmental knowledge that should be included/ infused in the Curricula and the school books of the other subjects.

The nature of the research material dictates the Qualitative Content Analysis. According to Berleson (1971: 18) it is that method that is used for the "objective, systematic description of the evident content of communication", to detect those qualitative clues that contribute to the comprehension of the criteria and the relations between them that shape the quality of the Curriculum of E.E.

The recording of the issues that contain a certain clue declarative of the psycho-pedagogic status of the organisation of the program, the cross-correlation of the data as dependent variables and the assessment of the value of the subjects-categories that are involved in the organisation of the particular Curriculum led to the coding and analysis-interpretation of the information using *the item* as a unit of recording (Spanos, 1991). As *item* we define the text presented according to the case, as it is shown in the individual elements of Cross Thematic Curriculum Framework of E.E.

Assumptions and exploratory questions

Based on the aim of the research, we first studied the Curriculum of E.E and focused our interest on the subject-matter to be explored, which is the strategy of the infusion of Environmental Education in the new Curricula. Then, based on the theoretical frame, we reached the basic assumption of the research which is: Is the new Cross Thematic Curriculum Framework of Environmental Education compatible with the principles of the new psycho-pedagogic theories of learning and does it serve the modern epistemological approaches?

The subjects-categories that were brought out are:

- teaching subject-matter - environment,
- objective of Environmental Education,

- the role of the schoolteacher - methodological approaches and evaluation

The individual exploratory questions that derive from the above mentioned issues are:

Through the particular Cross Thematic Curriculum Framework of E.E.:

- Is a holistic approach of the environment promoted and if yes to what extent?
- What type of knowledge and skills is the student called to acquire through the educational process?
- Are values of environmental kind displayed, so that the students are sensitised on issues concerning the quality of life?
- Is the student's energetic entanglement in the processes of approaching the environmental problems also promoted and to what extent?
- Are instructive approaches of experiential type promoted?
- Is the cross-thematic and interdisciplinary character of E.E. highlighted?

The process of data will show, to the extent this is of course feasible, the strategy of infusion of Environmental Education in the new Curricula of the subjects of Compulsory Education in connection with the ideological – philosophical orientation of the Cross Thematic Curriculum Framework of E.E. that functions as a legitimizing valve of specific choices.

Presentation of data

The Instructive object – an approach of the concept of the environment

In the Cross Thematic Curriculum Framework of Environmental Education the objectives framework comes first. In this the awareness of man's relation to the natural and social environment on behalf of the students, their sensitization and activation on the problems that are connected with this, so that they contribute to the more general effort of confronting them appears to be the aim of the school subject. At the same time, E.E. is defined as the educational process that "leads to the clarification of concepts, the recognition of values, the growth/cultivation of psycho-pedagogic skills and attitudes that are essential in the process of decision-making and in the configuration of a behaviour code about the problems that concern the quality of environment in individual and then in common/social level". Finally, there is reference to the holistic conception of the environment with the following expressions: Natural, Artificial/Structured, Socio-economic and Historical environment (OFFICIAL JOURNAL OF THE HELLENIC REPUBLIC 304/v.B', 13/3/2003: 4360). With regard to the Content of Learning, the thematic axes proposed are (OFFICIAL JOURNAL OF THE HELLENIC REPUBLIC 304/v.B', 13/3/2003: 4360 -4):

- Air – Atmosphere – Climatic changes
- Water
- Ground
- Forests
- Biodiversity – Disappearance of types
- Energy
- Management of litter and waste
- Human activities
- Human relations and values

In the above thematic axes are included data that are related to the Natural Sciences, the Meteorology, the wider problems of environmental nature that are connected with the pollution of air, waters and soil, the degradation of natural environment as a result of man's interventions in this,

the overexploitation of natural resources, and finally the ways of exploiting technology aiming at the confrontation of environmental problems.

More specifically, the last two thematic axes-the human activities and the human relations and values- include issues which are closely connected to man's activity inside the environment-mainly the artificial and structured one-safety, health, living conditions, aesthetics, functionalism as well as the social and economic dimensions of the developmental and environmental problem. At the same time, there is an extensive report to the human living conditions in combination with the boost of the role of the large social groups in the permanent growth and the international collaboration between North and South, East and West for the confrontation of social problems such as: poverty, problems of minorities, wider social problems and unfriendly to the environment consuming models.

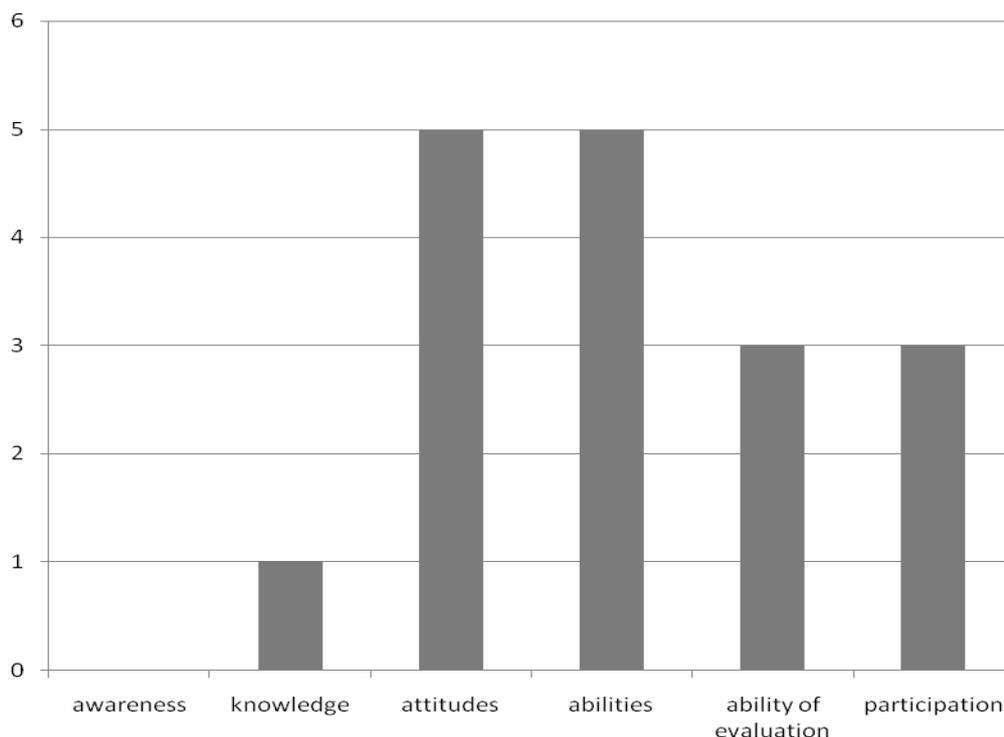
Knowledge, skills and attitudes in Environmental Education

Therefore, a beam of targets, which the student is called to conquer, is shaped around the student who attends a program of Environmental Education, so that he is provided with the essential knowledge, skills and attitudes that concern the critical and moral approach of the problems of the environment.

The general and specific targets, as they are characteristically reported in the particular Cross Thematic Curriculum Framework, are spotlighted in combination with the cognitive axes and the thematic units respectively. For reasons of better imprinting and explicit determination of the tendency that prevails, the general and specific targets of the subject of E.E. were categorized in the six categories of targets of E.E. (awareness, knowledge, attitudes, abilities, ability of evaluation and participation), as these were also defined in the Congress on Environmental Education in Belgrade (UNESCO - UNEP, 1985b: 3, 1994: 8-11).

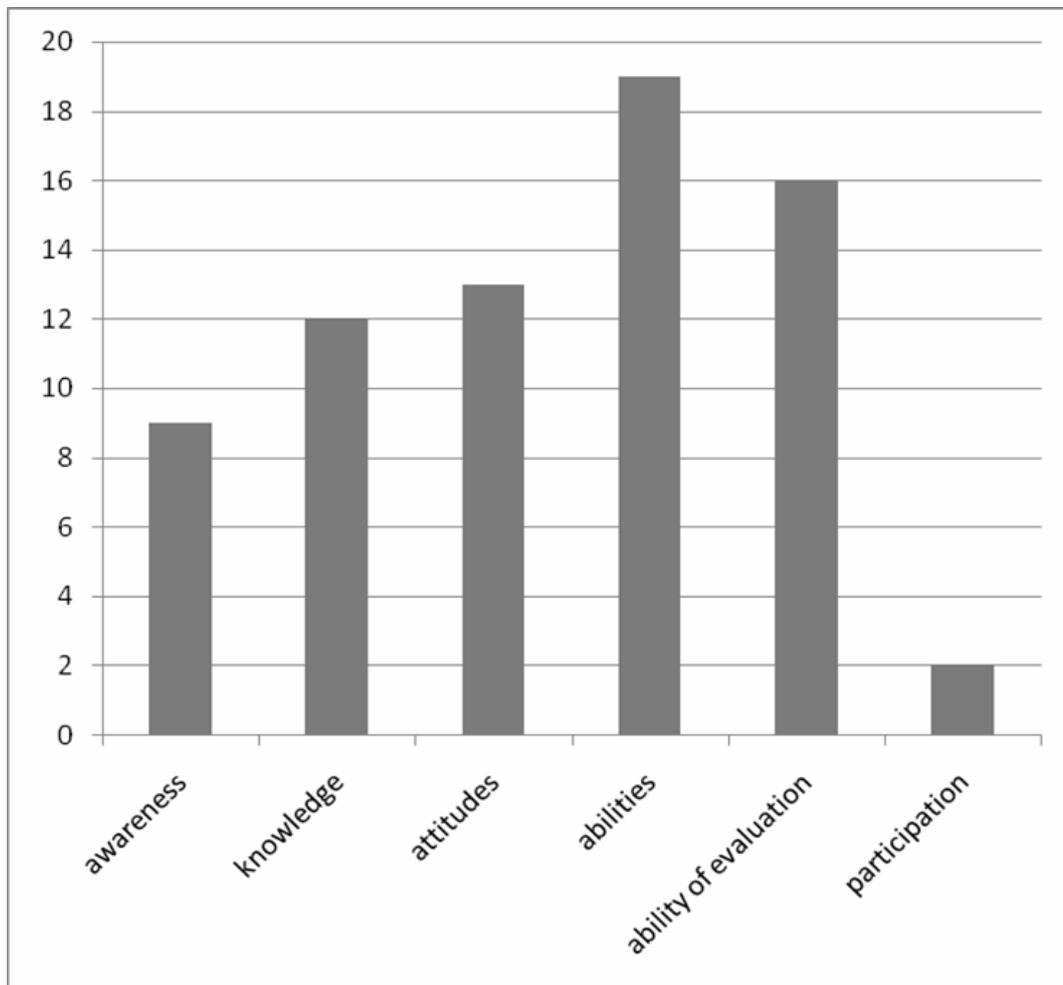
From the classification of the general targets in the above categories, according to content analysis, emerges that in most cases the attitudes together with the abilities, the ability of evaluation with the participation and, finally, knowledge are mentioned in declining order (Graph 1).

Graph 1: General targets



The classification of the more specific targets, that are mentioned parallel to the thematic units, adopting the same taxonomic model, results in the target reports of ability development, ability of evaluation, attitudes, knowledge, awareness and, finally, participation (Graph 2).

Graph 2 : learning and teaching targets



The role of the schoolteacher - methodological approaches and evaluation

The methodological approaches which are proposed by the Cross Thematic Curriculum Framework concerning Environmental Education are (OFFICIAL JOURNAL OF THE HELLENIC REPUBLIC 304/v.B', 13/3/2003: 4360-4): the project, the problem solving approach and the Field Study with the stages of their materialization.

The above mentioned methodological approaches are also complemented with various instructive strategies, such as:

- Detection and modification of alternative ideas of students
- Method of research with submission of questions
- Experimental method
- Analysis and study of a characteristic case
- Simulation activities and games
- Intellectual excitation
- Juxtaposition of opinions
- Feedback

- Roles Game -dramatization
- Manufacture of a conceptual map /map of ideas
- Centralized table

The approaches to direct environmental problems, such as the pollution or contamination of a lake or river, the bad management of the soil, the local ecosystem which is in danger, the energy problem, the pollution of air, water and soil, the perturbation of the balance in nature because of the human interventions etc. are suggested as indicative activities **in the frame of other courses**.

Simultaneously, however, **projects of an environmental kind on issues of wider interest**, such as the study of soft and alternative forms of energy, the management of litter, the development of residence concerning the environment, the children's obligations and rights, the study of culture, morals and customs of men with different nationality, the pros and cons of tourism etc. are proposed as well.

The fundamental concepts of the Cross Thematic approach recommended are: interaction, viability, aesthetics, independence, solidarity, change, unit, balance, system, respect, total, space, time, circle, classification, culture, protection, development, economy, communication and responsibility.

Finally, it is reported in the Cross Thematic Curriculum Framework that evaluation is necessary, "because via this the effectiveness of educational practice is rated on the one hand and on the other the continuous improvement of learning results is sought " (OFFICIAL JOURNAL OF THE HELLENIC REPUBLIC 304/v.B', 13/3/2003: 4366). In parallel, the following criteria are mentioned:

- Target achieving degree
- The methodology that was followed
- The originality in the confrontation of the issue
- The cross-thematic approach
- The amount, the heterogeneity and the quality of resources that were chosen
- The ability of organising and processing data, information and material that were assembled
- The inference and documentation of conclusions that resulted from the data, the measurements and the diagrams
- The degree of exploitation of new technologies
- The composition of the work
- The degree of difficulty of the issue and, finally, any other criteria the teacher considers essential.

Interpretation of data

The holistic approach of the environment as an instructive subject

It is obvious that E.E. is structured around the key-concept of the environment, which was placed under a new *interpretive approach*, because of the continuously worsening ecological crisis. The term "environment", as it is presented in the Curriculum of E.E. refers either to the element of space - natural or man-created, the social environment related to the effects that are practised on man via the interpersonal and social relations in which he participates or the ecology and our relations with the plant and animal world.

It is pointed out that in the basic texts of Environmental Education, the environment-teaching subject-matter is presented to be intermingled with all other sciences and simultaneously is recognized as a complicated set of mutually influenced natural and anthropogenic systems (Odum, 1989: 8-25; Loukeris, 2000:10-6; Giannoulas, 2007: 53-4). Also, in the same texts it is noted that the reasons of the ecological crisis need to be detected in certain aspects of human decisions and particularly those concerning man's economic activities in all stages of goods production. In this

way, E.E. leads us inevitably to the critical interpretation of human choices which are also the deeper causes of environmental problems. In other words, the concept of "environment" includes a mesh of natural, anthropogenic and social elements that concern human existence, which elements comprise a set of cultural, moral and personal values and interpersonal relations in all sectors of human activities. For this reason, however, the particular Cross Thematic Curriculum Framework of E.E includes - as teaching subjects - questions that are not limited only to the viable use of natural resources and systems, but are also related with the need for the world collaboration aiming at the obliteration of poverty, the collaboration between North and South, the upgrade of the environment, the achievement of world peace and safety as well as the economic growth of the countries of the so-called Third World, so that they cover their basic needs. It is marked that the Education for Viable Growth, according to the Brundtland Report (WCED, 1987), the Agenda 21 of Conference in Rio (1992) and the Conference of Thessalonica (1997), promotes the opinion that the ecological destructions and the technological-industrial dangers arise, not only from wealth but from poverty as well. Even the conflicts between the social groups in local, national or super national level are immediately connected with the appearance of environmental problems. The particular parameter renders explicit that the environmental problems are interlinked with issues that are related to the way the developed countries and the big economic interests they represent exploit the wealth-producing resources of energy in the developing countries of the world (Loukeris and Tavoulauri, 2002; Modinos, 2002).

It is obvious that these observations are fundamental for the examination of the holistic environment and its problems. In this concept the environment is considered to be a dynamic system continuously evolving and shaped by the dependence and interaction relations between the elements that constitute it, a holistic, that is to say, approach of the environment founded on a wide interdisciplinary basis. Under this prism all disciplines – and not only the traditionally environmental – and by extension school courses, since these are their reflection in the curriculum, can be developed and contribute to the achievement of the aims and objectives of E.E.

The approach of multiple dimension of the environment in the frame of the objectives of the Cross Thematic Curriculum Framework of E.E.

The objectives frame of the Cross Thematic Curriculum Framework of Environmental Education seeks the harmonious growth of the cognitive, sentimental and psycho kinetic sector of students, that is to say, it is consistent with the objectives of Environmental Education regarded as education about the environment, through/in/ from the environment and for the environment (UNESCO – UNEP, 1985a: 4; Alexopoulou and Glavas, 1987: 5-6).

The education "about the environment" focuses on the acquisition of knowledge and familiarization with the processes of the operation of the environment. It is marked that the previous Curricula in a more general level focused on this dimension, that is to say, on the cognitive character of learning. More specifically, they gave emphasis on the acquisition of the teaching material and the reproduction of knowledge of a fragmentary kind (Maridaki-Kassotaki, 2001· Kossyvaki, 1997), which in certain cases was deficient, that is to say, the scientific validity of the content of learning through the apposition of past or even erroneous knowledge of informative character was not ensured (Loukeris, 2004·2005: 136).

The reference "through/in/ from the environment" creates conditions for a more effective course to the acquisition of knowledge and learning of activities connected to a student-centred perception. On the contrary, the reference "for the environment" stresses the enrichment of the moral character of the educational process that aims in the upgrade of the total quality of life (Palmer, 1998: 144). The last two dimensions are those that correspond to the wider socio economic and political parameters, which highlight the particular nature of E.E. and, finally, render it different from the earlier educational movements of the past (Ditsiou, 2002: 27). The critical and political character of E.E, which is interlinked with political and social values (Gough, 1997) of the socio cultural frame where the student lives and creates, is approached through them.

The mediatory role of the teacher in the acquisition (approach) of environmental knowledge

In the particular Cross Thematic Curriculum Framework of E.E. modern epistemological approaches are promoted, whose principles the teacher is called to develop. The learning process is described as a result of the re-comprehension of knowledge that pre-existed in the light of new data. The emphasis in the learning procedure focuses on the process and not only on the result. In other words, the interest focuses on the awareness of what and how, that is to say on the study and analysis of the processes via which the students are led to learning (Driver et al., 1986).

The concept of the support of the cooperative- participative process and at the same time the rejection of the fragmentary teaching as regards Environmental Education is also included in the above frame and in the case of team learning the advisory and supporting role of the schoolteacher results as an important parameter. According, of course, to constructivism, learning is determined by the complex interaction among the already existing knowledge of students, the social environment and the problem that demands solution and it takes place via discovery, action, reflection and meta-knowledge (Panteliadou, 2000: 308). Consequently, in the frame of E.E the students should be provided with a cooperative, collective environment, in which they will have the occasion and the ways to manufacture new intellectual forms via energetic action and experience during the solution of realistic environmental problems, which are of importance and direct interest to the students. In other words, the individual data and the elements concerning the layout of knowledge, its transmission, evaluation and the way it is co-shaped via the interaction of the subjective consideration and objective truth should be re-examined (Jickling, 1997: 5).

The subjective consideration includes the student's former experience, his innate interest and his participative action on one side as innate elements of promotion of energetic learning (Dewey, 1987) and on the other side as elements of added value for E.E. (Palmer, 1998: 145). The objective truth, which up to recently also constituted the sovereign school knowledge, consists of the knowledge taught at school that derives from sciences.

At the same time, alternative forms of evaluation are developed, such as the observation, the discourse, the attendance of creative-exploratory work, the self-evaluation of students, their evaluation by their schoolmates and the portfolio /report card of student (YPEPTH – P.I. 2002a: 18), where the results are mainly expressed in qualitative means. The above reports conclude that the evaluation –in the frame of Environmental Education – consists of processes, which relate to the degree of attendance and activation of all factors involved in the educational process. Thus, via self-evaluation as an internal process and emanation of rethinking and criticism of the members of the group, the evaluator tries to investigate questions concerning the ethos of each school (Bernstein, 1991), as, for example, the most important environmental events-programs that happened in school, the degree of students' entanglement in them, the collaboration of teachers in carrying out the project, the collaboration of parents and local society (social partners) with school, the results of school opening to the local society, the way the students were activated about the vital environmental questions of the wider environment (Eisner,1985), the intra-team and cooperative inter-team students' relations, the extent of responsibility assumption, solidarity, collectiveness (Matsagouras, 2003), and intrapersonal and interpersonal communication among the students. It is a humanitarian model of evaluating the educational processes that is mainly supported by the opinion that the measurable results do not suffice to value the qualitative dimension of the human experiences of the students (Worthen et al., 1997). Depending on the result the evaluation functions as a feedback concerning the comprehension of all process and the undertaking of responsibility in a team level –teacher and students – for the improvement of the educational action and the redefinition of choices and strategies.

Conclusion

In the frame of developing new Curricula it is the first time an autonomous curriculum for Environmental Education is worked out as an official institutional document, the philosophy of which determines the frame of incorporation of E.E. in the Greek educational reality.

The Cross Thematic Curriculum Framework of Environmental Education determines the basic environmental knowledge (information, attitudes and skills/abilities) which, according to the principles of the new Curriculum, Environmental Education is approached either via its infusion into the other subjects or via the materialization of a project of an environmental character.

In this frame, the indicative cross thematic environmental concepts and skills are developed as well as the macro concepts and macro skills, which recommend the basic core of knowledge of an environmentally literate student.

The Cross Thematic Curriculum Framework of Environmental Education corresponds to the modern educational needs and expresses to a large extent, the philosophy of Environmental Education in the light of Sustainable Development. It adopts the educational applications of constructivism, where the frame of school knowledge shapes the proportional conditions of creation of a curriculum that would suit and be comprehensible to the students, as their intellectual growth and development advances in this way (Duffy et al., 1990, 1998).

The teacher's role is equally important. In a community, where the schoolteacher and the students work jointly together, his role is not other than that of the most experienced, which is more facilitating, advisory and pedagogic. The schoolteacher is not the authority of knowledge anymore, but the authority of learning (Duffy et al., 1998; Kokkotas, 2003). Thus, they are provided with chances of constructing concepts and learning in a cooperative and learning environment, in which the child will be present and where he will also have the possibility of conversing and re contemplating at the same time not only among his schoolmates but with his schoolteacher as well, depending on the messages he perceives from the socio cultural environment he lives.

It is explicit that the previous Curricula, which were included in the frame of the positivist example⁴, gave their place to Curricula that are included in the explanatory/interpretive and critical example. Specifically, the new Cross Thematic Curriculum Framework of Environmental Education adopts approaches of an explanatory and socially critical character. According to the explanatory/interpretive approach (Robottom and Hart, 1993: 26-27) concerning E.E., those activities are promoted that focus *through/in/ from* the environment, the role of the teacher is coordinative and knowledge does not constitute a tool irrelevant to man's social activity. For precisely this reason, this approach ventures to point out the social expediency and criteria, on the basis of which school knowledge is selected, distributed and takes precedence over each situation (Bernstein, 1991). Simultaneously, the pedagogic frame that is defined in the Cross Thematic Curriculum Framework of Environmental Education encourages the critical approach and the rethinking of teacher and students via discourse, communication and cooperative and critical investigations of environmental questions, so that they are led to the composition of new knowledge, disputing the old one. It is precisely these data that also express the basic principles of the critical approach (Robottom and Hart, 1993: 26-27), where school knowledge is re-defined, in contradiction to scientific, considered as an emanation of the dynamic interrelation between the empiric-experiential and scientific knowledge (Matsagouras, 2003: 18, 21).

⁴ In the frame of these programs, the E.E. is considered to be a linear interpretation of environmental problems, in absentia of their sociocultural frame of report (Robottom and Hart, 1995), since technocratic perceptions of achieving the cognitive objectives are put forward, which aim mainly in the repetition of knowledge of a fragmentary character.

Proposal

Depending on this reasoning, it becomes obvious that this new pedagogic - educational process is constituted of a different perception about the content of knowledge and the way knowledge is founded and developed (Schiza, 2005: 491).

In teaching E.E., the outcomes show that there is need for tools of thought, educational materials, means of teaching, strategic planning of our pedagogic actions and methods of teaching, all "open» to changes from continuously developing teachers and students. Since, each change is connected with decisions that presuppose explanatory and critical dimensions; it appears that the total venture "School curriculum E.E" could be placed in the frame of Critical Communication Pedagogy.

The Critical Communication Pedagogy promotes the consolidation of an open communication process (communication and critical dimension of educational process), absolutely compatible with the principles of Environmental Education.

Therefore, in the frame of Critical Communication Pedagogy in E.E., it is pointed out that (Giannoulas, 2007):

- 1) **the teaching-learning subject**, the environment, enters the teaching-learning field either as a set of intellectual and aesthetic-sentimental information "under continuous discourse and consultation" or, otherwise, as theoretical and evaluative information from the subgroups and the environmental group in session,
- 2) the student virtually undertakes **to organise and continuously reorganize the information** in the frame of subgroups and the environmental team, so that he comprehends, interprets critically and expresses his attitude towards the issue via communication-discussion and has the ability to imagine it differently and share his ideas and expectations with others proposing changes,
- 3) the teacher is responsible for planning the procedure, thus "**creating pedagogic** (teaching-learning) **situations** " and "**proposing pedagogic materials**" without imposing his opinions except in the field of communication practice, so that the students become capable of discourse and consultation about issues that concern their daily life.(Karageorgos et.al., 2005, 104).

Quantifying all the afore mentioned issues, the Teaching method of E.E could be traced in the schematic representation of Critical Communication Pedagogy, as it is reported in Winkel, (1986: 85) and Kossyvaki (1997) on one side and on the other in the schematic representation of a model of methodological planning of E.E. in the frame of the Information Communication Technology (ICT) (Giannoulas, 2007, 73-81), readjusting its factors -sectors suitably.

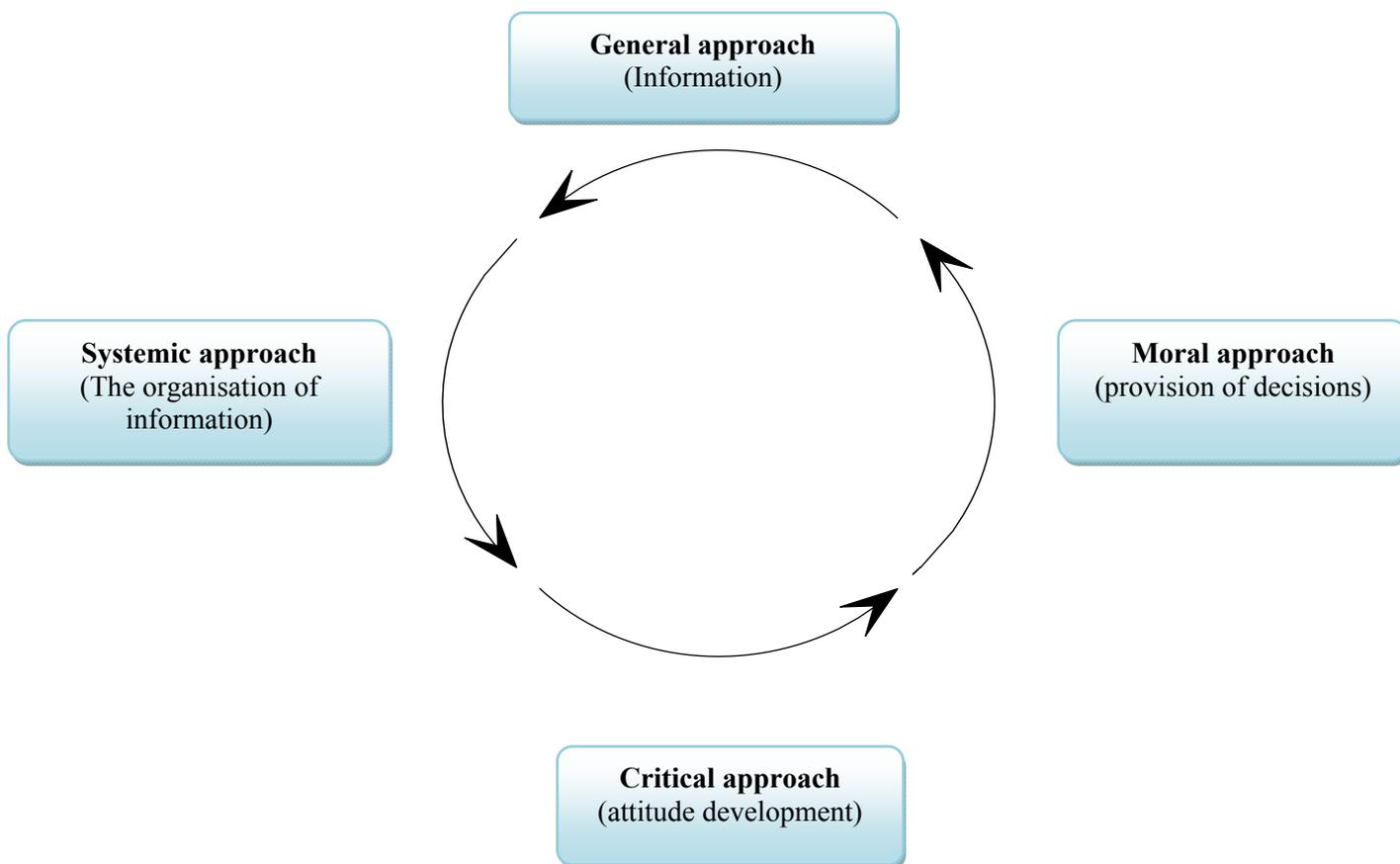


Figure: Teaching method of E.E.

The circle is used in order to imply that no one of the sectors is broken away from the remaining ones and, consequently, any review of the way one of them is approached involves reviews to all the others. In other words, the discrimination of teaching in sectors – approaches is clearly made for methodological and practical reasons, since in practice all together constitute a real situation or an action with the acting subjects to find themselves in a retroactive relation with the information, the supervisory means and the total reality.

Outside the circle we place the four basic approaches in order to show that the particularity of the "natural object" of the school curricula of E.E., the objectives and the methods do not exclude any approach. On the contrary, all can co-exist and co-evolve, since the new roles and the new relations between teacher-students and students-students of the Critical Communication Pedagogy of E.E. allow and activate fertile structures. The Critical Communication Pedagogy proposes methods, with which the teacher seeks the progressive and systematic reduction of his guidance and intervention and the simultaneous emergence and increase of students' attendance. And this is the reason why frontal teaching and methodical work are initially considered to be essential processes, which should progressively give their place to other more flexible and communicative forms of teaching.

These approaches can, therefore, be composed fruitfully:

- the "General approach" (the information), that is to say, the opinion that the environmental questions require explicit knowledge of new concepts and data from almost all scientific sectors, without which the other approaches cannot evolve.
- the "Systemic approach" (the organisation of information), that is to say the opinion that the environmental questions become more comprehensible, if they are observed as "organised complexity" or "organised structures" or "organised operations"

- the "Critical approach" (attitude development), that is to say the opinion that the environmental questions presuppose a critical explanatory glance-observation, since they are intermingled with human decisions and choices, and finally
- the "Moral approach" (provision of decisions), that is to say the opinion that the environmental questions bring us in confrontation with the multiple dilemmas, which presuppose a deep moral constitution of the developing person in order to be solved. Therefore, in order to draw an E.E curriculum in the frame of the Moral approach, we need to shape the teaching-learning situation, so that it progressively builds towards the conjugation of individuality-subjectivity to collectiveness.

References

Adorno, Th.W. (1961). Regarding the logic of social sciences. In *Epistemology: Texts* (ed. Kouzelis, G). Athens: nisos.

Alahiotis, S. (2002b). The Flexible Area of School. *Inspection of Educational Subjects. Special Oblation on Flexible Area*, 6. Athens: YPEPTH-P.I.

Alexopoulou, G., Glavas, P. (1987). *School and Environment*. Athens: OEDB.

Berleson B. (1971). *Content Analysis in Communication Research*. N. York: Hafner Publishing company.

Bernstein, B. (1991). *Pedagogic codes and social control* (trans. J. Solomon). Athens: ALEXANDRIA

Danassis – Afentakis A. (1997). *Modern Tendencies in Education*. Athens.

Dewey, J. (1987). *Experience and Education*. New York: Touchstone.

Ditsiou, M. (2002). *Evaluation of the program of Environmental Education "First acquaintance with the natural resources: From production to consumption "*, doctoral thesis, Philosophical Faculty of University Athens, Department of Philosophy, Pedagogy and Psychology. Athens.

Driver, R. & Oldham, V. (1986). A constructivist approach to curriculum development. *Studies in Science Education*, 13.

Duffy, T. & Cunningham, D. (1998). Constructivism: Implications for the design and delivery of instruction. In *Handbook of Research for Educational Communications and Technology*. New York: McMillan.

Duffy, T. & Knuth, R. (1990). Hypermedia and instruction: Where is the match; In *Designing hypermedia for learning*, (eds Jonassen, D. & Mandl, H.). Heidelberg, FRG: Springer.

Eisner, E. (1985). *The educational imagination: On the design and evaluation of School Programs*. New York: McMillan.

Fensham, P. (2001). Providing Suitable Content in the "Science of All Curriculum". In: *Improving Science Education*. Buckingham: Open University Press.

Flouris, G. (1983). *Curricula for a new era in education*. Athens: Grigoris.

Giannoulas, A. (2007). *The New Technologies of Information in the processes of teaching and learning of Environmental Education in the Secondary Education*. Doctoral Thesis, Philosophical

- Faculty, Department of Philosophy, Pedagogics and Psychology, Sector of Pedagogics, University Athens.
- Gough A. (1997). Education and Environment: Policy, trends and the problems of marginalisation. *Australian Education Review*, 39.
- Hatzigeorgiou, G. (1998). *Get to know the curriculum. General and special issues of Curricula and didactics*. Athens: Atrapos
- Jickling, B. (1997). The future of E.E.; *Canadian Journal of Environmental Education*, 4.
- Karageorgos, D., Mercouri, St., Giannoulas, A. (2005). The effect of Technologies of Information and Communication in a CrossThematic Single Frame of Curricula (DEPPS): The case of Mathematics and Environmental Education. *Nea Paedeia*, v. 113, p. 92-105. Athens.
- Kokkotas, P. (2003). *Didactics of Natural Sciences: Modern approaches in the teaching of N.S*. Athens.
- Kossyvaki, F. And Brouzos, A. (1996). Basic Thesis and Perceptions of Critical Communication Didactics. In: Matsagouras, the *Development of Didactics. Epistemologic Consideration*. Athens: Gutenberg, p.p. 277 – 357.
- Kossyvaki, F. (1997). The Curricula in Primary schools. The experience of Greece –Application, difficulties, problems and prospects. Proceeding of Congress on the subject: *The Curricula in the First degree Education*. Athens: DOE –POED.
- Loukeris, D. (2000). *The course of Study of environment in the light of Environmental Education*. Doctoral Thesis, Philosophical Faculty, Department of Philosophy, Pedagogics and Psychology, Sector of Pedagogics, University of Athens.
- Loukeris, D. and Tavoulari, Z. (2002). Education for viable growth or environmental education in the era of globalisation? Comparative consideration of the issues that is highlighted in the courses: "Study of Environment" and "First steps in Science" in Greece and Cyprus respectively. Proceedings of the VII Pancyprian Congress of Pedagogic Company in Cyprus on the subject: *The Educational Research in the era of globalisation*, v. A'. Nicosia.
- Loukeris, D. (2004). The Environmental dimension of Curricula: Theory, action and evaluation. Proceedings of the Meeting of the First degree Education Authorities, Lakonia: *The Environmental Education in Primary School and Kindergarten: Programs – Activities*. .
- Loukeris, D. (2005). *Environmental Education: Theory and Action*. Athens.
- Marcuse, H. (1971). *The Mono dimensional man*. Athens: Papazisis.
- Maridaki –Kassotaki, A. (2001). The teaching handbooks of the series "My Language": Inquiring-evaluative approach. *Glossa*, 53.
- Matsaggouras, I. (2003). *The Cross Thematic Issue in the School Knowledge*. Athens: Grigoris.
- Modinos, M. (2002). *Globalisation and Environment*. Athens: Ellinika Grammata-Interdisciplinary Institute of Environmental Researches (DIPE).

- Muthoka, M., Rego. (1985). Environmental Education : Module for In - Service Training of Social Science Teachers and Supervisors for Secondary Schools. *Environmental Education Series*, 10.
- Odum P. E. (1989). *Ecology and our endangered life - support system*. Massachusetts: Sinauer Associates Inc. Publishers.
- Official Journal of the Hellenic Republic 304/v. B, 13/3/2003
- Palmer, J. (1998). *Environmental Education in 21st Century. Theory, Practice, Progress and Promise*. London and New York: Routledge.
- Panteliadou, P. (2000). *Training Difficulties and Educational Action*. Athens: Ellinika Grammata
- Robottom, I. & Hart, P. (1993). *Research in Environmental Education. Engaging the Debate*. Victoria: Deakin University Press.
- Robottom, I. & Hart, P. (1995). Behaviourist Environmental Education Research: Environmentalism as Individualism. *Journal of Environmental Education*, 26 (2).
- Shiza, Mr (2005). The particularity of Environmental Education starting from its teaching object, in A.D. Georgopoulos (ed.), *Environmental Education. The new culture that emerges*, Athens: Gutenberg.
- Spanos, G (1991). *Pedagogic instructive and psychological consideration of the organisation of the course New Greek Language in Secondary Education based on the A.P.* Doctoral Thesis, Philosophical Faculty, Department of Philosophy, Pedagogics and Psychology, Sector of Pedagogics, University Athens.
- UNESCO – UNEP. (1985a). *Module for In-Service Training of Social Science Teachers and Supervisors for Secondary Schools. Environmental Education Series*, 10.
- UNESCO – UNEP. (1985b). A comparative survey of the incorporation of the environmental education into school curricula. *Environmental Education Series*, 17.
- UNESCO – UNEP. (1994). A prototype environmental education curriculum for the middle school. *Environmental Education Series*, 29.
- UNESCO (1997). Declaration of Thessaloniki. International conference on the subject: «*Environment and Society: Education and Sensitization of citizens on viability*». Thessaloniki, 8-12 December.
- Vrettos, J.& Kapsalis, A. (1999). *Curricula*. Athens.
- WCED (World Commission on Environmental and Development). *Our common future*. Oxford University Press.
- Winkel, R. (1986). Didaktik als Bildungslehre, Teil 1: Theorie der Bildungsinhalte und des Lehrplans, Beltz, Weinheim 1930, 8/1965. In: Kossovaki, F. (1997), *Critical Communication Teaching. Critical Approach of Teaching*. Athens: Gutenberg.
- Worthen, B., Sanders, J. & Fitzpatrick, J. (1997). *Program Evaluation. Alternative Approaches and Practical Guidelines*. New York: McMillan.

YPEPTH-P.I.. (2002a). *Cross Thematic Single Frame of Curricula – Analytic Curricula of Obligatory Education*, v. A'. Athens: YPEPTH-P.I.

YPEPTH-P.I.. (2002v). *Cross Thematic Single Frame of Curricula – Analytic Curricula of Obligatory Education*, v. B'. Athens: YPEPTH-P.I.

An Application of Two Experiential Learning Models in Teaching Database Systems: A Comparative Preliminary Study

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Abstract

Teaching Database Systems to students majoring in environmental studies is a complicated and multilevel task. Students not only have to develop skills working under a Relational Database environment, but they also have to understand basic design principles, conceptual models of a fourth generation language (the Structure Query Language-SQL) and above all they have to become familiar with the application of such Systems in environmental practice and protection. A person who fulfills the above background requirements can perform successful data storage and information retrieval and consequently he is able to use Databases when working on sustainable development orientated projects. In this research effort two learning methodologies were tried in teaching the databases subject to third year students of the Department of Forestry and Management of the Environment and Natural Resources, Democritus University of Thrace. Also, a comparative study on the efficiency of the methodologies was performed.

Keywords:

Database Systems teaching, Kolb's experiential learning model, model based on the categories of learning being told, trial and error and thinking, University education.

1. Introduction

In using experiential learning models we do not only help students acquire information, ideas, skills, values, ways of thinking, and means of expressing themselves, we also teach them how to learn. In fact, the most important long-term outcome of instruction may be the students' increased capabilities to learn more easily and effectively in the future, both because of the knowledge and skill they have acquired and because they have mastered learning processes. How teaching is conducted has a large impact on students' abilities to educate themselves. Successful teachers are not simply charismatic and persuasive presenters. Rather they engage their students in robust tasks helping them to become powerful learners (Joyce and Weil, 1996).

This paper applies two experiential learning models as teaching approaches in the course Forest Informatics II which is offered to third year students at the Department of Forestry and Management of the Environment and Natural Resources, Democritus University of Thrace, and includes basic principles of Database Systems. The first model is designed by the authors using

ideas from the literature on categories of learning and in particular the categories being told, trial and error and thinking. In the second model, Kolb's model, the process of learning is divided into four stages, all of which must be gone through for learning to be most effective.

Theoretical and practical aspects of Databases and their applications in Environmental and Sustainable Development problems were taught to third year students using the above described methodologies. Real world specific cases (related to forestry and environment) were used in order to make the concepts more tangible. Several cases of innovative Database Systems (DBS) and also Intelligent DBS (IDBS) that have been developed in order to offer solutions to important *Sustainable Development* problems of our times were presented to the students. This presentation was designed on the basis of the models mentioned above. Several such IDBS that estimate the *partial and the overall Risk Indices* in the cases of *Torrential or Forest Fire natural disasters* were presented to the students (Iliadis, 2005, Iliadis and Spartalis, 2004). Such Systems have proven their capacity to work on actual meteorological, morphometric, social and hydrographic data, in order to perform Natural Disasters Risk estimation and to help towards the design and potential application of a natural disasters protection and prevention policy. From this point of view it is actually very important for the students to understand the use of DBS towards Sustainable Development and also to develop skills that will enable them to work efficiently with them.

It would really be a major problem if the students did not see the connection between DBS and Environment for several reasons. First, they would not know where to apply the knowledge on DBS even if they were capable of capturing it. Secondly, they would not be motivated to work with DBS if they would consider the subject matter as foreign to their environmental studies. It would be like offering a very powerful tool to someone who does not know what to do with it. The European Union realized this several years ago and is currently spending dozens of millions of Euros towards Intelligent Information Technology (IIT) applications on sustainable development (SD) orientated projects.

Finally, two separate tests of the same content were performed in two equal parts of the sixth semester class in order to discover the advantages and disadvantages of each methodology.

2. Theory

Before proceeding to the discussion of the actual research that was performed in the department of Forestry and Management of the Environment and Natural Resources it would be necessary to make a brief presentation of the theoretical background of the teaching methodologies.

2.1. Four Ways of Learning

2.1.1. Trial and Error

This is probably the simplest and most traditional form of learning. Learners try to do something and learning takes place where they review the success or failure of their attempt. Trial and error learning is essentially a practical activity and is, therefore, particularly suitable for learning skills.

One of the most important features of trial and error learning is knowledge of results. When a learner tries to do something, the attempt has to be reinforced by the provision of information (feedback), either confirming that the attempt was correct (positive reinforcement) or, occasionally, for making an incorrect attempt (negative reinforcement). This means that:

- Trial and error situations should be so designed that learners have a good chance of making successful attempts, leading to positive reinforcement.
- Learning events leading to probable failure should usually be avoided. Errors lead to a lowering of confidence and reluctance to attempt further trial and error learning activities.

- Learners should feel a sense of security. They should feel confident that if an attempt results in failure, it will not lead to anything other than friendly advice from the instructor.

Opportunities for practicing trial and error learning should be created around practical, realistic activities. The learning opportunities should be events that are structured rather than unstructured. Structured learning events are those that the instructor has carefully planned, where learners are learning in a cumulative way with each attempt leading to probable success and to further, even more demanding, learning opportunities.

2.1.2. Being told

The basis of this way of learning is that learners receive some information from the trainer delivered orally or in writing, or on a computer screen. The instruction can be in words, symbols, or figures.

Being told something is not always an easy activity for either learners or instructors. First of all, learners must be willing to listen and learn.

The relationship between trainers and learners is another factor. “Being told” implies that learners do not know and instructors do. In practical terms, this means that:

- Learners must want to learn the information and have to accept instructors as a provider of it.
- Trainers must know the information, be able to communicate it effectively, and be credible to learners.
- An instructional session must be created which gives learners the opportunity to learn. This requires preparation, effective presentation, and a sufficient amount of time for learning to take place.

Being told is a useful way to provide learning, especially when used for imparting knowledge. This is particularly so for situations where there is a clear-cut body of knowledge with a minimum amount of ambiguity. The effectiveness of this way of learning depends largely upon the ability of instructors to prepare and communicate the information.

2.1.3. Imitation

In learning by imitation, an opportunity is created whereby learners can observe somebody performing a task. Learners then attempt to imitate the performance they have observed. Essentially, learning by imitation is based upon what learners see done, not only what they are told should be done.

A ‘model’ which learners can imitate should be a positive influence because it should be a demonstration of the correct way to do something. It can equally be a negative influence because learners may see and imitate incorrect ways of doing something. In both cases, it is what learners see being done that matters most and influences behaviour. When using imitation as a method of learning instructors should take into account the following points:

- A good ‘model performance’ should be available so that it can be imitated by learners.
- The learning event should permit accurate and complete observation by learners.
- As far as possible, learners should not be exposed to bad models.
- Learning by imitation is far more effective when it involves the whole group and not individuals.

2.1.4. Thinking

Learning can occur when learners are encouraged to think about an experience and to reflect on it in learning terms. Using such questions as ‘Why do you think that happened?’ ‘What would you do if you were to repeat it?’, instructors are able to create learning events within which situations can be thought about and discussed. It may be that there is not a simple, clear-cut answer; learners may be presented with a number of options, each one having some advantages to offer. Learning can take place when learners have to evaluate options, draw conclusions, consider consequences, and generally think through the situation.

Learning by thinking is a valuable way of providing a learning experience. Some factors to be taken into account include:

- The maturity and experience of learners, relative to the thinking required. What is a complex, demanding, thinking experience for one learner, becomes a simple situation all too easily resolved by another.
- Instructors should adopt an advisory, counseling role. They must encourage learner-centered learning.
- The more complex the situation, the less likely there will be a simple, definitive answer. A learner, having struggled through to a possible solution, claims ‘ownership’ of it and is looking for support, critical appraisal, and generally, positive reinforcement.
- Thinking is a very personal activity and the time needed to reach a solution to a problem will vary considerably within a group of learners. This means that sufficient time should be allowed within the learning event for each learner to gain full benefit from the learning experience (Giannoulis 1980, Dervissis 1982, Libby 1984, Module 2: Helping People to Learn, 1991).

2.2. Kolb’s experiential learning model

In Kolb’s model, the process of learning is divided into four stages, all of which must be gone through for learning to be most effective. A brief description of these stages follows.

Concrete experience provides the basis for the learning process. Lessons at this stage engage the individual personally and learning relies on open-mindedness and adaptability rather than a systematic approach to the situation or problem.

Reflective observation makes sense of the experience. In this stage, students consider their concrete experiences from a variety of perspectives and articulate why and how they occurred. Learning occurs as a result of patience, objectivity, careful judgment, and observation. Reflection helps students break their experiences into parts and to categorize them for use in the next stage of learning.

Abstract conceptualization assimilates and distills the observations and reflections into a theory or concept. In this stage, students come to understand the general concept of which their concrete experience was one example by assembling their reflections on the key parts of their experience into a general model. Abstract conceptualization requires students to use logic and ideas to understand situations and problems. Students can require considerable help from the instructor to proceed through this stage.

Active experimentation tests the theories and leads into new experiences. In this step, students use the theories they developed during the abstract conceptualization stage to make predictions about the real world and then act on those predictions. Students’ actions, of course, are a new concrete experience. The learning cycle begins anew.

The key to planning lessons that take students full cycle is to note that the second word in each of the four stages' names indicates what the learner experiences. The learner begins by having an experience that involves him or her in a situation (experience) and then reflects on the experience from several perspectives (observation). From those reflections, the learner draws concepts or conclusions and formulates them into theories or models (conceptualization) that lead them to experiment or act (experimentation).

Kolb found that learners typically did not use all four learning stages equally, but preferred to concentrate on one or two of them. He identified four learning preferences, each of which shows learners being most comfortable in a different pair of learning stages. Based on responses to a set of questions called the Learning Style Inventory, Kolb described the four learner preference groups as divergers, assimilators, convergers, and accommodators. Understanding the preferences is critical to understanding how students may respond to lessons designed specifically for each stage.

Divergers prefer learning through concrete experience and reflective observation. They may be particularly adept at viewing a situation or problem from many perspectives and developing imaginative solutions.

Assimilators favor abstract conceptualization and reflective observation. These individuals are often able to pull together very different observations into an explanation or theoretical model.

Convergers learn best through abstract conceptualization and active experimentation. Their strength lies in the practical application of ideas. They tend to organize their thinking to use hypothetical-deductive reasoning to focus on specific problems.

The dominant learning preferences of accommodators are concrete experience and active experimentation. Accommodators tend to be risk takers who thrive on action and new experiences.

Teaching techniques that provide opportunities for concrete experiences include experiments, observations, simulations, fieldwork, films, storytelling, jokes, cartoons, newspaper articles, examples, problem sets, taking a survey, or reading texts.

Techniques that provide opportunities for reflective observation include logs, journals, peer appraisal, debriefing, discussion, brainstorming, thought questions and rhetorical questions. Listening to lectures, seeking out and critiquing models in texts or articles, building models and construction analogies, generating hypotheses, papers and projects draw upon abstract conceptualization.

Doing simulations, case studies, fieldwork, homework, projects, conducting an experiment in the laboratory or in the field require students to engage in active experimentation (Brock, 1999; Healey & Jenkins, 2000; Kelly, 2002; Kolb, 1984).

3. Elementary Database principles taught in the class

A Database is essentially nothing more than a kind of electronic filing cabinet; a repository for a collection of computerized data files (Date,1995). A database system is a computerized record keeping system, having facilities to perform a variety of operations on such files. Thus database management systems (DBMS) are concerned with the storage, maintenance, and retrieval of data facts available in the system in explicit form. Information does not appear as natural text but is structured instead, in the form of specific data elements stored in tables (Salton, McGill, 1983).

Today, most of the database systems are using a relational approach. A relational DBMS is the one in which the data is perceived by the user as tables and the operators at the user's disposal (e.g. data retrieval) are operators that generate new tables from old ones (Date, 1995). For example there will be an operator to extract a subset of the rows of a given table and another to extract a subset of the columns (Xenos, 2002).

To enhance the basic structural concepts of a database system used in our teaching experiment, we will consider the following tables of a relational database management system (RDBMS).

Table 1: Data concerning a mountainous watershed

<i>W#</i>	<i>Altitude</i>	<i>Slope</i>	<i>Rain Height</i>	<i>Forest Cover</i>
W1	1230	0.12	22	80
W2	1356	0.15	43	99

The above Table 1 contains data related to specific characteristics of a mountainous watershed namely (Watershed number, Slope %, Rain Height mm, Forest cover %). Obviously each mountainous watershed has a unique watershed number (W#) and it is not possible for two watersheds to have the same W#. In relational database terminology, fields like W# are called *primary keys*.

The basic design principle of RDBMS is the Normalization one. Normalization theory is built around the concept of normal forms. A relation (table) is said to be in a particular normal form if it satisfies a certain set of constraints. Numerous normal forms (NF) have been defined. However, in this study we will deal only with the first and second NF. For example, a table is in the First Normal form (FNF) if it satisfies the constraint that its underlying simple domains (the table cells) contain atomic values only (Connolly and Begg, 2003). Finally, a table is in the second normal form (SNF) if all of its fields are functionally dependent only on the primary key (Stephens and Plew, 2003).

For example, table 2 is not in the FNM because its cells contain more than one value. This is strictly forbidden in RDBMS design because it can cause numerous and serious malfunctions.

Table 2: Data concerning students of forestry and their chosen courses attended

Student#	Attended chosen courses	Degrees
St1	Informatics, English, Mathematics, Silviculture	5 7 8 9
St2	Informatics, Artificial Intelligence, Genetics, French	8 7 6 5

The following table 3 is not in the second NF because the field *Professor name* is not only depended on the primary key which is *Student#* but also it is functionally depended on the foreign key which is *Professor#*. This means that if we are provided with the *Professor#* we can determine the value of *Professor name*. This should not be the case in any table. All the functional dependencies should be connected only to the Primary Key which is *Student#*.

Table 3: Data concerning students of forestry and their Professors

Student#	Student Name	Professor#	Professor name
St1	Mavros	Pr1	Kitrinos
St2	Aspros	Pr2	Ble

Of course specific actions are required to overcome the difficulties caused by an unnormalized database. In this case its tables should be normalized and redesigned from the beginning. The result is the production of several normalized tables. This design approach guaranties the correct function of the database due to its conceptual structure.

4. An application of the models in teaching Databases to Forestry students

The third year students of the Department of Forestry and Management of the Environment and Natural Resources of the Democritus University of Thrace were divided in two almost even classes of 27 and 25 students each.

The first class was taught basic fundamental principles of Relational Databases design by developing tabular approaches and by applying Normalization (in the first and second Normal forms). The students were also presented environmental and forestry applications of DBS that provide significant aid towards sustainable development. Such Systems are the TORRISDESSYS and the FFIREDESSYS (Iliadis, 2005; Iliadis, Spartalis, 2004; Maris et al., 2004). The whole process was performed using a structured model following Kolb's principles.

In the second class, the teaching process on the same subjects was based on a learning model combining the categories of learning being told, Trial and Error and thinking. Of course, in both cases the lessons had an Environmental and Forestry orientation. In the end of the day, we provided the students of both classes with the same questionnaires in order to estimate the effectiveness of both lessons and the potential different impact of both methods (if any) on a theoretical and practical level.

4.1. Design of the lesson based on Kolb's model

The following proposal includes basic guidelines, the indicative content and the teaching techniques, for the application of various learning models in the lecturing of RDBMS to Forestry students.

4.2. Structure of the lesson based on Kolb's model

The lesson which was based on Kolb's model was designed and structured to comprise of four stages according to Kolb's cycle.

Stage 1: Concrete Experience

The students are initiated to fundamental design principles and they are presented with the execution of an innovative "smart" RDBMS containing data related to five morphometric and hydrographic factors with an important effect on Torrential Risk of mountainous watersheds (Iliadis and Spartalis, 2004). Also the students are shown the performance of SQL statements for the estimation of the Torrential Risk degree, without going into details concerning the Mathematical model and its background (Iliadis and Spartalis, 2004). In this way the audience has clearly seen an important application of databases in environmental management.

Stage 2: Reflective Observation

The students answer in specifically designed questions aiming in checking their reflective observations from the first stage. Details about the questions are presented below in table 5.

Stage 3: Abstract Conceptualization

The students hear a lecture that describes the basic design principles of a database and a RDBMS in the first and second normal forms. In the end the students have 15 minutes time to ask questions. Then the instructor shows the design of the tables of a RDBMS in the FRNM and in the second NF.

Stage 4: Active Experimentation

The students are presented case studies from forestry. The instructor presents a database table (table 6) containing details related to the personnel of forest departments and the students are asked to re-design the tables so that the database satisfies the constraints of the first and second normal forms. Students are encouraged to work in groups and hand in their answers in an anonymous mode.

4.3. Structure of the lesson based on the being told, trial and error and thinking model

The following table 4 presents the structure of the being told, trial and error and thinking model which was applied to half of the class.

Table 4: Structure of the lesson based on the being told, trial and error and thinking model

Learning fact	Learning method
<i>Stage 1:</i> Basic design principles of a relational database in first and second normal forms are presented.	Being told
<i>Stage 2:</i> The students are given the chance to re- design and implement table 6 so that the emerging tables belong to the two normal forms	Trial and Error
<i>Stage 3:</i> The students check the characteristics of the two normal forms and they make conclusions related to the two normal forms	Thinking
<i>Stage 4:</i> The students repeat the design process to correct some design errors of the tables	Trial and Error

4.4. The Kolb's testing questionnaire

The following table 5 presents the questions that were presented to the students based on Kolb's ideas to check their reflective observation. It is also based on the presentation of DBS applications towards sustainable development.

Table 5: Questions asked to check reflective observations

Questions to check reflective observations
1. Do you believe that databases have an application in the management of the environment and in Forest Science and that they answer to some extent in critical environmental issues?
2. Do you believe that databases have no relation to environmental issues and that they are pure computer science?
3. Do you believe that the construction of a database is a simple case that does not require systematic design?

4.5. The testing case presented in both classes

The following table 6 presents the table that was given to the students to of both classes in order to be normalized in first and second normal forms.

Table 6: Forest departments' data

Staff#	Name	Degree	Mark	University #	University	Campus
FR1*	John	Forestry	7,00	3,00	AUTH	SKG
		Biology	6,00	12,00	UA	ATH
FR2	Jack	Chemistry	8,00	12,00	UA	ATH
		Forestry	5,00	12,00	DUTH	ORE

FR* stands for Forester number

The students of both classes had to work in practical level to re-design this table and break it in several others in order for the database to comply with the first and second normal forms.

5. Results

Though the 52 students in the two classes were encouraged to work in teams of two, some did and some did not prefer to work individually. In the first class where the lesson was performed using the Kolb's model we have gathered 17 completed questionnaires and in the Try and Error class also 17. The results are presented in the following tables 7 and 8.

Table 7: Results of the Kolb's lesson testing

Model applied: Kolb's
Total number of questionnaires: 17
Students that believe that databases have an application in the management of the environment and in Forest Science: 17
Students that believe that databases have no relation to the environmental issues and that they are pure computer science: 0
Students that believe that the construction of a database is a simple case that does not require systematic design: 2
Students that have completed the re-design of table 6: 13
Students that have not completed at all the re-design of table 6: 4
Students that have completed the re-design of table 6 with no problems : 10
Students that have completed the re-design of table 6 with minor problems : 2
Students that have completed the re-design of table 6 with major problems : 1

Table 8: Results of the being told, trial and error, thinking testing

Model applied: Being told, trial and error, thinking model
Total number of questionnaires: 17
Students that believe that databases have an application in the management of the environment and in Forest Science: 17
Students that believe that databases have no relation to the environmental issues and that they are pure computer science: 0
Students that believe that the construction of a database is a simple case that does not require systematic design: 5
Students that have completed the re-design of table 6: 14
Students that have not completed at all the re-design of table 6: 3
Students that have completed the re-design of table 6 with no problems : 4
Students that have completed the re-design of table 6 with minor problems : 8
Students that have completed the re-design of table 6 with major problems : 2

It should be mentioned that the results of table 8, have been gathered before the students are given the chance to re-organize their tables using Try and Error in stage 4.

6. Conclusions

Though the research effort was quite successful and interesting and though some differentiations in the efficiency of both methods clearly appear, we will not jump into conclusions by applying this preliminary study in a class of 52 students. It is a first step beyond and quite innovative for the database teaching in students of forestry and environment. We just present it to the scientific community and we hope that it is a good initiative for other instructors to apply it wishing that we will have the time and courage to apply it again in the following years in order to make clear conclusions on the effectiveness of both methods. From this research we can conclude that we have been convinced for the usefulness and for the important role of informatics and specifically DBS towards sustainable development and this is a very important key point. Also it seems that the students of our department have mainly difficulties in understanding complex concepts like the functional dependencies between fields in a Database Table. Finally we can claim that we have indications for the better performance of Kolb's model. Of course this research should continue in order to make safe conclusions on the Environmental students' difficulties in DBS understanding and to design the most suitable courses for them.

References

- Brock, K. L. (1999), "Enlivening Political Science Courses with Kolb's Learning Preference Model," *Political Science and Politics*. Available http://www.findarticles.com/cf_0/m2139/2_32/54895453/print.jhtml
- Connolly T., Begg, C. (2002), *Database Systems*, Addison Wesley, UK.
- Date C. J. (1995), *An introduction to Database Systems*, Addison Wesley, UK.
- Dervissis, S. (1982), *Contemporary General Didactics*, Thessaloniki.
- Giannoulis, N. (1980). *Introduction to General Didactics*, Athens.
- Healey M, Jenkins A. (2000), "Learning Cycles and Learning Styles: Kolb's Experiential Learning Theory and its Application in Geography in Higher Education." Available <http://www.chelt.ac.uk/el/philg/gdn/discuss/kolb1.htm>
- Joyce B., Weil M. (1996), *Models of Teaching*, Allyn and Bacon, Boston.
- Iliadis L. "A decision support system applying an integrated Fuzzy model for long - term forest fire risk estimation" *Environmental Modelling and Software* Volume 20, Issue 5, pp. 613-621, May 2005
- Iliadis L., Spartalis S. (2004), "A decision support system incorporating fuzzy algebraic modeling for risk approximation," *Proceedings of the ICNAAM 2004 Conference*, Chalkis, Greece.
- Kelly, C. (2002), "David Kolb, The Theory of Experiential Learning and ESL." Available <http://www.aitech.ac.jp/~iteslj/Articles/Kelly-Experiential/>

Kolb, D. A. (1984), *Experiential Learning: Experience as the Source of Learning and Development*, Englewood Cliffs: Prentice-Hall, Englewood Cliffs.

Libby, B. (1984), "Creativity and Counselling". Available <http://www.ericdigests.org/pre22/creativity.htm>

Maris F., Iliadis L., Marinos D. Estimation of the torrential risk of Rodopi mountainous watersheds, by a Fuzzy Decision Support System: The case of Trapezoidal Membership function and Fuzzy conjunction; Proceedings pp 222-229, ISSN: 1109-6111X 7th Panellenic Geographical Conference with international participation 2004.

Module 2: Helping People to Learn (1991), Polytechnic of West London, Slough.

Salton, G., McGill, M. (1983), *Introduction to modern information retrieval*. McGraw Hill, USA.

Stephens R., Plew, R. (2003). *Beginning Databases in 24 hours*, Sams Publishing, USA.

Xenos M., (2002), *An Introduction to Databases. A Development Approach*, Papatotiriou Publications Greece.

Don't preach. Practice!
The acceptability of normative statements in academic sustainability education.

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Abstract

The slogan 'Practice what you preach' denotes that people should behave in accordance to the values that they preach. But isn't this a questionable slogan in that regard that university teachers should not preach values, i.e. transfer values to their students by the authority of their position? In this paper it is argued that academic education on Sustainable Development should aim at clarifying moral issues and helping students to develop their own moral positions given the global problems of today. However, we cannot claim to be value neutral as even the choice for the theme SD involves a moral position. The paper presents the results of a survey among international SD teachers on the acceptability of value laden statements. Moreover the paper presents results regarding the values that SD teachers represent, and compares these results to survey results among engineers and engineering students.

The aim of an SD course should be to make students aware of the values that are present in the professionals' work and options for their own role in global challenges. Teachers options how to address moral issues without preaching are described.

Keywords:

Sustainable Development, Engineering Education, Values, Academic freedom

Introduction

To teach our future leaders Sustainable Development is the key issue for our planet to survive: The challenge is so enormous that we need to mobilize all the brainpower that we can get. Education is of key importance: *By many years of research an academic might develop a 1 % more efficient technology. Compare that result to motivating 10 students a year to develop and apply technologies that are 1 % more efficient for the rest of their lives.....*¹

Sustainable Development is a normative concept: the responsibility for future generations and for the poor and underprivileged of this world is a normative choice. However, it is a choice that is as such almost universally accepted: I personally never met anybody that seriously argued to give up this planet, and just 'let various sustainability catastrophes happen'. The two main elements of SD, responsibility to the poor and to future generations, are present in all major cultures of the world:

- responsibility towards future generations is reflected in the virtually universal rule that children should be protected and taken care of
- Responsibility towards underprivileged is reflected in many rules in all major religions of the world as well as in humanism and socialism. Market liberalism, with its emphasis on

¹ The UPC School of Architecture of the Valles compared all of the schools direct CO₂ impact with the CO₂ impact of its graduates. The impact of the latter was almost a factor 1000 larger (ETSAV, 1999).

individual reward for individual achievement, is in practice almost always combined with a religion or a humanism that prescribes helping underprivileged.

On the basic issue that survival of mankind and human civilization is important, we all agree. However, if it comes to real action to become even a little more sustainable, the consequences might hurt group interest and values, and lead to normative conflict. How to deal with this conflict in higher education?

Values, Science and the Academy

Universities have an ambivalent position towards ideologies: Mediaeval universities were founded as communities of learning. However, academic learning (as distinct from learning for crafts) was not legitimized by its inherent value: The work of scholars was aimed at strengthening the glory of God by studying his natural and social laws (Van den Daele, 1978). We all know about the conflict that broke out between Galileo Galileo and the church. It marked the break between the church and its fundamental dogma (that truth is revealed by the Holy Scripture and that the church is infallible in interpreting this truth) on the one hand, and a new empirical scientific dogma (that truth is revealed by systematic observation of nature). The fact that the conflict between Galileo and the Pope is so well known all around the world denotes the meaning that we attach to it: science vis-à-vis religion, or empirical (measurable, replicable) facts against ideology. The conflict symbolized the independence of empirical research. This new science developed institutions to safeguard its independence from ideologies.

Science was mainly practiced in scientific communities, and institutionalized by academies of sciences. In the 17th and 18th century universities were less important in science. Universities taught sciences but also highly value laden subjects such as theology (always in accordance to the locally dominant religion), law (teaching and interpreting the law system, not reflecting on its justice) and philosophy (often proving the truth/principles of a current society). In accordance with this, universities were generally governed/protected by local rulers. Teaching was under their control and those that voiced opposing views were often dismissed from university. However, to attract students, that brought wealth to a city, students and professors had certain liberties (such as tax freedom for beer and wine) that came to be known as ‘academic freedom’.

In the 19th and 20th century, scientific research became more important in university life. The Enlightenment aimed at substituting traditional practices by the laws of science. Academies of Science and societies for the advancement of science (driven by science amateurs from the aristocracy) promoted natural sciences in the university. Promoting natural science was aimed at bringing rationality, and so the professors were not led by (irrational, short sighted) interests from society, but by their own views: this was the basis of our current ‘academic freedom’ (Blom/Kox/Veen, 1994): the independence of societal interests. This did not prevent all value conflicts (Cf. conflicts on dinosaur fossils in the 18th century, Darwin’s theories in the 19th century, and genetic screening/manipulation in the 20th century).

In the midst of the 20th century, the influence of governments, churches, and private industry became stronger as it was recognized that scientific research was of great interest to the economy, and university education became much more open to underprivileged groups. This required more money and people which were supplied by government and public interest organizations. Tensions occurred as sponsors could not always resist the temptation of promoting their own interests/values (An interesting collection of political attempts to influence research can be found in Kobben/Tromp, 1999).

At the same time however, the independent position of the university was increasingly recognized as an asset for society as there were at least some institutional guarantees that the knowledge that was produced was not the product of political or economic interests. However, as university professors received some independence from political ideologies to pursue their scientific interests,

it also implied that university professors would not base their public performances on ideology, but on scientific arguments. In some disciplines (theology, political theory, and modern history) this is hardly possible. In several countries, professorships in these disciplines were more or less divided over the main ideologies.

Apart from societal values, it was also recognized that scientific practice represents certain behavioral norms. In 1942, Merton formulated the norms of the scientific community:

- Communism or Communalism, i.e. scientific results are for everybody
- Universalism, science is universal, i.e. independent of its inventor, and independent of local practice
- Disinterestedness, science should be pursued by curiosity, not for profit
- Organized Skepticism, scientific knowledge should be tested before acceptance

These norms described an ideal scientific practice. They have been often criticized especially for the claim that science is universal and therefore independent of the local context in which it has been created. Many studies have been devoted to showing how theories (the ones that we still consider to be true and the ones that are considered to be false) were products of the context of creation. Moreover, applied disciplines, like technology were branded as inherently ideological: Habermass (1968) claimed that technology was based on the ideology of ‘mankind’s governance of nature’. Naturally, the same applies to medicine, law, business studies, etc.

As ideology is so deeply part of university, should we then just accept that universities teach ideologies as long as their content is tolerated? Many colleagues see this as unacceptable. But how much restraint should scientists have from ideology?

Lacey (1999) came up with another approach. He considered *independence* a key norm for science, consisting of:

- *impartiality*: there is no proper role for moral, social and any other non-cognitive values, alongside the cognitive (or epistemic) values, in the appraisal of the soundness of scientific understanding
- *neutrality*: well conceived scientific practices produce a body of understanding that is **neutral** among contending value-outlooks: neither cognitively nor in practical applications do they favor the claims or interests of any particular value-outlooks
- *autonomy*, its research practices are **autonomous**: their methodologies should be unencumbered by political, religious and other non-cognitive interests.

Lacey’s three norms do not exclude norms and values from playing a role in science, as his norms are only aiming at methods of science and evaluation of new knowledge. Independence rules are therefore a better starting point to discuss the issue of value laden teaching, instead of just skipping value related issues. Skipping value related issues could imply supporting existing value systems. With the enormous challenges of Sustainable Development, it could imply taking no action, which represents a value that almost nobody supports.

So academic education should respect a certain impartiality towards value systems, while at the same time stimulate reflecting on value related issues. Can we teach values without prescribing them? I will deal with that question in paragraph 5. In paragraph 4 I will analyze the results of a survey on values of SD engineering-teachers and compare them with ordinary engineers and engineering students. In paragraph 3 I will present the results of a survey on what lecturers themselves regard as acceptable value laden statements.

Acceptability of value related statements

To analyze how university teachers that teach Sustainable Development to engineering students deal with the issue of value laden statements, I conducted a survey during the Engineering

Education in Sustainable Development Conference in Lyon, in October 2006². The survey consisted of two parts. In the first part 23 statements were presented and it was asked if the respondent would hold such a statement (made in class, during a lecture, not as a joke) acceptable. The respondents could judge this by 4 categories:

- Completely acceptable
- I accept such a statement from a colleague, but (if I agreed) I would not make the statement myself
- I would make a remark if my colleague would make such a statement during his lectures
- Completely unacceptable to say this during a lecture

The questionnaire was filled out by 42 respondents. The answers were scored 0, 1, 2, 3 and an average acceptability was calculated (where the lowest value meant most acceptable statement):

Table I Lecturers judgment on acceptability of statements in class

Statement	Average
20. <i>Climate Change is not caused by humans, so we need not to reduce CO₂ emissions.</i>	2,56
10. <i>Corruption is acceptable if civil servants are underpaid</i>	2,51
1. <i>You should all vote for party XXXX</i>	2,49
19. <i>There is nothing wrong with killing whales</i>	2,43
12. <i>I don't care for Sustainable Development; I just make a living teaching it!</i>	2,20
16. <i>The 9/11 attacks were committed with the aid of right wing Americans</i>	2,03
23. <i>Wind turbines are just ugly bird killers!</i>	2,00
2. <i>You should all vote for party XXXX as it has a very good SD paragraph in its political program</i>	1,98
11. <i>Nuclear energy is sustainable</i>	1,75
17. <i>The use of all drugs, including alcohol and tobacco, should be forbidden</i>	1,72
22. <i>Everybody should become a vegetarian</i>	1,69
21. <i>No one should earn more than 200.000 euros per year</i>	1,64
18. <i>Violent resistance against elected officials might under some conditions be acceptable</i>	1,60
5. <i>Sustainable Development is impossible in a free market economy</i>	1,45
7. <i>Organized religion is a barrier to emancipation</i>	1,45
6. <i>Sustainable Development is impossible without a free market economy</i>	1,42
8. <i>Developing nations should nationalize multinational companies</i>	1,30
3. <i>SD means stabilization of population numbers, therefore we need family planning programs</i>	1,26
4. <i>Sustainable Development will never happen with Bush as US president</i>	1,26
13. <i>Sustainability for large companies is only window dressing</i>	1,11
15. <i>The US/UK war against Iraq was a crime</i>	0,77
14. <i>SD should be the first priority of every government</i>	0,36
9. <i>Discrimination against women is unacceptable, in every culture, everywhere</i>	0,27

² <http://www.eesd2006.net/>

Acceptability of lecturers' statements. Average calculated by:

0. Completely acceptable
1. I accept such a statement from a colleague, but (if I agreed) I would not make the statement myself
2. I would make a remark if my colleague would make such a statement during his lectures
3. Completely Unacceptable to say this during a lecture

There are a number of interesting responses that were discussed in a special session during the EESD III conference:

1. Clearly the SD teachers require from a teacher that he is fully supporting SD. Demanding governments to make it a priority (3) is therefore a completely acceptable normative statement in class, and the statement that the teacher is not personally committed to SD (12) is therefore unacceptable. So personal commitment to the subject is good.
2. The unambiguous support for statements supporting women's' rights (9) and the unacceptability of the statement concerning corruption (10) denotes that the respondents accept statements that reflect universal human rights and reject opposite statements. The UN security councils' refusal to approve the US/UK actions in Iraq was seen as sufficient to accept statement 15.
3. A number of other statements was not so much rejected because of their political/value laden character: They were unacceptable as they were considered to be a scientific mistakes: e.g. the statement on Climate Change (20) was considered as such. Although this statement is supported by a (small/declining) part of the scientific community it is regarded as unacceptable by this group of teachers. This denotes that in scientific controversy (like the one on climate change) facts and values cannot be discerned easily, if at all. Contestants in a controversy both regard their opponents as value/interest driven and disrespectful of established facts. This is consistent with Nowotny's analysis (1979) of Austrian physicists in the nuclear power controversy, and Nelkin's (1979) analysis of socio-technical controversy in general: both found that opponents regard the other as value- or interest driven and unscientific.
4. The vast majority of the respondents were European. Given this, it is remarkable that direct statements regarding the US (15) and the US president (4) were considered (almost) acceptable, but direct statements regarding political parties at home (1) were not, not even for the nice SD paragraph in their programs (2). It seems, therefore, that opportunism is a better explanation for the unacceptability of direct political statements than a deeply rooted impartiality towards political parties.

Some further information might be derived from the standard deviation of the answers. Statements of which the acceptability was most controversial have the highest standard deviation.

Table II Standard deviation of answers of Table I

Statement	STD
18. Violent resistance against elected officials might under some conditions be acceptable	1,44
22. Everybody should become a vegetarian	1,32
11. Nuclear energy is sustainable	1,30
21. No one should earn more than 200.000 euros per year	1,29
5. Sustainable Development is impossible in a free market economy	1,25
6. Sustainable Development is impossible without a free market economy	1,13
4. Sustainable Development will never happen with Bush as US president	1,11
13. Sustainability for large companies is only window dressing	1,10
23. Wind turbines are just ugly bird killers!	1,09
8. Developing nations should nationalize multinational companies	1,07
17. The use of all drugs, including alcohol and tobacco, should be forbidden	1,03

15. <i>The US/UK war against Iraq was a crime</i>	1,03
2. <i>You should all vote for party XXXX as it has a very good SD paragraph in its political program</i>	1,02
12. <i>I don't care for Sustainable Development; I just make a living teaching it!</i>	1,02
7. <i>Organized religion is a barrier to emancipation</i>	0,98
16. <i>The 9/11 attacks were committed with the aid of right wing Americans</i>	0,97
3. <i>SD means stabilization of population numbers, therefore we need family planning programs</i>	0,88
1. <i>You should all vote for party XXXX</i>	0,76
19. <i>There is nothing wrong with killing whales</i>	0,70
14. <i>SD should be the first priority of every government</i>	0,68
9. <i>Discrimination against women is unacceptable, in every culture, everywhere</i>	0,58
20. <i>Climate Change is not caused by humans, so we need not to reduce CO₂ emissions.</i>	0,52
10. <i>Corruption is acceptable if civil servants are underpaid</i>	0,36

These figures show that there is on many statements a considerable difference regarding their acceptability. Moreover, the way in which statements were presented by teachers, would be rather important for its acceptability (as an absolute truth to be duplicated by students during exam or as just a personal vision).

Lecturers agree on the acceptability of statements in these cases:

- Statements fully supporting SD are acceptable, or even obligatory
- Statements (irrespective of being scientific or normative) that are counteracting or downplaying the necessity of SD are unacceptable.
- Statements supported by the Universal Declaration of Human Rights or international law are acceptable
- Statements supporting/criticizing any national political organization are unacceptable, However, statements criticizing foreign officials/politicians are acceptable
- The acceptability of statements on social-economic issues, violence, nuclear energy and vegetarianism is controversial

During the discussion at the EESD meeting it seemed that there was some difference between the positions of lecturers in Northern European universities, which tended to accept less value laden statements and Southern European universities, which tended to allow more.

What values do SD teachers represent?

The basic normative underpinning of SD meets with little resistance. The normative divides in our society show up when we have to balance these SD values with other values. For this reason, there is not one Sustainable future, but many sustainable futures. Sustainability leaves scope for social choice. But by what norms and values do we make those choices? Does the community of SD teachers differ from other practitioners?

To study the norms and values of SD teachers, it was considered that a questionnaire regarding abstract values would not be appropriate. The real issues are prioritizing various conflicting values. How to do this in a concise questionnaire? I decided to include a second questionnaire in the survey at the EESD conference in Lyon, October 2006. In this questionnaire, the opinion on specific technologies was asked. The advantage of this approach was that the answers could be compared to the results of a similar survey among engineers in 1995. Therefore, I took the same list of

technologies, with the same question as the Royal Dutch Institute of Engineers³ had posed to its members in 1995 (Goorden et al., 1995). The same list of technologies was also used for students of engineering at Delft University of Technology. In total, 79 fourth year Civil Engineering students and third year Mechanical Engineering students filled out this list in May 2007.

Table III Social acceptability of technologies

	<i>EESD teachers, 2006</i>	<i>Dutch Engineers 1995</i>	<i>Engineering Students 1995</i>	<i>DUT students 2007</i>
<i>fuel cells</i>	1,73	1,54	1,52	1,77
<i>biodegradable plastic</i>	1,56	1,55	1,5	1,49
<i>Superconductive materials</i>	1,76	1,58	1,55	1,62
<i>Satellite communication</i>	1,66	1,61	1,56	1,38
<i>laser technology</i>	1,76	1,61	1,62	1,56
<i>nuclear fusion</i>	2,54	1,67	1,7	1,69
<i>Personal Computers</i>	1,64	1,69	1,54	1,36
<i>electric vehicles</i>	1,76	1,74	1,7	1,82
<i>global electronic networks</i>	1,67	1,81	1,67	1,85
<i>speech control for computers</i>	2,02	1,86	1,78	2,12
<i>microwave technology</i>	2,17	1,88	1,94	2,18
<i>Robots and automation</i>	2,06	1,89	1,82	1,68
<i>high speed trains</i>	1,57	1,94	1,86	1,78
<i>electronic banking</i>	2,00	2,02	1,91	1,48
<i>Mainframes</i>	2,06	2,05	1,83	2,29
<i>electronic databases</i>	1,88	2,06	2,04	1,97
<i>prenatal genetic diagnostics</i>	2,59	2,06	2,31	2,54
<i>electronic recognition systems</i>	2,44	2,1	2,1	2,18
<i>Human genetic curing</i>	2,69	2,13	2,28	2,49
<i>Genetic modification of plants</i>	3,33	2,19	2,35	2,58
<i>underground buildings &</i>	2,61	2,21	1,98	1,77
<i>nuclear energy</i>	3,08	2,35	2,51	2,36
<i>permanent space stations</i>	2,90	2,37	2,31	2,13
<i>Genetic modification of animals</i>	3,55	2,54	2,64	3,26
<i>supersonic civil aircraft</i>	3,07	2,78	2,3	2,36
<i>space settlements</i>	3,24	2,79	2,37	2,32
<i>video games</i>	2,98	3,11	2,81	2,46
<i>smart conventional weapon systems</i>	3,71	3,24	3,23	2,92
<i>commercial television</i>	3,40	3,29	2,9	2,65
<i>nuclear arms</i>	3,93	3,71	3,61	3,56
<i>Average</i>	2,44	2,18	2,11	2,12
<i>correlation to EESD teachers</i>		0,88	0,92	0,87
<i>correlation to Dutch Engineers 1995</i>	0,88		0,96	0,82

The respondents were asked “How do you assess the social acceptability of these technologies”. Each technology could be assessed by 4 categories, which received these scores:

- very useful 1
- well acceptable 2

³ Koninklijk Instituut van Ingenieurs, KIVI, The Hague.

- *neutral* 3
- *harmful* 4

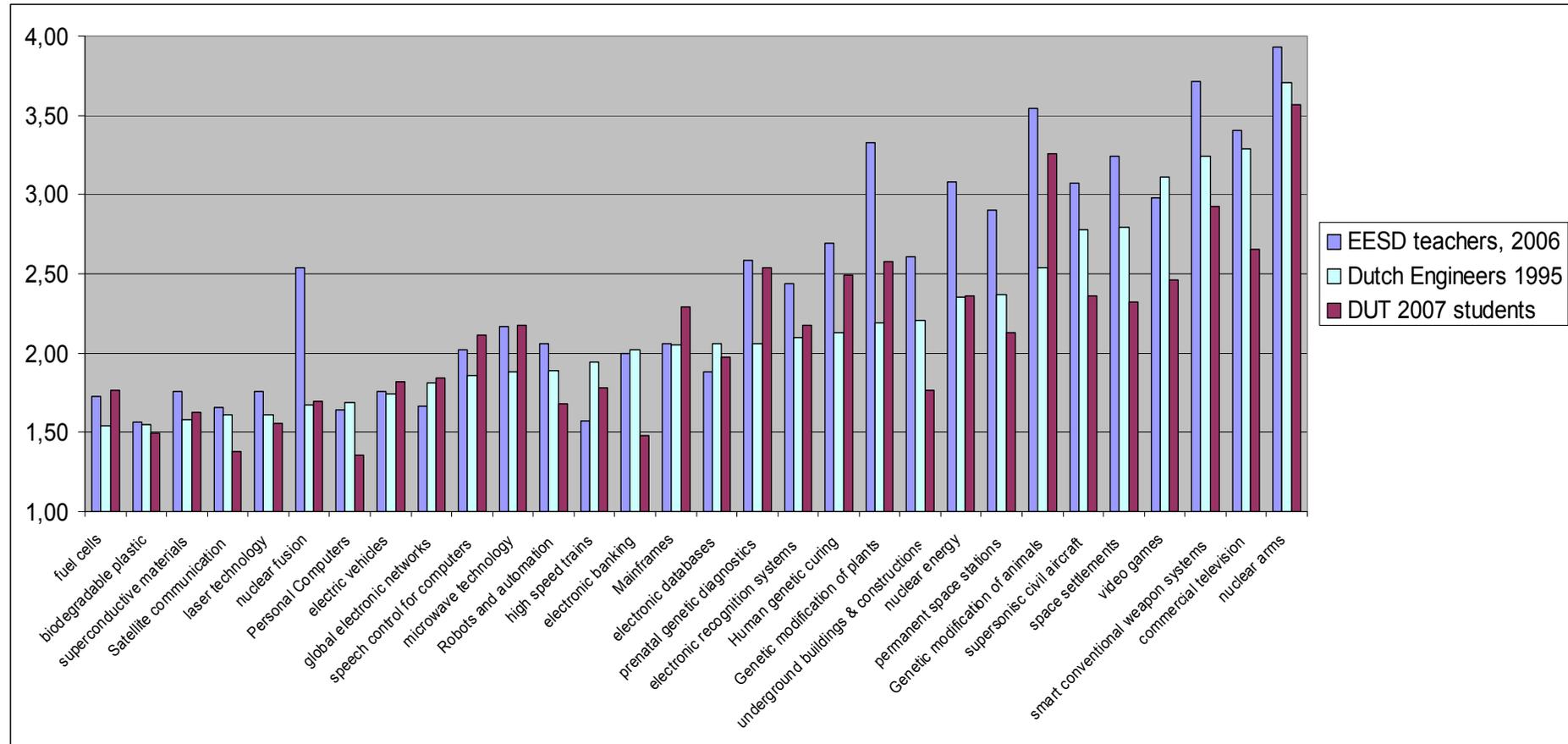
Naturally, it should be noted that the answers of the Dutch engineers were acquired in 1995 (Goorden et al., 1995), a difference of 11 years. Comparing the results of today's DUT students with those of engineering students of 1995 indicates that there are some general changes: micro-electronic technologies and communication is more preferred, genetic modification is less accepted. In general EESD participants were somewhat more negative on technology, their average score was 0.26 lower than that of the average engineer in 1995 and the engineer students of today. This was mainly due to far more negative responses in regard to all issues related to genetic modification, which seems in part to be a generally changing view in society. Other differences were that SD lecturers held more negative visions of :

- Nuclear fusion/fission
- Space

EESD participants were a little more positive on micro-electronics and communication than the engineers were in 1995, but this also seems to be a general tendency.

Correlations are relatively high. Engineering students of today correlate stronger to EESD teachers than they do to engineers of 1995. Therefore, one might conclude that EESD teachers are somewhat different in their assessment of the three mentioned categories of technologies. They are more critical towards technology, which can be seen as part of their task in engineering education.

Figure I Differences in judgement of social acceptability of technologies



How to teach values without preaching?

University education is not about implementing norms and values into the minds of students. Prescribing Sustainable Development norms and values might be tempting, but the consequence is horrific: if this would be possible, totalitarian ideologies might carry out the same trick. However, most likely, the students will recognize the inconsistency of preaching SD (i.e. attempting to implement norms and values, especially the norm of taking responsibility for future generations and the poor, by the authority of the lecturer). As a result, students might neglect all further messages that a lecturer is broadcasting.

University education is about sharpening critical minds that are able to make balanced appraisals of their subjects of choice and the norms and values to use in this appraisal. This does not imply that norms and values should be neglected by lecturers, as this does not contribute to the students' ability to make a balanced appraisal. Moreover, neglecting norms and values means in fact that the implicit norms of our society are taken for granted.

The basic solution is that lecturers should not prescribe norms and values to students, instead they should help students to find their own way by helping him/her to sharpen his/her judgment. This is contrary to the university teaching practice of the all knowing lecturer that broadcasts one clear message to the students. Instead, it might be far more useful to create confusion: in such a situation the student is forced to think for himself. For example, trying to make a case for some of Bjorn Lomborg's (2001) controversial claims (like the claim 'things are getting better') before discussing it with students might stimulate the students' learning process much more than the negative critique that everyone might expect. Making some fresh and unexpected moves in the case of the nuclear energy issue might also be refreshing. In that respect, university education should be subversive, i.e. stimulating the thought process in regard to established beliefs (Cf. Lemkowitz et al., 2001).

To achieve such learning process, the lecturer needs new capabilities: In his research, the lecturer needs to build up a compelling case for his argument, but in his teaching, he should not do the same: he should help students identifying normative issues in work that seems to be of a technical nature and should help students in building up their own argument in these cases. This requires active learning processes, or ***practicing, not preaching***.

Conclusion

It is not surprising that SD lecturers are somewhat more critical to technology than engineering students and engineers are: it is just part of the SD lecturers' job to raise question about technology, and create awareness of negative side-effects. Of course, these figures are averages. Therefore, there might occasionally be reason for some student criticism regarding the too negative views on technology of some lecturers. Especially the high standard deviations point out that occasionally, viewpoints might be opposed. However, it is rather clear that SD lecturers' criticism focuses especially on specific technologies: nuclear-, space- and genetic manipulation technologies. These technologies are all under debate in the outside world, and therefore, the lecturer has to bring them into the university.

Basically, differences between SD lecturers and Dutch engineers of 1995 reflect changes in the appreciation of technology in society at large. One can observe a growing support of ICTs and diminishing support for all genetic manipulation technologies. The fact that the responses of engineering students of today have a higher correlation to the SD lecturers than to engineers of 1995 shows that the SD lecturers do not have a fundamental problem: SD lecturers are somewhat more engaged in the issues of society, but these issues are also reflected in changing preferences of students.

If students are confronted with material or lectures that is strongly defending a position, they might reject a course altogether as 'just a view'. Australian colleagues quoted a student saying that the reading material of an SD course was '*what tree-hugging socialists have to say about the world*' (Trigwell/Yasukawa, 1999). Clearly for this student, the course was too much preaching, by which it failed to activate the self learning process of the student. The failure denotes the risk of preaching. Perhaps preaching would not be completely bad as long as students could elect their own parish. Being able to chose might be the explanation for the lower appreciation of obligatory SD courses to voluntary SD courses that Segalas et al. (2006) observed.

Finally we can conclude that the value laden character of SD courses is in practice not a large problem, at least not for elective subjects, as long as the lecturer perceives his role as stimulating the students self learning process instead of preaching.

References

Blom, JCH., Kox AH., Veen, TJ., 1994, *Academische Vrijheid*, Vossiuspers Amsterdam University Press, Amsterdam,

ETSAV, 1999, Informe MIES, Una aproximacion al impacto ambiental de la Escuela de Arquitectura del Valles, UPC Escola Tecnica Superior d'Arquitectura del Valles, Valles.

Goorden, W., Mulder, KF, van Rossem, J., Woerlee, M., 1995, *Eerste Nationale Ingenieursdag*, 10 juni 1995, *Nieuwe technieken, fantasie in de werkelijkheid*, KIVI, The Hague

Habermas, J., 1968, *Technik und Wissenschaft als 'Ideologie'*, Edition Suhrkamp, Frankfurt.

Kobben, AJF., Tromp, H., 1999, *De onwelkome boodschap, of hoe de vrijheid van wetenschap bedreigd wordt*, Amsterdam: Uitgeverij Jan Mets

Lacey, H., 1999, *Is Science Value Free? Values and scientific understanding*. Routledge, London.

Lemkowitz SM, Schupp, BA, Nikolic, I., Lameris, GH., Bonnet, HA., 2000, How 'subversive' is good university education. In: *Gordon Research Conference on Industrial Ecology*, New London, New Hampshire, USA.

Lomborg, B., 2001, *The Skeptical Environmentalist: Measuring the Real State of the World*, Cambridge University Press, Cambridge UK.

Merton, RK, 1942, *The institutional Imperatives of Science*, In: Barry Barnes (edit), 1972, *Sociology of Science*, Penguin modern sociology readings, pp. 65-79.

Nelkin, D., (edit), 1979, *Controversy, politics of technical decisions*, Sage, Beverly Hills/London.

Nowotny, H., 1979, *Kernenergie: Gefahr oder Notwendigkeit - Anatomie eines Konflikts*, Suhrkamp, Frankfurt.

Segalàs, J., Ferrer-Balas D. Mulder, KF, 2006, *Concept mapping, a way of measuring learning processes concerning sustainable development of ICT students*, paper EESD III conference, Lyon

Trigwell, K., Yasukawa, K., 1999, *Learning in a Graduate Attributes-based Engineering Course*, paper presented at HERDSA, Melbourne, July 12th-15th,

<http://www.herdsa.org.au/branches/vic/Cornerstones/pdf/Trigwell.PDF> (June 12th, 2007)

Van den Daele, W., 1978, The Ambivalent Legitimacy of the Pursuit of Knowledge, In: Boeker, E., Gibbons, M., Proceedings of the conference on Science, Society and Education, Amsterdam

Potentiality of collaborative learning to train behaviours oriented towards sustainability

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Abstract

One of the functions that the University must meet in order to contribute to the sustainable development of our societies is to forge the attitudes and behaviours of its graduates according to the values and principles of sustainability. In this sense the UNED counts with a training model among whose methodological procedures outstands, due to its potentiality to achieve the axiological objectives of this educational approach, the collaborative learning, which is nowadays enhanced due to the new information and communication technologies. The objective of this paper is to present the experience of the use of this technique in the courses taught by the UNESCO Chair on Environmental Education and Sustainable Development of UNED, and to justify its relevance to conform attitudes and behaviours oriented towards sustainable development. First of all, because it provides the students with the opportunity to exercise joint liability, coral work towards a group objective, negotiation and constructive dialogue between pairs. In second place, due to the possibilities that Internet provides the educational process by allowing a reticular interaction model – and independently from the physical, geographical or temporary location of the subjects – which reinforces the most symmetric aspects of the educational relationship. The current process of construction of a European Higher Education Area (EHEA), common to all the EU countries, Bologna Process, offers the opportunity to increase that methodological proposal on the new model gets moving the reform.

Keywords:

Education for sustainability, collaborative learning, learning networks, training in attitudes, educational axiology.

The context of the proposal

The objective of progressing along the sustainability development path seems to be increasingly reinforced in the international European agenda. Since the *Lisbon Strategy* presented the proposal to achieve, by 2010, that the European Union be the most competitive and dynamic economy of the world, based on knowledge, capable of a sustainable economic growth, with more and better jobs, more social cohesion and within the respect for the environment (European Commission, 2000), in order to achieve this, different initiatives of educational policy have arisen, among which is the current process to build a European Higher Education Area (EHEA), called the Bologna Process, which intends to allow the harmonization of the university studies in all member countries of the European Union, strategy which carries a modification on the appropriate university systems.

In Spain, the current University changes are based on three main innovations: the *structural modification* of the organization of university subjects, the *change in the pedagogical model* and, at

the same time, the emergence of a new organizational culture whose identity sign is the search for *total quality* in the institution.

Concerning the modification of the pedagogical model, the most radical news is the emphasis on both the leadership of the students, main responsible agents of their own training process, and the methodologies that provide the autonomous and reflexive learning, whose virtues to facilitate the training objectives within the higher education scope are more than verified.

Due to the above, the UNESCO Chair on Environmental Education and Sustainable Development of UNED is promoting an internal research line to include in its university teaching, innovative approaches based on methodologies focused on the student and the use of information and communication technologies. These initiatives pretend to benefit from the training potential of one of these methodologies, *the collaborative learning on the web*, which is especially interesting from the sustainability education point of view.

In this work, we are first of all ready to theoretically justify the relevance of the *collaborative learning on the web* in order to train university students in sustainability requirements. And afterwards, to describe an educational project which has been recently implemented within the disciplinary scope of the Chair, whose main methodology consists in organizing small groups of students that analyze and solve problem-cases. They collaboratively learn using the information and communication technologies.

Theoretical frame of the project

The sociocultural constructivism is the theoretical frame that supports our methodological proposal. The role of the social component of learning, already stated years ago by Vygotsky, is completely certain nowadays and provides a solid theoretical base for the new teaching methodologies of participative type (Gilroy, 2001; Hogan & Tudge, 1999; Samaras & Gismondi, 1998). We know that, being the student the unquestionable main character of his own learning – there is no education without self education – each individual acquisition, although personal and subjective, takes place within a communication process, mediated and inter subjective, in which the individual interacts with other humans.

To learn is, by nature, a social phenomenon in which the obtention of the new knowledge results from the interaction among human beings. We find ourselves facing a new dialectic and dialogic process because an individual verifies his personal point of view with that of another one (including the intimate and personal dialogue with himself) till he becomes satisfied with himself as a person. This is why “*collaborative learning*” has a pedagogical potential. It’s a peculiar type among the methodologies called participative or socio-educational – some of them similar to each other– whose techniques emphasize and take advantage of the social dimension of the human being in order to provide the quality of the educational processes. Along these methodologies, learning basically takes place in the group negotiation and dialogue; using the word in conversational contexts whose characteristic is the symmetry in the relationship among the different members of the group.

In the practical implementation of the approach we may find different variations or touches, but they all always coincide in the fact that learning is carried out through the *reciprocate interaction of students in a social context*, be it attending or virtual. The second specific feature of the model is the *collaboration within the centre of the group*, whose members assume as their own the common aim, an aim that cannot be reached individually. As third characteristic we may highlight *the direct and personal activity of each member of the group*.

The three requirements grant the “*collaborative learning*” its character of active, participative and solidary learning; all the group members contribute both to the collective construction of knowledge, and *vice versa*, to the individual learning of each of them. The responsibility of the student is extraordinarily reinforced in the process, at the same time as the functions of the teacher as learning provider or adviser, are revalued (Du, Havard, Adams, Ding & Yu, 2007; Duart y

Sangrá, 2000; Alderman, 2000). It is a substantial change in relation to *cooperative learning*, another of the best known socio educational methodologies, whose processes must be highly structured by the teacher.

First condition: The integration of the students in the group

A first condition of *collaborative learning* is that the interaction with the group, apart from being carried out, must be directed towards the objectives of the educational process. Thus, the importance does not lie so much in the amount of communicative exchanges, as in their influence degree on the cognitive and learning processes of the group members.

Interaction between individuals reinforces their own mechanisms of individual cognition – through which we learn (induction, deduction, compilation, etc.) – by means of activities, such as, for example, to verbalize explanations, to express disagreements or mutual regulation. Learning in this case comes from thinking together, the exchange of ideas or the choral analysis of a matter, which allows obtaining a more consistent and elaborated result. Thus, the experts mention three main necessary requirements for the appropriate performance of the groups: a) communication must be agile, frequent and quick; b) it is necessary that the statements, suggestions and opinions, are rigorously demonstrated so that they may be constructively criticized and be the base for a joint work; and in the third place, c) it is necessary to use the most appropriate communication mechanisms for each activity and task.

Precisely the instrumental possibilities of the new technologies that facilitate this last requirement, is the factor that gives rise to the renewed methodological interest that the *collaborative learning* offers us today. This procedure went through a great boom during the 70's and 80's and has now experimented a great impulse with the appearance of e-learning in higher education, thanks to the fact that Internet offers different interaction possibilities, among which one may choose the most appropriate one depending on the task at each different moment: chats for agile communication processes – as to achieve agreements in a quick and punctual way-; email for a more meditated relationship; shared documents, to work with the information in the most elaborative and reflexive way; virtual periodical meetings to follow up the process and keep up motivation. A new sociocultural context-scenery has arisen, in which it is redefined *how we learn* (socially) but, especially, *where we learn* (in the Web). The new lecture hall of the XXI century is the Web, where meanings, contents and basis are shared, where knowledge is built and values and attitudes are explained (Castells, 2000).

The virtual teaching-learning contexts especially meet appropriate characteristics for the group interrelation, such as: interactivity, ubiquity and synchronism, apart from the possibility of organizing learning groups in distant lecture halls, geographically separated but interconnected by technology. In cyberspace this type of groups may work asynchronously, this is, without coinciding in time nor space among its members, so once the walls of the lecture hall are open, the interaction opportunities are exponentially multiplied (Tokoro & Steels, 2004). The education for sustainable development has, in this methodology, a firm ally to achieve its objective of training people who are capable to think globally and act both globally and locally, because the reticular structure and the diversity that virtuality allows to introduce in the composition of the collaborative group, are circumstances that make the understanding of complexity easier as well as the adoption of the systemic paradigm by its members.

Second condition: collaboration among students

The great challenge of *collaborative learning* is precisely in the first term of the concept, which requires all the members of the group to carry out together the stipulated work, because the division of tasks would distort the methodological approach. This division could be established, at the most, for merely instrumental matters, but it is essential, in this case, that the tasks are strongly linked and, especially, that they are put in common to allow the argumentative expression of the different

points of view and the search for consensus, as well as an own sub-process which constitutes the global learning process in its different sides and dimensions.

The negotiation is a distinctive element of these collaborative interactions and is especially important when trying to negotiate meanings. The members of the group do not impose their vision due to the status that they may hold within the relationship network, but due to their capacity to debate and justify the proposal. The challenge is found in the negotiation and the achievement of consensus till the point that, for some authors, the negotiation of the meaning is not a mere interaction effect, but one of its constitutional elements. They even state that without negotiation, the dialogue would be transformed in a monologue, at the same time as the function of the other person he was speaking to would be reduced to a simple message receptor. The interaction mechanism allows a mutual understanding to appear (Craig&Zimring, 2000; Kealy, Discroll& Mullen, 1999; Thousand, Villa&Nevin,1994).

From this perspective, learning is an emergence or synergic effect of the interaction model, which belongs to the adopted methodological system itself. It is only achieved successfully if all the group members assimilate the objectives they are presenting and they learn something as a team from an activity focused on teaching one another and make sure that each of them, as individuals, has achieved enough command in the common aims. It is a totally different approach from the one that shares, distributes and divides tasks among the members of the group; the objective is the group and individual training – both simultaneously and without renouncing to them -, to build a common learning that each member may individually demonstrate.

Third condition: the direct and personal activity of each group member

While building choral knowledge requires the collaboration between all the members of the group, it is not less true that the individual learning requires the direct and personal activity of each student. Because to build knowledge is not only a social process, it also has an individual thinking character and internalization, which validates the asynchronized communication space. Within this communication, the results which are personally thought, may be expressed, and not only as an interactive dialogue (Foyle, 1995).

The individual, direct and personal participation of each group member in the training activities is, thus, a third essential element of the *collaborative learning* paradigm. Each student must become actively involved in the group work and assume a direct responsibility, both concerning his own learning and that of his colleagues. He needs to become conscious that he belongs to a working team with the condition and characteristics of a system whose result must be the learning progress, both individual and collective.

This membership feeling strengthens with the participation exercise. The group members determine the objectives and the method to achieve them through dialogue and consensus. Group interaction is an element used as basis to work out new ideas and build up knowledge. It is also equally necessary to achieve a clear group objective to share experiences and knowledge, because feedback is an essential element for the success of this venture.

The strengths of the web collaborative learning

The results of the pedagogical research guarantee the group membership to *collaborative learning* for the efficiency of the educational processes into two main complementary areas: the cognitive and socio-affectivity one. Although initially research seemed to emphasize the advantages of the method on the socio-affectivity of the students – it was evident that the improvement of the social abilities, integration and group cohesion were derived from social interaction based on negotiation strategies, mediation and cooperative search for alternatives, the benefits on the cognitive command are not less; among others, their efficiency to allow the problem solving capacity in a creative way. Thanks to the diversity of approaches, sources and strategies derived from group plurality, a

cognitive approach to problems is made possible, allowing more complex qualitative solutions (Alexandrov, Ramirez & Alexandrov, 2005; Glinz Pérez, 2005; Schneider & Synteta, 2005).

On another side, there is evidence that the collaborative teams reach higher thinking levels and retain information longer than the students that work individually. On top of this, choral learning offers them the possibility of personally becoming involved in an argument, assuming the learning responsibility, both of themselves and of others, and to become critical thinkers.

Thus, *collaborative learning* is a training process and to build up interactive and collective knowledge, which encourages the development of mixed abilities (of personal and social development). It allows educational achievements concerning a very wide range of fields, among many others: those of systemic and cognitive character, of technical, relational or social type. And it offers the best opportunity to train in ethical scopes because it not only requires the students to assume the disciplinary contents, but also to, simultaneously, internalize values and co-responsibility, solidarity, and cooperation attitudes, or negotiated resolutions of conflicts, which are all basic from the sustainability point of view.

Essential elements of the model are the positive interdependence (as responsibility), interaction, individual contribution and personal and group abilities. The following are stated as learning achievements: problem-solving, joint work, analysis from different perspectives, self-responsibility for the learning process itself and self-conscience for the role carried out in the choral learning-teaching process. It is also necessary that the students develop social abilities such as knowledge and confidence among the members of the group, the necessary communication – avoiding ambiguity – active listening, mutual respect, acceptance and the support of one another as well as conflict solving in a constructive way. They are all necessary capabilities in order to achieve the objectives that within the sustainable development scope, higher education must achieve.

Acquisition of meta-cognitive abilities

Collaborative learning requires carrying out “activities of high cognitive level”, such as: a) to search and evaluate the relevance of information, b) to establish relationship networks between concepts, c) to carry out based critics which promote critical thinking (Gokhale, 1995), or d) to use knowledge in a contextualized way. It is a model that provides systemic thinking; the ability not only of knowing but to know how to use that knowledge in practical matters and to solve problems in a creative way. Both characteristics have been highlighted by UNESCO as belonging to an education that allows facing successfully the sustainable development dilemmas and challenges (UNESCO, 2004).

On the other hand, to learn in a collaborative way provides the student with a feedback on his behavior and training process, which allows, if necessary, to readjust and consequently self-regulate his meta-cognitive strategies. For example, it obliges him to self-evaluate his own understanding of the task; it promotes reciprocal communication of the personal strategies and contributes to purify them, at the same time that it widens the possibilities of multi-methodological projects, and promotes, in any case, the reflexive practice.

Acquisition of values and attitudes: co-responsibility, collaboration, participation

The collaborative learning model lies on three main axial pillars: co-responsibility, collaboration and participation. The commitment of each group member with his pairs, the responsibility (co-responsibility) towards themselves and the participative attitude sustain the behavior of students.

Co-responsibility, *solidary responsibility*, is a principle found on the base of the theoretical conceptualization of sustainable development; it is one of the most radical axiological references of the sustainability paradigm. We find ourselves facing a concept that places emphasis in the reciprocal interdependencies between responsibility and solidarity. The latter, in one of its most common senses, refers to the reciprocal attendance that several people grant each other when they find themselves in an interdependence situation concerning common interests. This is the case of

collaborative learning groups and also of the situation of human beings engaged as species in a common destiny, of a very uncertain future, if Humanity does not steadily direct itself along the sustainability path.

In collaborative learning students must strengthen their abilities in order to help them interact with their pairs to build, discover, transform and increase the conceptual contents and, in this sense, it is necessary to consolidate non-competitive relational contexts whose emergence is provided by the co-responsibility, collaboration and participation attitudes.

On top of the active participation of all the group members and the negotiation to achieve consensus, two distinctive elements of collaborative learning allow to take into account in decision-taking, the expression of the needs felt and the interests of all those involved, which is another characteristic that UNESCO claims for the educational processes within the sustainable development frame.

All these characteristics and circumstances of the pedagogical model of collaborative learning have originated its main election by the UNESCO Chair of Environmental Education and Sustainable Development of UNED (Spain) and its incorporation to the instructive design of the subjects that constitute its training offer within the scope of distance higher education. As an example, in the following paragraph of this paper we will describe one of the teaching projects that are currently being carried out.

A project of collaborative learning for sustainable development

We have a double motivation underlying the teaching innovation project that we present. First of all, to optimize the training processes promoting the autonomous and group work of the students in order to improve the meaning and functionality of the learning. In second place, to adjust the teaching project to the European Higher Education Area (EHEA) methodological model from the perspective of the time dedicated required to the normal student to carry out the tasks and activities included in the instructional design; the point is to adjust its relevance taking into account the Bologna Process requirements. It is all part of a medium term renovation process within the pedagogical design of the subjects of the Chair, being coherent with the university reform started among us due to the Bologna Process.

The experience is centered in one of the programmatic nuclei of the subject *Sustainable Development: social and educational implications*, of the educational plan of the Bachelor's degree in Pedagogy at UNED, whose training objective is to provide the students with the capabilities to design, manage and evaluate the educational projects and programmes for sustainable development.

The design proposes a group activity set forth as a transversal axis to the II thematic part of the subject Programme, which consists in elaborating an educational proposal to answer the training need on one of the most urgent problems of global sustainability: climate change and its foreseeable impacts on extreme poverty and hunger, in a moment in which the United Nations, as the *Millennium Declaration* states, proposed eight objectives as the aim to universally achieve by 2015, being the first of them, precisely, to eliminate extreme poverty and hunger from the world.

Objective of the instructive design

The instructive design foresees activities and tasks to be carried out by the students, allowing them to establish the nexus that link the binomial *climate change-extreme poverty and hunger*, and to elaborate, in a simulated professional exercise, an educational proposal that in the future would allow them to transmit that knowledge to their own students, together with the values, attitudes, and especially commitment to act responsibly and with solidarity.

Partial aims

To reach the general objective, the learning group must achieve the following partial aims:

- To analyze the factors due to the human influence that underlie both in the *climate change* phenomenon and in the problem of *extreme poverty and hunger*.
- To establish relationships and possible reciprocal influences between the identified factors.
- To design a simple project or educational programme on the matter to be used in school or out-of-school contexts (at choice). It must include: objectives, means and resources, didactic procedures, criteria and evaluation procedures.

Activities and tasks to be carried out by the participating students

The students that participate in the experience organize themselves in collaborative working groups of virtual character in order to initiate a teaching-learning process which will take place in two complementary levels: individually and in groups. Individually they will study texts, carry out the necessary schemes and summaries or the instrumental tasks that the group assigns them. As a group, they will participate in debates, decision-taking, etc., related with the objectives and activities of the subject.

Among the *individual* activities and tasks, we may mention the following:

- a) Comprehensive reading and studying the basic texts of the fifth matter of the programme of the subject: "*The necessary education: education-development synergies*".
- b) To look up complementary documentation: search in libraries, through internet, in magazines, periodical publications etc.
- c) To draw up a personal list of ten questions with their corresponding solutions and answers, to evaluate the knowledge on the matter. Eight questions will be as a test, with three possible options, and the other two will be developed as an extensive essay. These questions will afterwards be used as an individual contribution to one of the two collective works that the group as such has to carry out and present to the teaching team.

Among the *group* activities and tasks, we may mention the following:

- a) To participate in the common work by including a study group in the WebCT platform of the subject.
- b) To participate in the self-organization of the group: to distribute tasks, to elaborate a working calendar, to achieve consensus, etc.
- c) To carry out and present the teaching team:
 - A report including a list of ten agreed answers for the evaluation of the matter: eight questions as a test and two long ones with the same characteristics as those carried out individually.
 - An educational programme on the relationship between the climate change and its synergic effects on extreme poverty and hunger, and the possible alternatives to the situation described. This programme may either be developed within the formal educational scope, or within the non formal educational one.

Evaluation System

The evaluation has been brought up as a continuous agreed upon process, with the participation of teachers and students. The individual and group self-reports allow the teacher to tinge his own perception of the collaborative group and the appraisal worth by the works they carried out during the training process. The achievements of individual learning are evaluated by means of an attendance test carried out by each of the students.

Students value the experience

A total of twenty nine students started the experience. Seven of them abandoned the collaborative learning groups without completing the process. The data obtained correspond to five groups which, on the whole, are integrated by the twenty one students that maintained their commitment till the course ended.

The voluntary character that the appointment to a collaborative group had for the students, already announced that the participation would not be massive taking into account that to take part in a pilot group requires an additional activity to those normally required in the subject. The percentage of participation in the experience has been around ten percent of the total of people registered in the subject.

The groups were formed by students who did not know each other personally, who lived in very distant cities and circumstances, distributed by the whole Spanish geography, and also coming from different studies and specialties. Most of them were future pedagogues, but also biologists, specialists in environmental sciences, anthropologists, social educators or technicians of tourism enterprises.

The implication of the members of each group in the experience may be qualified as high, both due to the high participation level in the virtual forums, with a quarterly average of 115 messages exchanged by each working group, and to the appropriate fulfilment of the agreed-upon working plan, and, in general, due to the active, warm and very collaborative character of the distance interaction.

The evaluation of the experience has been collected by using a simple questionnaire, whose answers are adjusted to a Likert scale, with five satisfaction levels and the following nine items:

1. *To participate in the group has helped me to widen my knowledge on the matter.*
2. *It has helped me to understand and relate relevant aspects of the subject.*
3. *It has enhanced my capacity to apply the contents of the matter to real situations.*
4. *It has motivated me at times when I felt discouraged.*
5. *It has improved my abilities to work out of solidarity in a team.*
6. *It has increased my interest for Environmental Education and sustainable development*
7. *It has improved my ability to act in virtual spaces*
8. *It has motivated me to periodically use the WebCT platform.*
9. *They are a useful and efficient studying procedure.*

The punctuations given by the students when evaluating the experience give a global average of 3,96 points –out of a possible maximum of 5-, with little dispersion on the punctuations, which all fluctuate between a minimum of 3,4 and a maximum of 4,6.

Conclusions

The experience has been satisfactory within its condition of initial proposal. The students have stated a very positive valuation of their participation; they declare they feel more interested in the matter and willing to intensify its study. The group climate has positively influenced in the motivation of the participants and in the final results of the learning, which were more ambitious than the initial ones forecasted for the subject.

Some weak points have also been detected. Among them, the slowness of the group self-organizing process, which requires to forecast a longer time for this step, till the group achieves to “start to perform”. And also, the tendency of the group to divide the work, to divide the tasks among the members in order to obtain results in shorter times; which shows the need to work out corrective

mechanisms that avoid to spoil the real meaning of collaboration, reducing it to a mere cooperation among students.

In spite of these limitations, the expectations concerning *the collaborative learning on the web* have been met as a particularly appropriate methodology for the objectives of the university training within the scope of education for sustainable development.

The experience carried out guarantees the methodological relevance of the model and, at the same time, brings up the need to continue exploiting and optimizing its possibilities. Consequently, the project, once readjusted to increase its strengths and mitigate its weak points, will be again used in the 2007-08 academic year.

References

Alderman, B. (2000), “*Get Real! Collaborative Learning in Higher Education*”, *Text*, Vol 4 nº 1. Available (24. 05.07) <http://www.griffith.edu.au/school/art/text/april00/alderman.htm>

Alexandrov, N., Ramirez, R. & Alexandrov, V. (2005) *Novel Pedagogical Paradigms facilitating mixed mode and collaborative learning using open source software* International Conference on Interactive Computer Aided Learning, Villach, Austria. Available (24.05.07) <http://cs.mty.itesm.mx/rramirez/documentos/ICL-2005.pdf>

Castells, M. (2000), *The rise of the Network Society*, Blackwell, Oxford

Craig, D. L., Zimring, C. (2000) "Supporting Collaborative Design Groups as Design Communities" *Design Studies*, Vol 20 nº 2, pp.187-204. Available (24.05.07) http://coweb.cc.gatech.edu/csl/uploads/des_studies.1.pdf

Du, J, Havard, B, Adams, J., Ding, G.& Yu, G. (2007) “Project-Based Online Group Collaborative Learning Characteristics” in Tomei, L. *Integrating Information & Communications Technologies in the Classroom*, Hershey PA : InfoSci, pp. 188-202.

Duart, J.M. y Sangrá, A. (2000), *Aprender en la virtualidad*, Gedisa, Barcelona

Gilroy, K. (2001) *Collaborative e-learning: The right approach*, Ars Digita Systems Journal. Available (24.05.07) <http://www.eveandersson.com/arsdigita/asj/elearning/>

Glinz Pérez, P. (2005) *Un acercamiento al trabajo colaborativo*, Revista Iberoamericana de Educación, nº 35/2. Available (24.05.07) <http://www.rieoei.org/deloslectores/820Glinz.PDF>

Gokhale, A.A (1995), “Collaborative learning enhances critical thinking” *Journal of Technology Education*, Vol. 7 nº 1. Available (24. 05.07) <http://scholar.lib.vt.edu/ejournals/JTE/v7n1/pdf/gokhale.pdf>

European Commission (2000), *Lisbon Strategy*. Available (24.05.07) http://consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/00100-r1.en0.htm

Foyle, H. C. (Eds.) (1995) *Interactive learning in the higher education classroom: Cooperative, collaborative, and active learning strategies*, National Education Association, Washington, D C.

Hogan, D.M. & Tudge, J.R.H. (1999), “Implications of Vygotsky’s theory for peer learning” in O’Donnell, A.M. & King, A. (Eds.) *Cognitive Perspectives on Peer Learning*, Lawrence Erlbaum Associates, Mahwah, New Jersey, pp.39-65.

Kealy, W.A., Discroll, M.P. & Mullen, C. A.(1999), *Knowledge maps and their use in computer-based collaborative learning environments*, Paper presented at the Annual Meeting of American Educational Research Association, Montreal, Canada

Schneider, D. & Synteta, P. (2005), “Conception and implementation of rich pedagogical scenarios through collaborative portal sites” in Senteni, A.&Taurisson, A. *Innovative Learning & Knowledge Communities / les communautés virtuelles: apprendre, innover et travailler ensemble* (ICOOL 2003 & Colloque de Guéret 2003 selected papers) University of Mauritius/UNESCO, Genève. Available (24.05.07) <http://tecfa.unige.ch/proj/seed/catalog/docs/schneider-icool-final.pdf>

Samaras, A.P. & Gismondi, S. (1998), “Scaffolds in the field: Vygotskian interpretation in a teacher education program”, *Teaching and Teacher Education*, Vol. 14 n° 7, pp.715-733.

Thousand, J., Villa, A. & Nevin, A. (Eds) (1994), *Creativity and Collaborative Learning*, Brookes Press, Baltimore.

Tokoro, M. & Steels, L. (Eds.) (2004) *The Future of Learning II. Sharing representations and Flow in Collaborative Learning Environments*, IOS Press

UNESCO (2004): United Nation Decade of Education for Sustainable Development 2005-2014. Draft International Implementation Scheme. Available (24.05.07) <http://unesdoc.unesco.org/images/0014/001486/148654e.pdf>

Education for Sustainable Development and Global Citizenship in Wales

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Abstract

The Welsh Assembly Government has decided that sustainable development and global citizenship should be central policy drivers for Wales and Welsh life, and that from 2007 onwards, education for sustainable development and global citizenship (ESDGC) has to be integrated into all aspects of education in Wales, both in the curriculum and other activities – transport, heating, purchasing etc., from the Foundation phase (3-7 years) to Life-Long Learning. In order to embed this into education all candidates seeking qualified teacher status, will have to demonstrate their ability to integrate ESDGC into their teaching. The work also linked in with CTCS Comenius project for ESD providing a frame work for ESD.

All universities which provided teacher training have had to adjust their Initial Teacher Education and Training programmes to meet this need, particularly in the light of the fact that these programmes will be inspected by Estyn, the office of Her Majesty's Chief Inspector of Education and Training in Wales. In order to support this process a group of university staff and NGOs put in a bid for money from the Welsh Assembly to fund projects aimed at providing a professional training programme that would enable university staff to better integrate ESDGC into their teaching and to deliver the principles of sustainable development and global citizenship in all subject areas.

In the first project the group created bespoke materials and collated existing materials, so as to ensure that universities, schools and trainees all had access to quality, Wales-relevant, materials for ESDGC. It was decided that the best way to disseminate this material was to construct a web site and place the material there.

The second project provided on-site training days at the seven Universities in Wales which train teachers. The days addressed pedagogy and methodology for staff at each institution across the full range of subjects and key stages. This training utilised the expertise of subject specialists across the disciplines with experience of ESDGC. The sessions followed a format of information giving and workshops and the feedback from these sessions was very positive.

Keywords:

Education, sustainable development, global citizenship, training

Introduction

This paper is a work in progress report. It considers two projects which were intended to assist the process of embedding Education for Sustainable Development and Global Citizenship (ESDGC) into Initial Teacher Education and Training (ITET). These projects came about as a result of a decision by the Welsh Assembly Government to promote ESDGC across the whole range of education from Early Years to Life Long Learning. This was part of the process of creating a distinct Welsh identity, in education as well as other areas, as a result of powers which had been

held centrally by the UK government being devolved to Wales. The work also linked in with CTCS Comenius project providing a framework for ESD.

On 1 July 1999, the UK Government transferred powers from the Secretary of State for Wales (a minister in the UK Government based in London) to the National Assembly for Wales (based in Cardiff). The National Assembly was given responsibility for policies and public services formerly exercised by the Welsh Office (a UK Government institution). These include economic development, agriculture, industry and training, education, local government, health, social services, housing, environment, transport and the Welsh language.

Education legislation contained in Acts of Parliament applies to both England and Wales. To some extent this continues, but the National Assembly for Wales now has the power to implement policy in a range of areas including education and training. In practice this means, for example, that the Assembly is responsible for setting the content of the National Curriculum for Wales.

The Welsh Assembly decided that all educational institutions in Wales would have a binding statutory duty to promote and pursue sustainable development and global citizenship in both their curriculum and their activities – transport, heating, purchasing etc. Supporting this commitment are the Welsh Curriculum and Schools Inspectorate Authorities (ACCAC & Estyn respectively). This presents an invaluable opportunity in the long term to mainstream ESD&GC into educational policy.

The perceived need for ESDGC to be integrated into education grows out of an awareness of the low level of understanding of the subject. In the Welsh consumer council survey of 2002, 81 % of 16-24 year olds were unaware of the concept, despite its prominence on policy statement and news items. (Bibbings, 2003, p.17)

The political support for ESDGC is unlikely to be reversed with a change of Government as has happened in other countries. This is due to a number of factors. First, there is a specific Welsh attitude to the environment which is expressed through art, literature and music which places a high value on its enjoyment and preservation. Secondly, Wales has always compared itself to England, and this comparison is not helpful – England is richer, more influential in the world etc. Now, however, there is clear move to view Wales as part of the wider world, to see itself as a nation amongst nations, and her people as global citizens. Linking in with the UN statement that: ‘ESD is fundamentally about values, with respect at the centre’ (UN, 2004, p.4). The result of these attitudes is that of the four parties in Wales, the Labour Party, the Liberal Democrats and Plaid Cymru (the Party of Wales) are all fully supportive of the ESDGC agenda, and even the Conservatives are not opposed to it.

This is highly significant because, as Flynn and Morgan point out: ‘while sustainable development policy is largely *designed* at the national and supra-national scales, it is actually *delivered* at the sub-national-scales.’ (2004, p21)

The Welsh Assembly Government has put forward an Action Plan to:

- *Make sustainable development and global citizenship a feature of required whole school policy for all schools.*
- *Undertake to include sustainable development and global citizenship in the review of future requirements for educational strategic plans (ESPs) and School Improvement Plans.*
- *Review the place of sustainable development and global citizenship in the curriculum as part of ACCAC’s current curriculum review.*
- *Introduce sustainable development and global citizenship into initial and induction training opportunities for teachers and develop specific Continual Professional Development training.*

Education for Sustainable Development and Global Citizenship is about:

- The links between society, economy and environment and between our own lives and those of people throughout the world
- The needs and rights of both present and future generations
- The relationships between power, resources and human rights
- The local and global implications of everything we do and the actions that individuals and organisations can take in response to local and global issues

(ACCAC, 2002, p6.)

The First Project: Embedding Education for Sustainable Development and Global Citizenship in Initial Teacher Education and Training in Wales

Aims

1. To identify the knowledge needed by ITET teachers and students in order for them to effectively address the 9 key concepts within ESDGC
2. To develop the associated pedagogy to enable effective delivery of ESDGC
3. To assess the resource implication of these aims and to make recommendations regarding existing materials and development of bespoke materials.

The 9 key concepts were:

- **Interdependence**
understanding how people, the environment and the economy are inextricably linked at all levels from local to global
- **Citizenship and stewardship**
recognising the importance of taking individual responsibility and action to make the world a better place
- **Needs and rights**
understanding our own basic needs and about human rights and the implications for the needs of future generations of actions taken today
- **Diversity**
understanding, respecting and valuing both human diversity – cultural, social and economic – and biodiversity
- **Sustainable change**
understanding that resources are finite and that this has implications for people's lifestyles and for commerce and industry
- **Quality of life**
acknowledging that global equity and justice are essential elements of sustainability and that basic needs must be met universally
- **Uncertainty and precaution**
acknowledging that there are a range of possible approaches to sustainability and global citizenship and that situations are constantly changing, indicating a need for flexibility and lifelong learning
- **Values and perceptions**
developing a critical evaluation of images of and information about the less and more

economically developed parts of the world and an appreciation of the effect these have on people's attitudes and values

- **Conflict resolution**

understanding how conflicts are a barrier to development and a risk to us all and why there is a need for their resolution and the promotion of harmony. (ACCAC, 2002, p8/9)

This was intended to embed the different types of knowledge which teachers promote. All teachers possess, or should possess general pedagogical knowledge, the ability to communicate ideas. The training would include not only content and the principal ideas of ESDGC (Shulman, 1986, p9), issues such as human rights, poverty and wealth distribution, climate change, etc. but also demonstrate the methods through which this knowledge would be communicated. This is a key element the importance of which has been fully demonstrated (Cochran, 1997, p7). If the Welsh Assembly government's aim of integrating ESDGC into the life of Wales is to come to fruition then the skills required of the people of Wales will mean that 'a firm foundation must be laid down in schools to ensure both their early and systematic learning.' (Heater, 2004, p343)

The project, which comprised representatives from ITET institutions in Wales alongside representatives from NGOs which had already made substantial contributions to the ESDGC agenda such as Oxfam, Amnesty International and the Royal Society for the Protection of Birds, made an audit of standards and policies for EGCSO from Estyn, ACCAC and the Welsh Assembly and of similar projects from elsewhere in order to ascertain the status quo. A range of materials both from within the group and sourced from other organisations and projects were incorporated into the project, including examples of student work in partner schools. A skills menu (see below) was developed to promote values and attitudes in relation to EGCSO, and both a 'knowledge path' - what teachers need to know in order to comprehend the 9 concepts and a 'pedagogy path' - how to teach these concepts, were developed.

A collation of existing materials and materials was created by, or commissioned by, the task and finish group. This involved contacting ITET College in Wales and consulting with colleagues on the external changes needed to promote institutional change, best practice world wide, and the inclusion of all ITET Colleges in the project: In particular ensuring that Colleges, schools and trainees all had access to quality, Wales-relevant, materials for EGCSO, in one place.

The group examined the nine concepts and noted that, whilst these concepts represent the ideal that the Welsh Assembly is aiming for, the reality is unlikely to match this in all its aspects. The group decided, however, that the concepts should promote the following skills, values and attitudes:

Skills

- Ability to think critically
- Ability to argue effectively
- Capacity to challenge injustice and inequalities
- Facility to respect other people and things
- Expertise in co-operation and conflict resolution

Values and attitudes

- Sense of identity and self esteem
- Empathy
- Commitment to social justice and equity
- Value and respect for diversity
- Concern for the environment and commitment to sustainable development
- Belief that people can make a difference

There was also a perceived need to engage the feelings of both teachers and those they were teaching since, as Cornelius states: 'Thinking, reflecting, valuing, taking decisions and acting are inseparably tied to emotions. Emotions are an essential part of the decision making process' (Cornelius, 1996, p8)

It was decided that the best way to make the materials which had been gathered and produced available, and to promote the concepts, values and skills was to construct a web site which would be open to all. <http://www.esdgc-wales.org.uk/> Such a resource had previously been suggested by Peattie 'One suggested solution to this problem is to develop on-line and interactive self-study materials on sustainability to educate trainee teachers.' (2004, p133)

What has been created by this project is a resource for ESDGC into which all ITET Colleges have had some input, and in a number of cases substantial input. All ITET institutions are aware of this resource and the statutory requirements which drive the process. This has proved to be a popular and well used site.

The Second Project: The Provision of continuous professional development provision in sustainable development and global citizenship for lecturers in Initial Teacher Education and Training in Wales

Aims

The aim of the second project was to provide a professional training programme for ITET staff at different levels:

An introduction for those staff who had no or little previous experience in the delivery of ESDGC to resources and methodology which would enable them to begin the process of implementing this agenda in their own teaching.

Further training in the area for those staff who had already begun the process of implementing ESDGC into their teaching.

Training through the medium of Welsh for those who requested it.

Although the resources on the web site developed by the first project were now available to support teaching and learning in ITET at all 7 institutions in Wales which provided such training, it was apparent that their use and effectiveness would be enhanced by a programme of Continuous Professional Development (CPD). This was essential as the competence of teachers is strongly influenced by the beliefs and values he or she holds. Given that issues in ESDGC are often controversial, and decisions on these issues are sometimes based on value judgments it is important that teachers are introduced to the relevant material. (Summers et al 2005, p630).

Quantifiable Outputs against which progress was monitored

1. Establishing a programme of activities meeting the needs of CPD training requirements at each institution.
2. Publishing timetable of CPD training days at each institution.
3. Evaluation reports from each participating institution
4. Evaluation reports from those providing the training

Method of Approach

An effective group had already been established for the previous project 'Embedding ESDGC into ITET in Wales' and members of that group indicated that they would be willing to contribute to the management of the new project to aid continuity. New members were also encouraged to participate. This group was responsible for clarifying issues, inputting expertise, ensuring applicability and

maintaining relevance of this project to ITET courses in Wales. It also assisted the project leader in assessing and recommending appropriate methods and approaches for CPD training days and identifying suitable, experienced facilitators.

All ITET institutions in Wales were contacted in order to organise and publish a timetable for delivery of CPD training days, and negotiate programmes of training to meet the specific needs of the individual institutions. As a result of these consultations, a major problem arose. The group had intended to utilise the expertise of providers such as Oxfam, Amnesty International, Forest Schools, CAT the Centre for Alternative Technology, etc. to provide the training in the ITET institutions. These organisations had already provided training in both schools and some ITET institutions which had been welcomed and appreciated, and they were both well equipped and enthusiastic about delivering the training required.

When this was discussed with key people in the institutions who were keen to implement the ESDGC agenda, the response from some was negative. Whilst they themselves had no problems with training being provided by these organisations, they felt that their colleagues, particularly those who were not yet 'on-board' with the project would be more likely to see it as having credibility if the sessions were delivered by other academics. They expressed the view that if we wished to get the best response to the training, then we should bring in respected academics with high profiles in their subject areas, whose status would guarantee a positive reception.

Given the expertise of the providers mentioned, this was not something that we had anticipated. Having had these responses from the institutions, however, we felt that we had no choice but to re-think the training, and, for some but not all of the institutions, bring in academics who were experts in this field with track records in publishing at a high level. This we saw as essential, since if they were not engaged with the issues then the training would be of little value. As noted above it is important that the interests and emotions of those involved are engaged in order to facilitate the process (Cornelius, 1996, p8). This caused inevitable delays in the process as such people are very busy.

The training programme was eventually set up, with varied programmes depending on the identified needs of the institutions. Initial introductions to the principles of ESDGC and their implementation were given to a number of institutions who were in the early stages of implementing the ESDGC agenda – University of Wales, Aberystwyth; University of Wales, Newport; University of Wales, Swansea; University of Wales Institute, Cardiff and Trinity College, Carmarthen. These introductions were followed up in all the institutions (apart from the University of Wales, Aberystwyth) by further specific training.

Some institutions e.g. the University of Wales, Swansea had requested training in specific subject areas for their Secondary staff (teaching pupils 11-18 years), so academic experts were provided in curriculum areas such as Maths, Science, Economics, English and Modern Foreign Languages. Others such as the University of Wales, Newport, which has more of a Primary (3 – 11 years) focus requested training in cross-curricular areas such as children's rights, global footprint, Forest Schools etc.

Two institutions - University of Wales, Bangor, and the North East Wales Institute - had already had considerable input in ESDGC training and they requested more advanced training. Bangor is the home of the *World Education Centre* which, for a number of years has pursued this agenda and provided the School of Education there with a sound base. The training provided was therefore focused on particular curriculum areas and specific age ranges.

The North East Wales Institute has had input on the sustainable development agenda and requested that their training should focus more on the citizenship aspects of ESDGC, which was provided by the Citizenship Unit of Glasgow University.

Training was also provided through the medium of Welsh for both the University of Bangor and Trinity College, Carmarthen.

Results

The participants in the 'Introduction to ESDGC' sessions were asked 3 questions:

1. Has the session made you rethink how the planet works/understand it more simply/more confident to explain it to students?
2. Has the session helped to answer the question 'why the fuss'?
3. Will it have helped you and colleagues to plan for ESDGC to permeate the whole of your courses rather than simply being an add-on?

These were not simply yes/no questions, spaces were left for participants to write constructive comment and they were encouraged to do so. The large majority in all these sessions answered yes to all 3 questions. The lowest numbers, though still the majority (66%), were from the morning Secondary session at Swansea. They were much more positive, however, after the afternoon subject specific sessions, and this probably reflects Secondary teachers focus on their own subject.

Specific comments tended to demonstrate that even with this audience, specifics were appreciated:

Newport

'The demonstrations were particularly useful - a reminder of just how persistent one has to be to establish ideas which are counter intuitive'

'Investigations and websites were invaluable'

'One of the better training days we have had, I feel much more confident about delivering the ESDGC agenda.'

Swansea

'Valuable to colleagues who had little prior knowledge of ESDGC and its application within subject areas'

'Learnt a lot about how to integrate these concepts into my subject area'

'Maths session very useful'

'Economics of SD was a very thought provoking session'

Trinity

'An effective stimulant to action, today will be the start of some important changes to the ITET course'

'Left me feeling much less worried about implementing ESDGC'.

'We will continue today's very useful discussion'

UWIC:

'Helped to reflect on some key principles that might have been taken for granted/as read - both in terms of school and university'

'Very informative, even inspiring morning goading us into the necessary action, thank you'

'This was a very informative stimulating and interesting session. Interactive/group activities really useful - got a lot from it'

'Very useful illustrations to make us think about the issues - good to have opportunity to discuss ideas with colleagues'

In those institutions which had already experienced input, the questions were different:

1. Was the workshop as a whole worthwhile?
2. Which aspects, if any, of the workshop did you particularly enjoy?
3. Were there any aspects you did not enjoy? If so, what and why?
4. Do you have any comments/suggestions?
5. Will you take any action as a result of the workshop?

Bangor

‘What was really useful was the engagement at an intellectual (rather than purely practical) level.’

‘I particularly appreciated the discussion about Welsh language issues vis a vis language issues in Africa - seeing answers from Kenya provided a really interesting perspective.’

‘No preaching just exploring ideas.’

‘Making use of relevant examples from across the world, instead of just dealing with abstract examples.’

‘The professional framework: Discussing situations which are relevant to us here in Wales, and seeing the worth of discussion and open-mindedness in dealing with these issues.’

‘“Teachers in and with the wider world” was excellent especially with the chance to discuss with other staff

‘I have taken away ideas for incorporation into my future GC/ESD sessions. That’s what I wanted.’

North East Wales Institute

‘Good to have a practical focus on the challenge of inter-disciplinary issues.’

‘This was a real help in making us face the issues raised by global citizenship, and how we might integrate this concept into our teaching.’

‘A very useful opportunity to reflect on what we teach and to place it in an ESDGC context, especially in the light of inspection requirements.’

Conclusion

The aim of the second project was to provide a professional training programme for ITET staff at different levels.

Overall this was a very successful project which met the key objective. The response of staff was very positive and there was a general view that this would help the introduction of ESDGC into ITET. Those who were involved were positive about the training offered, and there was a clear view from them that such training was badly needed. Some indicated that, before the training, they had felt ill prepared for the introduction of ESDGC. It was also clear that whilst a theoretical base is necessary, even for university lecturers, practical examples were a real stimulant.

What has become clear from the training is not only how much this programme was needed, but also how much more is necessary. This project has only scratched the surface and a programme of CPD needs to be established in all institutions if ESDGC is to become a reality within universities.

This is the central issue:

There are staff who are fully committed to the agenda and are pro-active in including this in their learning and teaching

There are staff who, whilst they are positive about the agenda, lack the skills and confidence to fully embrace it. Clearly these projects will help, but they are not enough on their own.

There are staff who have no real interest in ESDGC and see it as simply another initiative on top of many others. One of the points that came out of this project, however, is that when such staff are engaged in their own subject by those they respect, this can produce a significantly different attitude. In the end, of course, there is always the stick of the inspection process. It was clear from comments expressed verbally at several of the sessions, that some of those attending were doing so primarily to prepare for future inspections. This, however, has limited value, if staff are not convinced then their adoption of the agenda will be superficial. As Westen points out, if people's emotions and feelings are not engaged, no amount of rational policy formation will move things forward. (Westen, 2007)

It is also the case that, if the ESDGC agenda is to be successful then it is not simply about changing the way institutions teach, but about changing the way they operate. Issues such as purchasing, heating and lighting, building construction, transport etc. are also fundamental. It is here that the inspection process has a key role to play. If senior management in schools and colleges are pushed by the inspection process into changing the way they run their institutions then this could have a profound effect on such institutions and on how people in those institutions work. These reports are demonstrating a clear commitment on the part of Estyn to push the ESDGC agenda forward.

www.estyn.gov.uk/press_releases/pr_Eng_ESDGC_report_from_Estyn_30_06_06.pdf

www.estyn.gov.uk/publications/Update_on_inspecting_education_for_sustainable_development_and_global_citizenship

This may well work for schools and colleges, universities, however, are independent institutions, so, although the Welsh Assembly Government can enforce standards in terms of both curriculum and resources in schools and colleges, in the case of universities they can only enforce standards in the ITET curriculum, in all other areas they can only issue advisory documents. This they have done, but the impact so far has been limited.

In conclusion, much good work has been done, but if ESDGC is to become central to Welsh education, let alone to the lives of the people of Wales, much more needs to be done.

References

ACCAC, 2002, *Education for Sustainable Development and Global Citizenship*, ACCAC, Wales.

Cochran, K. F., King, R. A., & DeRuiter, J. A. 1991, *Pedagogical Content Knowledge: A Tentative Model for Teacher Preparation*. East Lansing, MI: National Center for Research on Teacher Learning. (ERIC Document Reproduction Service No. ED340683)

Cornelius, R 1996, *The Science of Emotion*, Prentice Hall, New Jersey

Bibbings, J. 2003, *Consumption in Wales: Encouraging the Sustainable Lifestyle*, Welsh Consumer Council, Cardiff

Flynn, A, & Morgan, K., 2004, "Governance and Sustainability" Thomas, M & Rhisiart, (Eds.)M 2004, *Sustainable Regions*, Aureus, Vale of Glamorgan

Heater, D. 2004, *Citizenship*, Manchester UP, Manchester

Peattie, K. 2004, "Building a Region's Sustainability Knowledge Base" Thomas, M & Rhisiart, (Eds.)M 2004, *Sustainable Regions*, Aureus, Vale of Glamorgan

Shulman, L. (1986) "Those who understand: Knowledge growth in teaching." *Educational Researcher*, **15** (2), 4-14.

Summers, M, Childs, A. & Corney, G., 2005, "Education for sustainable development in initial teacher training: issues for interdisciplinary collaboration." *Environmental Education Research* **11** (5), 623-647.

UN, *United Nations Decade of Education for Sustainable Development 2005-2014*, October 2004, Draft International Implementation Scheme.

Westen, D., 2007, *The Political Brain: The Role of Emotion in Deciding the Fate of the Nation*, Publicaffairs, New York.

<http://www.esdgc-wales.org.uk/>

www.estyn.gov.uk/press_releases/pr_Eng_ESDGC_report_from_Estyn_30_06_06.pdf

www.estyn.gov.uk/publications/Update_on_inspecting_education_for_sustainable_development_and_global_citizenship

Training key-people in sustainable development at post-graduate level: Complexity and resilience as basic principles

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Abstract

The environmental crisis and the economic and social imbalance represent a challenge and a commitment for the universities in their task to train key-people (planners, teachers, managers, decision-makers...) who are taking decisions in our societies about sustainable development, because they have the possibility to reorient the policies, projects and programs in an adequate direction.

The training of these political and social leaders is frequently carried out at a postgraduate level, with courses for Experts, Specialists and Masters, which are designed “ad hoc”. At our UNESCO Chair we have been training key-people, emphasizing sustainability, since 1990. In this period, we have learned that in order to achieve success in our programs it is especially appropriate to use two basic reference points within the teaching task: complexity and resilience.

To teach about complexity involves working on real environmental problems (rather than on academic subjects); to adopt a systemic approach; to emphasize the relations; to show the links between the whole and the parts, between the subject (or the object) and the environment... As for resilience, the capacity to change the challenges and crisis into opportunities, an appropriate training stimulates the participants’ anticipation mechanisms and their capacities and strengths rather than their weaknesses, contributing extraordinarily to the objectives of sustainability.

Keywords:

Environment, sustainable development, training, key-people, university, post-graduate programs, complexity, systems, resilience, ecological balance, equity, paradigm, modernity, science, integration, knowledge, transdisciplinarity.

Introduction

It is not easy to describe in a few words our environmental situation. Because the *environmental problems* that the planet is currently suffering have their origin in the activities of the human species, we must address not only the behaviour of our species within its habitat, but also *the thinking models that sustains it*. At the same time, not every person and human group contaminates or impacts in the same way, because they do not have access to the resources in an equivalent manner.

Together with the serious problems of the *natural environment* (air, water and soil pollution; growing deforestation and desertification; misuse of energy and water; increasing reduction of biodiversity and extinction of species...), our *social environment* equally shows the human irresponsibility and insolidarity of having created an uneven model of access to resources that has four fifths of humanity sunk in poverty.

Accordingly, governments, regional and local administrations, companies, and in general all the human groups with responsibilities in the management of the environment (obviously including the universities) should *advance towards ecological balance and social equity*. *But this progress is not*

only solved with efficiency criteria, (with corrections in the production and consumption systems that the Western world has spread throughout the whole planet...) No. We need a true transformation of such models, *a change that affects the “heart” of the system* and of the laws which, explicitly or implicitly, rule its performance.

Promoting this change is a task that has to be addressed by the universities, by fostering the postgraduate training of key-people that are right now acting as planners, managers, educators or decision-makers, as the changes in the mindsets and awareness of these professionals would, undoubtedly, have a *multiplying effect* as well as a quick and forceful influence on the world views and the models that guide the use of resources in all fields (Novo, 2006, a).

As for the training mechanisms that these groups require, two strategies whose effectiveness we have been able to verify throughout a training process of nearly two decades in our postgraduates courses should be emphasised: the first one, related to knowledge, consists in showing the complexity of the living world and teaching how to interpret it; the second one is of methodological order and it focuses on promoting the resilience of the people who learn.

Where we come from: the paradigm of Modernity

Where and how did the thinking models that have led us into the environmental crisis appear? At the risk of falling into simplification given the brevity of this chapter, we may say that one of its origins lies in the *Nature appropriation and exploitation model that was originated during Modernity in the Western world*, a model whose scientific and technological dimension, turned out to be capable of solving mechanical problems, but that has gone beyond its valid scope and has spread into an overarching explanatory view of the world.

This world view (based, among others, on the *ideas of order and hierarchy*, and on *forgetting the limits...*) turned out to be very functional for the interests of the liberal economy, with which it has been going hand in hand. Unfortunately, this view was based on an understanding of Nature that frequently *left aside the relationships, synergies and feedbacks which take place in the living world*.

These approaches have led to world view that shows Nature as a mere warehouse of resources (without limits and without its own history) and sees the human being as the owner and dominator of the natural resources, with no moral dimensions that might stop its plundering attitude.

Since the XVII century, the positivist-scientific paradigm, has unfolded with a *complete and exclusive pretension of rationality* that, in its excesses, has removed from our understanding of the world such important aspects of life as feelings and emotions, a model that, widening its area of influence to the social world, has made us accept a social order with different social classes where *economic segregation* is regarded as a mere reflection of the “natural order” (Toulmin, 1990).

From this point of view, mainstream technology becomes, in many cases, a dominating instrument, while some social groups –those that form the rich Northern part of the planet impose their economic and cultural rules on the others.

Sustainable development

The key idea that we humans have worked out to face this challenge is *sustainable development*. To mention this concept is somewhat easy, but to apply it is very difficult. Some governments, companies, administrations, and even many university programmes, too often forget that the sustainability challenge is not a mere technological one, or one to add new content to their teaching, but one that faces us with the need of a *radical change within the thinking models* to lead us into new ways of relating to nature and to new production and consumption models.

Quick, quick

We have gone too far. From 1750 until today, and especially since the second half of the 20th century, humanity has released more polluting agents into the atmosphere, seas, rivers, soils... than during the previous thousands of years since the beginnings of humankind. *We are inside a spinning wheel that turns with the slogan “quick, quick”,* and the only solution is that the Western countries review their models of life and stop the senseless race towards purely quantitative growth that countries with huge emergent economies, such as China, are pursuing.

When, in Rio '92, we worked on the concept of sustainable development, the main matter of our worries was how to adequately distribute resources, how to eliminate poverty. Nowadays, confronted with the evidence of a *climate change* that has started to arise, the problem of the rich and the poor, whilst still urgent, is encompassed by another one: *Will we survive as a species if we do not take a quick turn towards other ways of life?*

The paradigm shift

If the environmental crisis that the planet is undergoing nowadays is, mainly, the *historical result of three centuries of rule of the modern world view, of the way of understanding the world and one's place within it characteristic of industrialised societies,* then to step out of this crisis implies re-evaluating these assumptions, submitting them to criticism and bringing forth *a new explanatory paradigm that takes into account the complexity of the world.*

In this sense, a new way of perceiving the natural world and seeing ourselves, the human species, in it, is arising. There are already many intellectual, scientific and social forums supporting a vision based on *the inherent value of the living,* an intrinsic value unrelated to commercial estimates. A new type of relationship between human beings and Nature is also being accepted, more based on *symbiosis* than on domination, a model that takes into account the limits of Earth as a closed and finite system.

At the same time, the pressing problems of several billion people who live on the planet without real possibilities to reach natural, technological and social resources, are being regarded as a challenge that must be faced within the framework of *an equal and sustainable model.* From this new model emerge new and urgent challenges that touch the “heart” of our philosophical, economical and social system .

The scientific revolution and its proposals

These proposals for change have not emerged by chance. Fortunately, science has internal mechanisms that let it reshape and modify its paradigms. And the XX century has been a very interesting period which has seen the emergence of new theories (quantum physics, non-equilibrium and irreversible thermodynamics, theories of chaos and complexity) that form, as a whole, *a new paradigm accepting uncertainty and disorder as a source of order.* In the XX century we have seen a revolutionized science *that negotiates with chance and understands – starts to understand – its limits.*

During the last decades there have been many scientists of different disciplines whose thinking warns us about the need to understand Nature from a wide range of approaches (ecological, ethical, aesthetical...). The best example could be the words of David Bohm (1983) suggesting that Nature acts more as an artist than as an engineer... and thus requires a basically artistic attitude to be understood. The echo of these and other voices is already felt in many university scenarios, and in general in the *academic and intellectual world,* but it would be very interesting that this proposal of a possible and necessary integration between the scientific rationalism and intuition, aesthetics,

ethics and so on would reach those in charge of managing *resources*. Hence the importance of our training processes and the need that they influence decision-makers.

Towards a new episteme

I believe that this new paradigm should at least be based on the following *basic principles*:

The complexity of living systems (a network of relationships, synergies, feedbacks, not reducible to machines).

Integrating people and Nature.

Dialogue between reason and feelings, values and so on.

Relationships between the observer and the observed.

The relationships between the individual and his/her context.

The fact that scientific knowledge cannot be neutral.

To reconstruct this world view requires a dialogue, a meeting on equal grounds between researchers and people of other fields of knowledge (philosophers, historians, artists...), that promotes an integration of cold rationalism with the world of emotions, in order to reach *a reason informed by feelings* that helps to fully understand the Humanity-Nature relation and the bonds and moral links between human groups.

The importance of questions

The old and new paradigms give rise to different models of resource management. The first one has led us to a crisis and can lead us to the collapse of our societies; the second one guides us towards *sustainable development*, a model which takes into account the limits of the biosphere and the needs of future generations. But both have something in common: they essentially respond to a *system of questions* which is useful to reveal, because when a *paradigm shift* takes place what is basically transformed are not so much the answers but the *questions*.

Let us see some of them:

- a) In the world view based on productivity, the main concepts are the *control of Nature* and the search for *economic profit*. The main issue could be summed up in the question *How to make more money?*
- b) In the sustainable development model, the main concept is that of the *biological community*, understanding it as a community of interests whose final objective is to maintain life on earth. The main issue could be expressed like this: *How to live better in community together with Nature and all the other human beings?*

According to these statements, the questions of the first model, still valid today in neo-liberal economic globalisation, are mainly *technological* (how to make?), *economic* (how to increase the benefits?) and *political-anthropological* (how to control Nature and subject it to our needs/wishes?)

The sustainable development paradigm presents not only different questions, but also *questions of different types*, such as *ecological* questions (how to produce while being respectful with biodiversity and the dynamic balance of the ecosystems?), *ethical* questions (how to equitably share the benefits of development?) and *artistic* questions (how to imagine other ways of sustainable life?).

In this sense, as we see, sustainable development is neither a simple technological issue, nor a mere efficiency matter. It is a real *philosophy of life*, a challenge to our knowledge forcing us to modify our training systems, both in the contents and in the methods and values that we use while teaching.

A trans-disciplinary knowledge

It is therefore necessary that our university teaching, in order to really contribute to sustainable development, brings forth a change in models, and turns towards a new interpretation of reality in which *transdisciplinary approaches* are taken into account, integrating different scientific perspectives, values and cultural visions.

In these processes, *interdisciplinarity* is a shared working *process* about common information and languages that must lead, in their maturity, to *transdisciplinarity*. This arises as a *product* when this process takes place within a common framework of understanding, in such a way that a *meta-language* is reached joining theories and practices under the same *interpretative paradigm*.

The decision-makers environmental training:

The work of our UNESCO Chair on

Environmental Education and Sustainable Development.

With these assumptions it is urgent and necessary to develop the training of political and social leaders, of the key people in our societies who make decisions affecting Nature and the life of people. To train planners, teachers or managers is the function of the universities, through its Expert, Specialist and Masters courses.

The first difficulty found in the environmental training of these people is their lack of available time. We have solved this problem by designing *online courses* through which, by means of a *personalised tutorial activity*, the student has at home all the training instruments to be used at the time most convenient for him/her. This *flexibility of the model* has allowed us to successfully develop Master Programs for 17 years (since 1990) and to reach with them the following three types of objectives (Novo, 2006,a):

- *Human objectives* (focused on the personal and professional development of the students).
- *Strategic objectives* (in order to promote changes in society and in the models to use and manage resources).
- *Curricular objectives* (concerning the contents, methods and feedback mechanisms of the process itself).

The *multiplying effect* of these training programs has been immediate. As the new approaches reach the responsible people in the businesses and in the public administration, as well as teachers at different levels, the changes in their thinking models quickly influence how they manage the resources or how they teach. Thus a “*cascade effect*” is created, in which the diffusion of a new paradigm is introduced within the social fabric through new theoretical formulations but, especially, through practical experiences.

As I have already stated in more detail (Novo, 1998), *the advantages of this distance education model* are, among others:

- Training related to the student’s professional career as opposed to “confined” training.
- Flexible training as opposed to homogeneous groups.
- Flexibility with respect to students’ role.
- Flexibility with respect to trainers’ role.

- Flexibility with respect to communication channels.
- Lower administrative costs.

Education, systems and complexity

Concerning the educational contents, during these years we have learnt that it is essential *to promote a thinking from and about the complexity of the living systems*, which means, to start with, to adopt a systemic approach that helps the students to interpret the world in terms of relationships and not of isolated objects, showing the relationships between the different parts and the whole, such as those that take place between the individual (and the object) with the environment. This is how *the concept of system* (key word to interpret reality) becomes the *root to progress towards a complex thinking*.

The following step is to tackle complexity, which can be defined as *the approach that leads us to think jointly about the one and the whole*. An approach that at the same time means to integrate, conceptually and methodologically, *what is certain and uncertain...*, that sets forth the need of considering the notions of *order and disorder, of chance and necessity*, mutually antagonistic and complementary at the same time (Morin 1990).

We accept the idea that everything that has been said has been said by an observer, *somebody who, in the act of knowing, brings forth a world* (Maturana/Varela, 1990). This means that the processes which we guide towards sustainability, are always realities and events that lay within the sphere of description of an individual who, while observing or investigating them, *conditions, and sometimes even determines, the results of his observations*.

Having said the above on the complexity of the observer, we must address the complexity of the systems themselves that we study and develop. They are generally living systems that *exchange matter, energy and information with the outside world*.

As we know, such systems, in far-from-equilibrium situations have the capacity of using *self-organisation* mechanisms, a capacity related to the entrance of new information and to the complexity of the system itself. Prigogine (1983) called *dissipative structures* these forms of organisation that allow for the restructuring of the system.

In this process, when the different possible paths bifurcate, the system “chooses” one of them, and in such an “option” the system’s *emergences* (new qualities/properties) are involved. Thermodynamics explains these bifurcations in terms of *chance*, a creative chance which represents the innovative and revolutionary aspect of complex systems, and, particularly of living systems (Wagensberg, 1985). In the environment of social and human systems it is necessary to introduce the concept of *freedom*.

Thus, we find ourselves with a key idea in order to understand development processes, given that they are never linear: it is the idea of *non-equilibrium as a source of order*. This is often the path for the innovations and changes that are needed to transform established processes and to reorientate them towards sustainability. In this sense, *innovation is, in the end, a fluctuation which is accepted by the environment* (Prigogine, 1983).

Through these mechanisms, the social and human systems are able to open to the unknown, to establish a continuous self-production in which *order and disorder act jointly*, in a increase of complexity that multiplies the possibilities (Balandier, 1988). This idea is essential for those who work in the sustainable development field, as it implies that the sustainability processes will go through situations with more or less stability, in which *order and disorder must be contemplated as complementary elements, not antagonistic ones*.

The complexity of the living systems which are the object of the development processes is thus explained from the necessary *association of unity and diversity*. It is related to their capacity to self-organise to use the information they import and to face the risk that their opening to the environment entails.

These scientific considerations are in the background of our post-graduate training processes, which are oriented *to prepare social leaders for sustainable development*. When these decision-makers (people with management responsibilities, or teachers) understand these performing mechanisms of the living systems (physical and social), their interpretation of the world changes and it has a direct influence on the way they behave professionally. To leave aside the consideration of Nature as a machine and to start seeing it in its whole complexity is such an important change that it erases or softens any intention of continuing to apply the old paradigm. The same happens with the behaviour of societies.

The thinking model inherent to modern society essentially follows positivist thinking principles: disjunction, reduction and abstraction. To include other approaches requires an epistemological turn, without having to demolish everything previously built, *placing once again the viewpoints and methods of the old paradigm within their limited validity scope*. For example, analysis is necessary; but it wouldn't do to remain in the analysis of the parts without proceeding to the reconstruction of the whole, contemplating the relationships.

This does not require us to dismantle our educational systems overnight, but it does require us *not to confuse the divided and disciplinary knowledge with reality* and to establish *inter and transdisciplinary mechanisms* to share the findings that seem scattered.

However, the paradigm shift means, above all, that we should change the concepts of what education means and adopt other methods to practice it. For example, in our Masters Course *we work on real environmental problems instead of on academic subjects*, and we let the disciplinary knowledge appear as necessary to solve such problems. We also work in interdisciplinary groups, favouring the interactions between those who learn..., which requires us to start leaving aside the pre-eminence of the programmes and to *start discovering the value of the projects* (understanding a project as *the statement of a process* that is only partly foreseeable and that remains open...).

Complex thinking thus unfolds from different assumptions to those of the positivist thinking. Let us remember that *complex means "intertwined"*. Thus, complexity is that world view that allows us to *embrace in one gaze the individual and the multiple, the whole and the parts, the object with the environment and the subject...*, a way of seeing the world that is not only rational but that includes *a reason informed by ethics and feelings* (Novo, 2006).

In this way, complex knowledge allows us to advance towards *a knowledge that brings forth the capacity to know oneself*; a knowledge that does not pretend to impose order, but to *organise* (within the framework of the order/disorder/organization relationships); that does not manipulate but *communicates*; that does not direct but *encourages to go deeper into the adventure of knowledge*.

In this sense, it is very effective to work at *building stories*. This educational strategy allows us *to identify common elements in different phenomena*, thus allowing us *to build relationships, without needing to eliminate the differences*, as it frequently occurs in the conventional teaching models.

The stories allow us to relate the individuals and the objects to their contexts, even broadening the latter to observe the problems from more and different points of view. As Bateson reminded us, *two descriptions are better than one* (Lagos, 2004).

Finally, the education from and about complexity allows us to turn educational areas into environments where *"legitimate questions"* are brought forward (Von Foerster, 1987) That is, *questions whose answers are not constructed*, and where each person can choose the information and interpretative methods in such a way *that the results are not predictable*, they are open and may even be considered as the start of new questions. A model like this undoubtedly produces individuals who are much more creative and linked to the problems of their environment, capable of approaching scientific theories and recognising the provisional of the answers, the incompleteness of human knowledge and the links between knowledge, conscience and moral responsibility.

Building resilience and resilient people

Resilience is a *creative adaptation* shown in moments of crisis, when living systems are capable of facing difficulties, *even using in their advantage events and circumstances that were initially against them*. In nature we often find mechanisms like these, constantly operating to overcome crisis (for example, the mechanism of ecological succession that follows after some fires in the Mediterranean Area). Resilience is also applied to describe *the time that the system takes to recuperate its dynamic balance after the perturbation stops*, and in this sense, resilience is useful to evaluate the amount of perturbation that a determined system may resist (in order to get to know its “*resiliency threshold*”).

To be *resilient* means to have *anticipation capacity*, to *foresee the perturbations* and, when they arrive, to overcome them without losing our own identity, this is, *to stay changing*. The adaptative complex systems (like the human one) are resilient systems (Holling/Gunderson, 2002), *capable of learning and adapting themselves* and also *capable of innovating in their advantage* from the crisis.

The importance of resilience is that it *sets forth a radical turn in the way we normally work in education* (with so many methods and prescriptions concerning the “failure of students” at different levels...) and focuses on the *possibilities of success* that everyone has, even in difficult situations (Henderson/Milstein, 2003). If it is true that *everybody is excellent in something*, the function of educators is to discover such excellence and stimulate it within the framework of the reality of each individual, which is sometimes very hard. This is the direction in which education is moving.

To support it, education must, for a start, stimulate *two basic capacities*:

- The *anticipation* capacity, in order to foresee the threats and possible alterations which endanger one’s stability and security.
- The *capacity to change the environment (or to move into another environment)* in order to overcome the crises, often influenced or reinforced by the context.

The first of these capacities – *anticipation* – is essential to develop knowledge mechanisms and insight that allow foreseeing changes, aggressions, and the difficulties which may arise. The second one – *to change the context or to move into another context* – focuses on teaching criteria and strategies to obtain, whenever possible, positive changes in our life space, but it also focuses on preparing the students to understand in which moment (in which conditions and under which risks) they must assume a change of place.

Conclusion

The paradigm shift that our societies need to advance towards sustainability will be stimulated if, from the universities, we contribute to environmentally train the decision-makers, as it will generate a multiplying effect and an immediate application of knowledge which would be very beneficial for change.

To work in this direction requires implementing postgraduate courses that tackle the sustainability problem. In them, apart from other conceptual contents concerning development, it is essential to advance towards thinking models that face the complexity of the living world, and to do so favouring the resilience of those who learn, which would make them more creative and resistant in order to introduce the changes in society.

Concerning complexity, *this is a question, not an answer*. It is a thinking challenge and not a recipe for thinking. In its development, complex thinking tends to (Morin, 1990):

- Overcome the divorce between scientific and humanistic culture, establishing a necessary dialogue.
- Question the current disciplinary and partitioned organization of knowledge, trying to join what is divided.
- Face the challenges that complexity raises in every area, including the political one.
- Place the human world not as a separate sphere from the living world but as something that emerges from it.
- Question the possibilities and limits of human reason.
- Explore the continent which is less known of all: the human spirit which brings forth knowledge.

From the resilience perspective, education should be *more focused on the strong points of people instead of in their weaknesses*, that is, to analyse the individual and group possibilities and behaviours from the point of view of their *strength*. In our post-graduate courses we rely on two important ideas-strengths: the first one is that *crises are occasions for human growth*; the second one is that, as an old African proverb says: *every rain has its end*, which means that the aggression or disturbance factors will not always stay forever unchanged.

The issue is, therefore, *how to manage resilience*. There are many ways, but some are generally accepted because they have been shown to stimulate resilient behaviours: to support persistence and success of that which is small and decentralized...; to defend threatened values and beliefs...; to enhance values that do not lead to competitiveness but that make us more human..., and all this through certain *aims and strategies*, such as the following:

- Strengthening positive thinking.
- Stimulating personal autonomy.
- Focusing on the “strong points” of the students.
- Building relationships between learning and the real life of each participant.
- Favouring the awareness of limits
- Teaching how to value the present, taking into account the middle and long term.
- Offering always a successful perspective to individuals and groups.
- Introducing creative contexts to learners.
- Offering occasions for the students to participate actively.
- Supporting and caring about those who are learning, not only helping them but also asking for help when the conditions allow it.

In general, all these recommendations require a basic attitude from the teachers: *not to consider students as simple “users” of the system, but as differentiated individuals* to whom it is necessary to incentive. *Coherence* is also essential: coherence between the message and one’s personal capacity to assume it in daily life.

References

Balandier, G. (1988). *Le désordre*. Fayard, Paris.

Berman, M. (1981). *The Reenchantment of the World*. Cornell University Press. Ithaca.

Bohm, D. (1983). *Wholeness and The Implicate Order*. Routledge, London.

- Henderson, N. / Milstein, M. (2003). *Resiliency in Schools. Making it Happen for Students and Educators*. Corwin Press. California.
- Holling, C. H. / Gunderson L. H. (2002). *Panarch. Understanding Transformations in Human and Natural Systems*. Island Press. Washington.
- Lagos, G. (2004). “Gregory Bateson: un pensamiento (complejo) para pensar la complejidad. Un intento de lectura/escritura terapéutica. *Rev. Polis*. Nº 9. pp 353-372.
- Maturana, H. / Varela, J. (1990). *El árbol del conocimiento*. Debate. Madrid.
- Morin, E. en www.complexus.org
- Morin, E. (1990). *Science avec conscience*. Fayard. París.
- Novo, M. (1998). “Environmental Education at Distance: a Tool for Sustainable Development”, in LEAL FILHO, W. (Ed.). *Distance Education and Environmental Education*. Peter Lang. Frankfurt.
- Novo, M. (2006, a). “Research and Innovation on Sustainable Development from the Environmental Education Field”, in LEAL FILHO, W. (ed.) *Innovation, Education and Communication for Sustainable Development*. Peter Lang. Frankfurt.
- Novo, M. (2006, b). *El desarrollo sostenible. Su dimensión ambiental y educativa*. Pearson. Madrid.
- Prigogine, I. (1983). *¿Tan solo una ilusión? Una exploración del caos al orden*. Barcelona. Tusquets.
- Toulmin, S. (1990). *Cosmópolis: The Hidden Agenda of Modernity*. The University of Chicago Press. Chicago.
- Von Foerster, H. (1987). *Sistemi che osservano*. Astrolabio. Roma.

**S. E. M. E. P. - UNESCO secondary education project and network,
giving ideas for higher education for sustainable development**

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Abstract

A brief presentation of SEMEP-UNESCO secondary education project - network, its flexibility and extension to primary and pre-primary education and the changes in its goals, activities and methodology are mentioned. The shift from an environmental education project to a project related to the Decade of Education for Sustainable Development is discussed. Some activities related with water issues are briefly described. This paper, finally, attempts to propose the extension of some of the secondary education activities for the implementation of projects in tertiary education, aiming to education for sustainable development.

Keywords:

DESD project SEMEP-UNESCO, Water issues

Introduction: A brief presentation of SEMEP - UNESCO project and its evolution

SEMEP (South Eastern Mediterranean Environmental Project) was launched by UNESCO General Conference 1993, by means of a Draft Resolution initiated by Greece and supported by Cyprus, Egypt, Israel, Jordan, Lebanon, Syria and Turkey.

Albania, Bulgaria, Croatia, Cyprus, Egypt, Greece, Israel, Italy, Jordan, Malta, Palestinian Authority, Romania, Slovenia and Turkey are the participating member states. Over 350 schools, involving more than 1,000 teachers and several thousand school children and surrounding people participate in SEMEP.

SEMEP aims to create an educational, environmental and cultural network of communication and cooperation among students, teachers and the local community, which would promote the culture of peace and tolerance in the Eastern Mediterranean sub-region, which for thousands of years has been a crossroad for various civilizations. It endeavours to promote a consciousness in youths and school children of their common environmental, historical, geographical heritage in order to create lasting intellectual and sentimental bonds that can go a long way to defuse the tensions that lead to conflicts.

SEMEP began its implementation, in 1996, as an inter-disciplinary environmental education project that incorporated technological, economic, historical, ethical and cultural aspects. It combined interdisciplinary teaching approaches with holistic learning. It has also provided an opportunity to the participants to consider environmental issues that are of common concern to countries in the sub-region. It empowered citizens by promoting educational innovation in all aspects of education, including sustainable development, integrated and intercultural learning, materials development as well as capacity and awareness building.

SEMEP is coordinated by a general coordinator in UNESCO and a national coordinator in each participating country (nominated by the ministry of education). Once a year, a national coordinator's meeting is held for the evaluation of the last year of implementation and the planning of the activities for the next year. The project incorporates fixed activities while it gives the opportunity to the teachers to undertake initiatives and plan their own activities.

Communication between the participants (pupils and teachers) is taking place almost exclusively via e-mail. The working language is English.

SEMEP changes - Relation of SEMEP with the DESD activities

During the first period of its implementation (1996-1999), SEMEP was actually a science oriented project addressed to pupils and teachers of secondary education (mainly high secondary) and students of technical and vocational education schools. During that period the topics of each term were discussed during the annual NCs meeting and then Dr. Jack B. Holbrook, an expert on education from Cyprus and executive secretary of the International Council of Associations for Science Education, based on the decisions made, prepared detailed and structured worksheets for students, which were followed by teachers and students. Support documents for the worksheets and instructions for carrying out the investigations as well as national coordinators' and teachers' manuals were also prepared and distributed.

During the second period of its implementation (after 2000) the project kept on focusing mainly on secondary education level, but it was also extended to other levels of education (primary and kindergarten). Beyond environmental, technological, economic, historical, ethical and cultural aspects, its activities were extended to many other aspects based on human values, as well as issues concerning human rights and the culture of peace. It became a cross-sectoral project including key issues such as biodiversity, cultural diversity, technological diversity (and other "diversities"), energy, pollution, desertification, water, flora and fauna, etc. as well as health education, sustainable management of resources, sustainable consumption, sustainable tourism and, further more, the poverty, the human rights, mutual understanding, gender relations, socio-cultural heritage etc.

Aiming at giving more flexibility and creativity to the teachers and students, the topic of each scholastic year was discussed and decided during the annual NC meeting and only a frame of guidelines for the topic was written and distributed. The project was shifted into a teacher centered project rather than student centered, because teachers stay at schools while students are leaving it gradually.

As declared in the Draft Resolution submitted by Greece and adopted by the UNESCO General Conference 2005: "SEMEP is centred on science and environmental education, which are central to the international Decade on Education for Sustainable Development (DESD, 2005 - 2014), of which UNESCO is the leading agency in the UN system". SEMEP schools play a vital role in the implementation of various activities directly related to sustainable development in the Mediterranean region.

Past Achievements

- Creation of a network of SEMEP schools in each of the participating countries.
- Organisation of national and international summer schools for the training of the participating SEMEP teachers.
- Development of region-specific teaching learning materials for use in SEMEP schools, based on the common socio-cultural, historical, and environmental themes, such as: The sea and the shoreline; Water; Food and Diet; Biodiversity; Plants and Forests; Urban environment, etc.

- Organisation of national SEMEP campaigns in order to raise awareness in the general public on the activities of the project.
- Organisation of competitions on SEMEP themes as well as exhibitions to motivate the students, parents and teachers of the participating countries.
- Creation of a UNESCO SEMEP Web-page linking all the national SEMEP web-pages.
- Production of certificates, awards and flags for participating students, teachers and schools.

Future Action.

- Notwithstanding the title of the project, it is envisaged to extend it to countries of the neighbouring region (notably the Black Sea) many of whom have expressed interest in participating in the project.
- In order to develop the full potential of the project, it is necessary to count upon greater involvement of Ministries of education and environment of all the participating member states.
- Limited initially to the secondary school level, the project has already been expanded to primary and pre-primary level. It is planned to extend it to higher education and beyond in order to keep alive the involvement of the students in the principles and objectives of the project as adult citizens.
- The key to student participation being motivated teachers, the project must put greater emphasis on teacher training and teacher motivation if it is to have its full impact.
- Partnerships with the private sector must be actively sought in order to get the messages of the project across to the community at large.
- Networking with similar sub-regional projects (Baltic Sea Project, Blue Danube Project, The Caribbean Sea Project, etc.) is extremely important and must be amplified.

SEMEP themes so far:

“*The sea and us*”: The study of: (1) A beach area and the examination of various environmental factors affecting it, such as accessibility, facilities, use of the beach, maintenance and improvement of the beach, cleanliness (of the sea, of the land area and of the seabed) and attractiveness of this beach for its visitors. (2) A man-made structure on the seashore (port, marina, industry, hotel, aquiculture etc.) to study the benefit of the construction for the people (necessity for the area, increase of the employment, prosperity etc.) in relation to the environmental, social and aesthetic impact of it.

“*Water and life*”: This theme gives the opportunity to the pupils to estimate and calculate the water they use and, further, to study some environmental, scientific, sociological and political issues that arise from the extreme use of water. The theme is planned in order to help pupils study and learn about the way that human uses the water: home usage (water for drinking, for washing, for flushing the toilet etc.), water for irrigation and water for the industry.

“*Water in our environment*”: This theme provides the opportunity to study different types of ecosystems related to the water in our environment in relation to environmental, scientific, social and other factors. Sub-titles of the theme are: Sources of water; River water and its ecosystem; River estuary and its ecosystem; The sea and its ecosystem; Lake / Reservoir water and its ecosystem; The fresh water ecosystem and us; Ownership of the water in our environment; The ecosystems through the ages.

“*Go Green Quiz*”: The activities of this theme were planned to simplify the SEMEP worksheets for younger pupils as well as to make them more attractive for them. Pupils find answers to certain

questions and gather points. From the total points they have achieved they make a conclusion for the characterization of “How Green are they?”.

From that period and further on, no worksheets were prepared. Only guidelines for the each year’s topic were prepared and distributed. Teachers and students became freer to produce their own activities and implement their own ideas based only on a frame, decided during the national coordinators’ meeting.

“***Mediterranean environment & culture***”: Suggested subtitles are: Sea and civilization; Environment in ancient religion; Environment in literature; Environment in painting and sculpture; Environment, constructions and architecture; Environment in popular art; Environment and dancing.

“***Mediterranean Diet***”: Suggested subtitles are: Mediterranean food recipes; Mediterranean medicinal plants; Mediterranean, mythology and plants; Mediterranean, game and game animals; Mediterranean marine biodiversity and food; Farming around Mediterranean; Strangers in the Mediterranean; How much food we consume in one year; Food pyramid; Anecdotes on diet.

“***Water, the essence of life***”: Suggested subtitles are: Water as an architect of our planet Earth; Water and health; Water and diet; Water and sport; Water and law; Water and culture; Water and energy; Water and environment; How much water we consume?; Water and life.

“***Discover your city***”: Suggested activity titles are: Surveys to know your city; Statistics; Interviews; Catalogs; Collections; Maps; Utopias; Contests; Awards; Excursions; Historical and cultural study from a sustainable perspective; History writing (my family, my school, my habitat); Debates on sustainability at local level; Visual and auditory performances.

“***Discover Diversities***” would be the topic for the next scholastic year (2007-2008). With the term “diversities” we mean ecological, technological, cultural, ethological ... and other “diversities” related with the UN Decade on Education for Sustainable Development. Guidelines will be prepared and distributed to the schools by the end of August.

Some activities related with water issues

Aiming to give ideas of topics to be studied interdisciplinary and networking among students of higher education, I will briefly present some activities implemented during the study of the theme “Water, the essence of life” in primary and secondary education.

Water is absolutely decisive for human survival. Water demand increases rapidly as the population grows. This has caused government agencies to worry that a threatening water crisis waits just around the corner. On the other hand, important water reports claim that the water shortage occurs largely because of poor water allocation, wasteful use of the resource and the lack of adequate management action.

There is a water crisis today. But the crisis is not having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people and the environment suffer badly. The main purpose of these topics is to study the so called “water crisis” at local, regional and global levels in a comparative way.

The goal is not to make the pupils aware of the issue -although university students could become aware for it-, but to understand it within the life itself and to inspire the participants to change their life styles and behaviours.

How much water we consume?

- Forms and availability of water resources and their geographical distribution. Study of the amount of water and its consumption. Presenting findings by drawing maps, graphs, diagrams, etc.

- Study the reliability of the arguments claiming “wells running dry”, “water crisis”, “water wars”.
- Develop of a detailed average water consumption list and efforts to make meaningful groupings. Study the amount of water consumption, in household (including drinking water), in agriculture and in industry.

Water as an architect of our planet Earth.

- Study the effects that form landscape (erosion, sedimentation, weathering, etc.). Study how these effects shaped our mountains, plains, rivers, lakes, oceans and coasts.
- Study the evolutionary formation of a famous landform (canyon, cave, waterfall, peculiar landforms, etc.) and present the data collected.
- Investigate why some rivers are meandering?

Water and health.

- Study the interrelation between water and health through a historical perspective.
- Prepare a document on malaria and its effect on human culture.

Water and diet.

- Study the role of water on our diet.
- Prepare a booklet titled “The Story of Ice-cream”.

Water and sport.

- Study the relation between water and sport.
- List the world champions of water sports by years.
- Prepare a poster displaying the evolution of sail-boats.

Water and law.

- Study the regulations developed by ancient civilizations, such as Sumerians, Babylonians, Egyptians, Greeks, Romans, Byzantines, Ottomans, etc., to use water and water resources.
- Study the possessional situation of rivers flowing through many countries and the seas surrounded by many countries.
- Study the relation between ancient civilizations and water resources and its usage; study the traditional household use of water and water instruments in your country and in one of your neighbouring SEMEP countries. Study the water structures (aqueducts, dams, cisterns, wells, mills, etc.) in your country.

Water and energy.

- Study, describe and illustrate how water is used as a source of energy in the past and present. Make a model (maquette) of a typical water mill. Study the environmental impacts of thermoelectric power plants and compare it with other energy generating technologies.

Water and environment.

- Study the reasons and environmental consequences of drying a former wetland in your country.
- Study the wastewater treatment issue and its relation to environmental quality, where you are living.

- Study the reasons and harmful environmental impacts of water such as floods, landslides, erosion, etc.

Water and life.

- Study the origin of life on planet Earth.
- Study the transition from aquatic life into terrestrial life.
- Introduce an amphibian species of your country.
- Try to measure the evaporation rate of a plant.
- Investigate the water retaining mechanisms of drought resistance plant species.

Water studies.

- Develop a water collection project; measure the actual precipitation with a device developed by yourself; consider the whole surface area of your school (including, roofs, terraces and paved surfaces suitable for water collection) as water collection surface, plan a cistern large enough to collect the whole precipitation water and a network of a water collecting pipes; calculate the amount of water to be collected in one year time.
- Study the geometry of sediments. In each one of three PVC bottles, put up to 1/3 of their volume: sand into the first one, a mixture of sand and fine gravel (3-4 mm in diameter) into the second one, and a mixture of sand, fine gravel and loamy soil into the third one. Fill the bottles up to 2/3 of their volume with water (leaving the remaining 1/3 empty). Shake them about 10 minutes strongly and then put aside for observations. Make first observations 15 minutes later. The second 1 hour later, the third 3 hours later, the fourth 24 hours later and the last observation 5 days later. Each time put down the results of your observations on water and on materials settled at the bottom. Compare your observations with the orientation of gravels and sands of a beach or of a river bed. Summarize your findings and conclusions in a report supported by photos.
- Study the waters of different origin. Take four PVC bottles, fill the first one (2/3) with tap water, the second with the water taken from either a river or well, the third with sea water and the fourth with spring water. Put them all side by side in a shady place and observe regularly, every Monday and Friday for eight consecutive weeks. Evaluate your findings and write a report.
- River watch. Study a river close to your school from the spring (if possible) to the sea or lake it discharges. Try to discover the max. water level, the size and shape pattern of pebble-stones along the river bed, the velocity of the water flow (if applicable), the plants and animals in and around the river, the quality of water (if applicable), try to calculate the amount of sediments it carries to the sea or lake, etc.
- Develop original projects for saving or using water efficiently.
- Study the last 20 million years of Mediterranean.

Implementation of projects of education for sustainable development in the front of the teaching procedure in the university life and conclusions

In recent years environmental education and, nowadays, education for sustainable development have displayed a great potential to establish links between school and society. Not only by dealing with topics of growing importance in contemporary life, but also, because of the capacity of the interdisciplinary approach, related with them, which helps foster comprehension of the complex interactions between society and the environment.

Education for sustainable development aims to the promotion of education on the basis on a more viable human society and the integration of sustainable development in all educational levels. It uses all educational possibilities and training practices in order to make educated people acquire knowledge, skills and values for undertaking action for the establishment of a sustainable future. It could also help in the promotion of commitments for participation in social change through the development of competitions for responsible action, starting at the local level, with the possibility of bringing in the global dimension, which is becoming increasingly relevant to our lives. The emergence of such broader vision is supported when pupils focus on issues of immediate concern to their own lives and communities, because of the coincidence of individual and collective motives.

Taking advantage of the opportunity offered by the importance of water for sustainability and emphasizing holistic and interdisciplinary approaches for sustainable development, professors of higher education could collect topics from different science and technology disciplines as well as from the social sciences and organize them for planning and implementation of projects, concerning the effective use of water resources as well as the maintenance of aquatic ecosystems in a well-functioning society with healthy economy.

Such projects, implemented in secondary and primary education level has tended to make pupils concern about our environment. The author, believing in the power of education (formal -all levels-, non formal and informal) as a means of growing up of responsible citizens, would like to propose the establishment of projects for education for sustainable development, in the tertiary education level, aiming to increase students concern for a sustainable future of the environment.

In the implementation of the projects, some of the below principles, concerning environmental education and education for sustainable development, could be followed:

- Is constructivist and developmentally appropriate.
- Contains significant, inquiry-based, experiences for students.
- Gives opportunities to students to be trained in the scientific procedures and acquire substantial experiences in the natural and human impacted environments.
- Includes integrated and interdisciplinary activities that break down traditional boundaries between disciplines.
- Carries out community-based investigations as learning experiences that offer both minds-on and hands-on experiences.
- Has the local surroundings, natural and community, as the “venue” for connecting together the implemented pedagogies.

Some topics that students could deal with could be: the role of water in:

- Formation of the earth’s crust and the rock cycle (geology, ecology, physics, chemistry)
- Evolution of life on earth (evolutionary biology, ecology)
- Organisms and ecosystems (ecology, biology, anthropology)
- Influence of water in humanity (environmental science, history, law, water mechanics)
- Students should answer the questions:
- Do we use water sustainably? (without jeopardizing its use for future generations)
- Which is the value system of the society concerning the “property” of water? Is water a good whose ownership can be registered?

Conclusions

Sustainable is a development process that acknowledges the relationship between human needs and the natural environment and thus, satisfies one generation's needs without jeopardizing future generations (Rio 1992 World Summit, Agenda 21). It looks for ways of promoting new equilibria, new priorities and new options and possibilities, while maintaining harmony in all things (UNESCO).

Maintaining a sustainable present and future is a matter of culture connected with values that people cherish and with the ways in which they perceive their relationship with others. The overall goal of the UN Decade on Education for Sustainable Development (DESD) is to integrate the values inherent in sustainable development into all aspects of teaching and learning, in order to encourage changes in behavior that allow for a more sustainable and just society for all.

In a world where everyone has the opportunity to benefit from education and learn the values, behaviour and lifestyles required for a sustainable future, an increased quality of teaching and learning in all education levels as well as the facilitation of networking and interaction among students and teachers is important. Water usage, management of its resources and treatment of waste water could be used as "tools" for interdisciplinary teaching and learning as well as for networking among students.

References

Holbrook, J. (1996), "The sea and us. Worksheets for students, Support documents for the worksheets, Instructions for carrying out the investigations, National coordinators' manual, Teachers' manual". UNESCO, Paris

Holbrook, J. (1997), "Water and life. Worksheets for students, Support documents for the worksheets, Instructions for carrying out the investigations, National coordinators' manual, Teachers' manual". UNESCO, Paris

Holbrook, J. (1998), "Water in our environment. Worksheets for students, Support documents for the worksheets, Instructions for carrying out the investigations, National coordinators' manual, Teachers' manual". UNESCO, Paris

Piliouras P. and Orinos Th. (2004), "The water in our environment: An interdisciplinary approach for environmental education and education for sustainable development". ECER 2004, Rethymno Greece. Available: <http://www.eera.ac.uk/web/eng/all/annual/2004/index.html>

UNESCO (2005), Records of General Conference, 33 C/5, DR.32 (COM. II). UNESCO, Paris

Self-Evaluation as a tool in developing environmental responsibility

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Abstract

Environmental Education (EE) or Education for Sustainable Development (ESD) programmes frequently purport to help students develop attitudes and values that promote sustainable lifestyles. Nevertheless, the majority of assessment and evaluation practices associated with these programmes, while catering for knowledge content and skills, usually do not target the affective domain due to the use of traditional tools.

The Environmental Education Programme (EEP), offered by the University of Malta, was designed with the specific aim of providing an EE/ESD course (for student-teachers) that specifically targets the development of pro-environmental values. The course contained study units (spread over a period of three years) that fitted within the education *about/through/for* the environment paradigm, but the major effort was addressed towards the evaluation process.

Student-teachers were asked to keep journals in which they would reflect on their experience throughout the programme. Towards the end of the programme student-teachers shared their accumulated experiences and were asked to assess their own performance. Besides providing a documentation of the educational outcomes of the EEP, the paper provides critical insight into the student-teachers' reflections and provides suggestions for the development of similar programmes.

Keywords:

Education for sustainable development, environmental education, self evaluation, journal keeping, reflective writing.

Introduction

Two years into the UN Decade of Education for Sustainable Development educational institutions need to reflect on the mistakes and achievements of the past in order to avoid falling in the same pitfalls and ensure progress. The literature abounds with arguments justifying the shift towards Education for Sustainable Development because Environmental Education failed to deliver what it promised. Rather than engaging in endless semantic issues about the meaning of the terms, what needs to be asked is whether the implementation of environmental education failed because of the attachment educational institutions have with established ways of going about education (Leal Filho & Pace, 2006).

The important role that teacher education and universities have in preparing a cohort of individuals that have an environmental ethic, which is at the basis of a sustainable lifestyle, has been a recurrent theme in all major events related to environmental education (e.g. UNESCO, 1980; UNESCO-UNEP, 1988; Scoullou, 1998). The development of this ethic is dependent on transdisciplinarity, wide conceptualisations and a pedagogy that is primarily learner centred. Universities tend to be exactly the opposite: being more concerned with narrow monodisciplinary structures that promote the transmission of subject content. The development of an environmental ethic depends on whether "... *knowledge is interrelated to personal behaviour and social values, and if the learner*

experiences ethical demands in decision making” (Schleicher, 1996, p.32). The implication is that effective environmental education at universities is dependent on a change in praxis; and change is not always a welcomed alternative.

This appraisal of universities in relation to their commitment towards sustainable development is further elaborated by Moore (2005a) who identifies four barriers (disciplinary, competition, misdirected evaluation and unclear priorities) that university based environmental education programmes have to face. She also refers to corresponding pathways to change: i.e., research and teaching that is transdisciplinary; collaborative and transformative learning; participatory evaluation; and a vision of sustainability that is owned by all the administrative strata of university.

Whether we refer to it as environmental education or education for sustainable development, its objectives (see UNESCO, 1980; UNESCO, 2005) are multifaceted and complex. Achieving them necessitates the employment of diverse and integrated subject matter, diverse learning settings and a varied pedagogy that promotes participatory learning and higher-order thinking skills (Tal, 2005). Educational institutions, particularly higher education institutions, need to create, what Moore (2005b) calls, *space for pedagogical transformation* that supports transformative and transdisciplinary learning. She goes on to highlight that this is not just physical space, but also time for learners to engage in reflection, dialogue and action. These transformative pedagogies transform learners (and therefore classes and learning communities) into inquisitive, reflective, experienced and critical thinking individuals – the basic unit of a sustainable society.

Transformative pedagogies require an assessment programme that goes beyond traditional formats and addresses the various educational needs of the learner at the cognitive, psychomotor and affective levels (Tal, 2005). These assessment techniques (such as self-assessment, peer assessment, portfolios, reflective journals) support and promote learning and are gradually making their appearance in higher education courses. These new models of assessment focus on “*assessment for learning*” where the focus and first priority is to promote students’ learning (Black *et al.*, 2003, p.2). Assessment for learning however involves the learning of new skills and roles by both University lecturers and students in order to develop what Buhagiar (2007) calls ‘*communities of shared practice*’. Rather than nurturing pecking order of the traditional classroom setting, these collaborative communities are dependent on structures that promote dialogue in which teachers and students feel free and safe to share and critique each others’ thinking.

As stated by Black *et al* (2003), “*an assessment activity can only help learning if it provides information to be used as feedback by teachers and by their students in assessing themselves and each other to modify the teaching and learning activities in which they are engaged*” (p. 2). In practice at University level this relationship between learning and assessment is “*not adequately translated into working guidelines*” (Tal, 2005, p. 595). The absorption of such assessments within courses at higher education is still very slow mainly because such assessment practices are still looked upon as being a waste of ‘precious’ time.

This paper documents, primarily from the learner’s perspective, the educational outcomes of the Environmental Education Programme (EEP) at the University of Malta. In its design, care was taken to relate assessment procedures with the learning experiences to create a symbiotic association between them in which one supports the other. Although a mix of traditional assessment methods and innovative ones was used throughout the programme, this paper specifically focuses on the course evaluation from the student-teachers’ viewpoint and their self-evaluation. Moreover, it also proposes the lessons learned from this experience that might provide important insights for educators who wish to embark on a similar programme.

The programme

Set up in 1978, the Faculty of Education (University of Malta) is the major teacher education institution in the country. Although it has taken on a variety of roles linked to a wider conception of education and training, its main focus remains pre-service teacher education. Indeed, the largest proportion of Faculty students follow either the B.Ed.(Hons.) programme (a four-year undergraduate course preparing student-teachers either for primary education or for secondary education) or the Post Graduate Certificate of Education (PGCE) (a one-year course in secondary education for graduate students).

The EEP was designed by a team of three environmental educators from the Centre for Environmental Education & Research (CEER) of which I was a member. We wanted to provide prospective primary school teachers with the opportunity to specialise in environmental education as part of their initial teacher education programme. Enrolment in the EEP was on a voluntary basis following an information meeting for all 1st year primary track students about the available specialisation areas that they could opt for in the subsequent years. The PowerPoint presentation introducing the EEP described the programme as a personal journey and, after highlighting the cross-curricular nature of environmental education, it outlined the content of the study units. A total of 22 student-teachers (31%) – 21 females and 1 male – registered for the course from a total of 72 students following the primary education track.

We always presented the EEP as a learner's "*personal journey of awareness, understanding, concern and commitment to action*" and conscious efforts were made to present the course content as an integrated whole rather than a set of standalone units. Spread over three years, the programme was structured as shown in Table I. As is evident from the objectives of the course (see Box I), our main concern was developing the learners' (i.e. the student-teachers) competencies needed to become independent environmental educators. The course contained study units that fitted within the education *about/through/for* the environment paradigm. Besides providing the necessary content knowledge, the programme design ensured the provision of first hand experiences and opportunities for reflection on personal environmental attitudes and values. In this way we sought to maintain a balance between these three components, rather than falling into the trap of placing a heavier emphasis on the *about* component as is the praxis in traditional courses (Pace, 1997a).

Table I: Summary of the EEP course structure

Year	Title of Study Unit	Value	Brief Description	Assessment Programme (I = Individual work, P = Pair work, G = Group work)
2	Education <i>about</i> the environment I	4 ECTS*	The initial part of this study unit helps students identify the main trends and challenges that environmental education poses on educational systems and what curricular structures are needed to effectively integrate environmental education principles in the formal education sector. The rest of the unit starts to familiarise students with the main local environmental issues framed within a global perspective. During the initial year, students will focus on issues related to water.	<ul style="list-style-type: none"> • Audit of primary curriculum to identify opportunities for environmental education (P) • Dossier compilation about a specific environmental issue related to water (P)
3	Education <i>about</i> the environment II	4 ECTS	This study unit is a continuation of the previous one and explores issues related to land and air.	<ul style="list-style-type: none"> • Dossier compilation about a specific environmental issue related to land or air (P)
	Education <i>through</i> the environment	4 ECTS	The study unit starts off with a firsthand practice-based look at whole school approaches to environmental education. The study unit then extends the students' focus onto the surrounding community. Students carry out an environmental education audit of a particular community.	<ul style="list-style-type: none"> • Report based on interviews with pupils and teachers about their experiences of EkoSkola (I) • Design and production of teaching resources for an environmental education walk in a locality (G)

Keeping of journal for personal reflections about the experiences of the programme (I)

* ECTS - European Credit Transfer and Accumulation System

Box I: The EEP course objectives

By the end of the programme students should ...

- understand the concept of the environment and the principle of sustainability
- explore the role of humans in the environment
- become familiar with the main environmental issues of the Maltese islands
- become familiar with the global environment / development issues
- use the principles of sustainability to critically analyse their lifestyle
- examine and clarify their attitudes and values regarding environmental issues
- become aware of the impact of environmental education on the educational system
- develop skills in the organisation of environmental education initiatives
- critically analyse environmental education programmes and initiatives
- develop action-oriented skills required to promote a sustainable society

Consequently, as course co-ordinator, I issued guidelines for lecturers involved in the programme asking them to adopt participative methodologies ensuring that the students were actively involved in their learning. During face-to-face meetings with the lecturers, I discussed the possible assessment procedures to be adopted to ensure the monitoring/evaluation of the students' development of their cognitive, psychomotor and affective abilities through a variety of tasks that have different attainment foci (see Table I).

The Research Methodology

In certain educational courses, learners are presented with facts to be memorized and their success is judged by how many of these facts they manage to regurgitate in examinations and tests. EEP's aim to develop independent critical learners did not fit with this genre of courses. EEP needed a structure that would provide learners with the time to assimilate what was presented: i.e. time to explore and analyse information from different perspectives; relate knowledge to personal and past experience; value its relevance and internalize it.

Reflective writing is one of the tools that help individuals go through this effective learning process preparing them for reflective practice (Pollard, 2005). Teachers' knowledge emerges from experience and practice, i.e., *personal practical knowledge* (Connelly & Clandinin, 1988). Teachers' reflective writings are identified as an essential component of this knowledge and journals are one of the tools that can be used by teachers to come to understand and communicate what they know in a variety of ways (Cole & Knowles, 2000). So the students of the EEP were asked to keep a reflective journal throughout the programme in which they could both evaluate the individual study units and reflect on the impact the course was having on their personal development.

Nevertheless, reflective writing does not come naturally and students need help to understand the purpose of the process as well as how to go about it (Moon, 2004). For this reason a session was dedicated, at the very start of the programme, to prepare students for reflective writing. During this session students were introduced to the aims of the reflective journal and how it fits with the general objectives of the programme. Students were also shown examples of 'typical' journal entries and

helped to discern the difference between descriptive and reflective writing. Although free writing, as opposed to presenting specific topics for reflection was adopted, some sample questions and suggestions for reflection were provided to assist in the initial phases. I made it very clear that these were given as guidelines and that students were free to adopt any questions/topic they wanted. Due to their personal nature, the journals were never collected; however students could discuss their entries as well as clear out difficulties about keeping the journal with me throughout the course during tutorial sessions.

In this research I wanted to explore and give voice to the student-teachers' beliefs and points of view about their practice. I had to use qualitative research data consisting mainly of the personal, and hence very subjective, reflections of students contained in these journals. However, to respect the confidentiality of the journal entries, I made use of data gathered from the following multiple sources:

- a) four evaluation questionnaires given after every study unit in the programme asking students to comment on the quality, presentation techniques, follow-up, and the theory/practice balance of the sessions. An average of 9 students submitted each of these questionnaires.
- b) a reflective questionnaire whose open-ended questions asked students to make use of their journal entries to comment on their experiences before and during the course, their plans for the future and a self-evaluation of their performance. The questionnaire was given a week before the half-day seminar organised as the concluding activity of the EEP. All 22 students filled in this questionnaire.
- c) audio recording of a focus group interview (with 7 students) during the EEP concluding seminar that explored various aspects of the reflective questionnaire in detail.
- d) audio recordings of one-to-one interviews held towards the end of the final academic year with 5 individual students, who besides following the course, decided to do their dissertation project on environmental education.

Since the data emerges from the personal knowledge of the student-teachers, I obtained the information required from questionnaires and different forms of interviews so as to validate the data and ensure that it was trustworthy. This triangulation (Hammersly & Atkinson, 1990) of data ensured that I obtained a more holistic, more entwined and more interrelated representation of the data.

Through the questionnaires I wanted to obtain a general overview of the student-teachers' writings and through the interviews I wanted to get a more in depth view of the student-teachers' experiences and "*the meaning they made of that experience*" (Seidman, 1991, p.3). I also chose to use both focus group interviews and one-to-one interviews to ensure that a discussion was raised among the participants and at the same time get a more in depth view of individual student's thinking and feelings. Since I knew all of the students the relationship which developed among us was one of trust and the students felt free to say anything they liked. I was open and honest about what I was doing and ensured them that all data would be confidential and that I would do nothing to expose or harm them (Fontana & Frey, 1994).

One of the major difficulties with reflective journal writing is deciding whether writing is reflective or not. As this was not however important for the main aims of the study, even writing by student-teachers, which was purely descriptive and contained no critical analysis, was considered important and included in the analysis. The data was analysed by a reading and re-reading of the reflective journals of the students during which I searched for patterns and connections and developed categories and themes (Seidman, 1991). These categories and themes were used to build the conceptual scheme of the paper.

The Results

(a) Before the programme

Before commencing the programme, the vast majority of the students (20 out of 21) perceived environmental education as another subject primarily concerned with teaching about environmental facts

“... my idea was that environmental education was similar to environmental studies but I didn’t realise there was an important difference in the course name which I did not give too much attention to when I heard about it for the first time.”

(Josette)

There were some (3) who even thought that the faculty was preparing them for a new subject that would be introduced in the primary school curriculum.

“Since the primary sector is the only sector that does not have a subject specifically dedicated to the environment, I thought that the Education Division had plans to introduce it and that it had asked the Faculty of Education to start preparing teachers for it.”

(Lillian)

As it was offered by the Faculty of Education, students expected that the environmental knowledge provided by the EEP would not just provide facts but also possible actions that could be taken to address the issues studied. Consequently they thought that throughout the course they would be provided with skills and resources that they could use in their teaching and (in one case) to influence the whole school.

“I thought that it is very similar to Environmental Science but that it would include skills and handouts that I could use in my teaching practice ... and eventually in class.”

(Tony)

“I expected that we would be given something like we had at post secondary level ... but we would be trained to move towards making schools environmentally friendly.”

(Rose)

Only one student introduced the personal dimension in her perception of environmental education.

“I thought that environmental education apart from giving you more knowledge about important aspects of life as a human, it also makes you more responsible.”

(Kylie)

Keeping in mind the students’ perception about environmental education, not surprisingly many of them (14) cited their previous experiences of “*similar subjects*” as the main reason for choosing this specialisation. They said that these subjects (Biology, Geography and Environmental Studies at secondary level and Biology, Environmental Science and Systems of Knowledge at post-secondary level) provided them with the required background they could build on.

“Having come from a background of sciences in the ordinary level, I further pursued this by opting for Environmental Science at intermediate level. Studying this subject was something which I really enjoyed. Thus when Environmental Education was proposed as an area of specialisation I was thrilled and immediately sought out to further explore it.”

(Jane)

From the responses given by this cohort of 14 students, it is evident that while 9 students perceived their educational background as an opportunity to do better academically, the other 5 interpreted this ‘advantage’ as an adequate foundation to learn more about environmental issues and hence be in a better position to teach children about them.

“... because amongst the options we were given, it was the one which I had some background about and knew I could do better.”

¹ Unless otherwise stated all student quotes are taken from responses to the Reflective Questionnaire. This choice was made because all students responded to this questionnaire.

(Joanne)

“I wanted to learn more about the subject in order to be able to teach it.”

(Greta)

Three other students attributed their personal interest in environmental issues as the main reason for them to choose the specialisation.

“Being environmentally friendly has always been a priority in my life’s agenda. I thought that choosing EE as my area of specialisation will help me grow in this aspect and give me an opportunity to pass it over to my students.”

(Lillian)

Good marketing strategies tend to give good results. The same seems to have occurred with the EEP. Seven (7) students attributed the reason for their selection to the way the course was presented during the information meeting about the available specialisation options. The course came across as something interesting, well planned and challenging.

“The programme’s overview struck me with its differentiated content. Unlike the other options presented, it sounded different and interesting.”

(Sarah)

“I chose EE during the initial meeting where we were given a brief description on what each specialisation consisted of. I was immediately interested. This is due to the fact that it was presented as a forward looking programme, as an area where much more can be done and we can help make a difference.”

(Debbie)

When asked about what they expected to achieve through the EEP, all of the students (22) made it quite clear that they expected the course to prove useful for their future career as teachers. In other words, their main expectation was that going through the course would make them better teachers at dealing with environmental issues. The majority (16) felt that something needed to be done to ensure that the environmental education given in schools is based on professional decisions rather than sporadic initiatives that fail to develop environmental responsibility in students. Students expected the EEP to provide them with this professional preparation.

“Unfortunately, so much talk is done but action does not always follow so quickly. I think that that was something I was looking forward to learn: to be able to do something with the children, to help them understand the need to take care of their environment and try to help them become more caring about their environment.”

(Marilyn)

Others (5) expected the EEP to consolidate and build upon their personal environmental ethic. They felt that without a personal disposition towards environmental education a teacher cannot be effective in class and help children to become environmentally responsible.

“I expect ... to learn how to achieve a more sustainable way of living and thus to reflect upon my own behaviour vis-à-vis the environment ... to change my own actions and reflect on sustainable practices in the course of preparing to teach children.”

(Maria)

Rebecca extended this concept further and expects the EEP to be instrumental in making her a resource person in environmental education for the school she will be teaching in.

“The ability to be able to organise environmental education activities for the whole school, once I’m assigned to one.”

(Rebecca)

This section of the reflective questionnaire clearly showed that these students, although having notions of environmental education that might conflict with the models described in the literature, have aspirations and expectations that are in line with the general targets of environmental education (UNESCO, 1980) and education for sustainable development (UNESCO, 2005).

(b) During the programme

One of the questions of the Reflective Questionnaire asked students to judge how much they learned from the EEP. They were asked to score their level of learning on a 6-point Likert scale ranging from Learned a Lot (6) to Learned Nothing (1) and to provide a reason for their choice. The scores obtained were mainly distributed around scores 6 and 5 (6 and 12 respectively), showing that the majority of the students felt that they have learned from the programme. Several reasons were given to substantiate this claim, but the most common response (17 out of 22) was that through the EEP's content/practice mix, they learned a lot about local environmental issues and the situation of environmental education in Malta.

"I learned about different subjects such as the earth and different effects that are caused by humans. Then the theory learnt was put into practice by on-site visits and the EkoSkola visits."

(Rose)

Other students (9) remarked that they developed a holistic view of the environment and consequently of environmental education that widened their perspectives on a conceptual level:

"I learnt that the environment is a system of interrelationships. Just as we individuals need each other to live ... our environment operates in the same way in a system of interrelated parts that work together."

(Rebecca)

"I think that one of the most important things that I learnt was to open up my mind to new ideas and points of view. Before the course, my view of the environment was still a bit restricted. ... these study units have developed my way of thinking and made me more active and practical. While before I used to look around and see nothing worthwhile, now I am able to see endless opportunities for learning and things I can use to educate the children. ... Something else which I feel that I have learnt during the course was to look at issues from different point of views, social, political and economic, and to try to analyse all the information and data available to form my opinions."

(Marilyn)

Others commented that this widened view helped them conceive environmental education as a cross-curricular theme and influenced their professional practice.

"I have learnt how I can integrate environmental education through all the main topics in the syllabus. In fact I came to realise that environmental education can be a great help to children in order to understand some concepts. I also got to know how environmental education can make teaching so practical."

(Emily)

The issue of innovating classroom practice through environmental education was specifically highlighted by other students (6) who felt that what they learned had empowered them and will in turn empower their students.

"I learned to cut down on classroom preaching and move on to actively involving my students ... environmental efforts will only succeed if environmental education is targeted at the community's grassroots level, i.e. from primary school onwards. ... They can learn strategies to extend their personal appreciation to a responsibility at work and in the political spectrum."

(Maria)

A major contributing factor that seems to have left a marked impression on the student-teachers was the infusion of environmental education principles in the way the EEP lectures were taught.

"I can honestly say that (unlike other study units) throughout the EEP, lecturers practiced what they preached. ... They not only TOLD us how to do it ... (but) they showed us how by the way they taught and related with us."

(Lillian)

On the other hand, two students scored 3 on the 6-point Likert scale showing that they did not see themselves as having learned much from the EEP. They cite two major reasons for their assessment:

(i) the theory/practice balance of the EEP was not kept, and (ii) practical activities in schools showed the implementation problems environmental education faces in certain schools.

“... lectures were given at two extremes: either too theoretical or with no basic theories at all. I did not comprehend everything on the theoretical aspect since terms used were too difficult. I did not find the part which was non-theoretical useful as it was completely unstructured.”

(Joanne)

“The visit to the EkoSkola school involved a lot of work that proved futile. This shows the difficulty of schools to include environmental education.”

(Rita)

Considering the students' evident preoccupation with experiencing first-hand environmental education implementation in schools, when asked which sections of the EEP they found most relevant to their professional and personal needs, not surprisingly the majority (16) opted for the sections having a strong practical dimension: (i) the EkoSkola programme experience: providing students with an example of a whole school approach to environmental education, and (ii) the evaluation of the environmental education potential of community resources.

“These sections were most relevant to my professional needs because they had us indulge in activities and assignments which were concrete and which we could make good use of with the children in class. Personally I enjoy practical activities because I can see what we talked about coming to life and when one sees it happen right in front of his eyes one tends to believe more in the power of change and starts believing that there is a good possibility of materialising what we talked about.”

(Josette)

Some students (7) said that it was not easy to comment on the sections separately and remarked positively on the complementary nature of the sections.

“I feel that the four sections cannot be reflected upon independently. Each had some kind of impact on me to some extent. ... They built on one another and each contributed in its own way to extending my awareness of environmental education.”

(Connie)

Although in some way or another almost all students commented on the impact the EEP had on their value framework, five students explicitly identified the section dedicated to the analysis of personal attitudes and values as being the most relevant.

“This was the most relevant section because EE has to do with changing your lifestyle and with being a model for students and others.”

(Denise)

“In a way all sections were relevant but the section about values was very useful as it helped me relate environmental issues with me and my choices. I think that all people should be exposed to a similar study unit.”

(Claire)

Students were also asked to judge how much the EEP helped them change their perception of environmental education. They were asked to score their response on a 6-point Likert scale ranging from Changed a Lot (6) to Changed Nothing (1) and to provide a reason for their choice. The scores obtained were mainly distributed around scores 6, 5 and 4 (5, 9 and 6 respectively), showing that the majority of the students felt that the EEP changed – to some degree – their perception of environmental education. In the reasons given for this choice there is a marked departure from the group's initial 'definition' of environmental education (i.e. related to content knowledge about environmental topics).

The two most common reasons cited were: (i) the widening of their perception of the environment and consequently of environmental education (11 students), and (ii) the consciousness of their impact on and role in the environment (6 students).

“I have come to view environmental education as a much larger discipline than I had first envisioned; one which encircles not just natural aspects but also social, economic, cultural and

political aspects. So to tackle it in an effective way it should not be tackled as a standalone subject but incorporated in the everyday life of the school as well as the classroom.”

(Maria)

“I am much more aware of how my actions, no matter how small, can have an impact on the environment. This has made me think about my responsibility to do something tangible with my lifestyle ... although it is rather difficult.”

(Greta)

Other students (3) commented that although they had been convinced of the importance of environmental education before starting this programme, the EEP intensified this notion.

“Made me more aware about the need for EE in classrooms. Children are not being given enough of it and therefore are being deprived from important aspects of their life.”

(Kylie)

Students were also asked to identify deficiencies in the learning programme of the EEP, i.e. what they needed to and/or expected to learn that was not addressed in the programme. Three students clearly pointed out that their expectations were fully met by the EEP.

“What one learns is never enough, however I can confidently say that I learned more than I expected to learn at the beginning of the EEP. In fact I am very grateful to have chosen EE as my area of specialisation.”

(Lillian)

The most common response (14 students) was focused on the need for the EEP to give more emphasis on specific ideas for lesson plans and the provision of resources that they could use directly in class. Students felt that at times they needed more guidance on how to apply what they were learning to the level of the children they would be teaching.

“The programme could do with more direct references to the classroom context, referring to the way we should deliver the content in terms of practical activities which are suitable for primary school children. I would like to have enough simple information about environmental issues that could be presented to children. I don’t think I am able to simplify the material that we were given.”

(Angela)

The majority of these comments referred particularly to the content oriented study units. Although for some students (4) the material covered during these units was a repetition of their post-secondary level Environmental Science lessons, the rest found these units difficult to understand. As evidenced in the responses given in the study units evaluation questionnaires, these units were good for personal knowledge, but left the students bewildered as to what was relevant to schoolchildren. Moreover, it appears that too much information was presented at one go and there were times when the information imparted was too technical. Students commented that the redeeming factor was that these units were coupled with fieldwork sessions that managed to relate theoretical knowledge to reality.

On the other hand, a small group of students (3) felt that, in their journey to become independent learners, there comes a time when they will be expected to take the helm and make their own choices about subject matter and pedagogical options. They felt that the EEP made them realise this commitment.

“At first I thought that I needed some guidelines and objectives along which I could organise lesson plans for the class when I’m a teacher myself. I would have appreciated more tips on how to use the information and adapt it for the children, but now I realise that it can be done by me.”

(Josette)

The other responses did not specifically mention any particular ingredient that was absent from the course. Their comments were mostly directed towards the emphasis made on certain aspects of the programme. Four students preferred more exposure to first-hand experiences in the field reiterating what the students had remarked in the study units evaluation questionnaires.

“What I strongly suggest is improving the on-site visits – like visiting a valley to see the human impact on the environment. Going to different and opposing sites to give concrete examples how humans have improved or marred the environment.”

(Connie)

“I feel that although we had quite a number of lectures and hands-on activities with children I still feel that this was not enough. I thought that we were going to have a longer period on-task training since the (EkoSkola) programme in schools is ongoing and once I got the grip of the procedures of EkoSkola it was time to continue with our usual lectures.”

(Martha)

One student referred to the methodology adopted by the lecturers and suggested:

“Something I wish could have been done during the course was to have more group work and discussions. I do realise that there were occasions when we were asked to contribute our opinions about certain topics and subjects, but I think that it is not something that we were used to doing at university. Maybe, by organising workshops and more group work sessions, we would have been able to discuss issues together as a whole group. I think that this would have been beneficial in itself since it would have allowed us to share our ideas and opinions with each other, thus allowing us to learn from our own course mates.”

(Marilyn)

This issue had surfaced in the study units evaluation questionnaires and was followed up in the focus group interview. I pointed out that several EEP lecturers had told me that their continuous prompting of students to participate in discussions and to voice opinions was met by a general apprehension. Attempts to start a class discussion usually ended up in a ‘private’ conversation between the lecturer and a handful of ‘bolder’ students, with the rest of the class being passive bystanders. Students confirmed that this attitude was due to them *“feeling too self-conscious and afraid to make mistakes ... all the more reason why lecturers should avoid relenting from adopting this methodology”* (Amy - focus group interview).

(c) Following the programme

Students were also asked to judge the extent to which the EEP influenced their teaching on a 6-point Likert scale ranging from Influenced a Lot (6) to Not Influenced at all (1) and to provide a reason for their choice. The scores obtained were mainly distributed around scores 6 and 5 (7 and 12 respectively), showing that the majority of the students felt that the EEP influenced their teaching.

The vast majority of the students (18) reported that since they had started the EEP they started planning their lessons differently by looking for opportunities of infusing environmental education within the curriculum and/or in the interactive methodology adopted in class. The EEP helped them in building up their confidence and they now feel capable of engaging students in environmental issues.

“Although I have always been environmentally concerned in my teaching, the EEP led me to plan lessons and practice values promoted by EE such as leaving the room for children to share the decision-making process with the teacher and amongst others.”

(Lillian)

“The EEP has influenced a lot my approach to teaching because it made me realise that basically ‘good environmental education is ultimately a good education’. The EEP made me further aware that education does not simply involve teaching children to read and write. ... I should strive to stimulate and develop the pupils’ problem solving skills and provide them with what they need to be able to make responsible choices for a more sustainable life.”

(Debbie)

While all the other students seemed to be very positive and motivated about the influence the EEP had on their teaching, Rita was still overwhelmed by the implementation problems that environmental education has to face. Scoring 3 on the 6-point Likert scale, she commented thus:

“I would have ticked 6 but due to syllabus restraints I cannot say that I would manage to include environmental education as much as I desire.”

(Rita)

When asked whether they intend to pursue environmental education in their teaching career, all the students said that they would. Six students commented that they will do this by putting into practice what was learned in the EEP and hence improve their teaching.

“I plan to draw up a set of cross-curricular lesson plans for my students based on ideas and themes I learnt from the EEP.”

(Rose)

The plans of another eight students went beyond the classroom. They are planning to become resource persons in their school for environmental education. Some even wish to become peripatetic teachers whose task would be that of infusing environmental education in schools.

“I intend to take the initiative in the school I am assigned in, to organise activities and discussions about environmental issues. I will try to encourage other teachers to join in and enter our school in the EkoSkola project. I believe that I can be useful in helping the school adopt a whole school approach.”

(Rebecca)

“I would like to be a peripatetic teacher to be able to promote environmental education in our primary schools. In the future I also dream of co-ordinating some kind of programme for students and teachers.”

(Connie)

Three other students wish to go beyond schooling and see environmental education as an instrument of change in the community.

“I want to play a part in causing environmental awareness and moving tomorrow’s adults toward more sustainable living practices. I hope to do this through education, activist work, lobbying and other ways in order to make a constructive change.”

(Maria)

Almost half of the group (10) clearly highlighted their intention of furthering their specialisation by reading for a Masters degree in environmental education, particularly after settling in their teaching.

“I wish to pursue EE further, but I am still not aware of the opportunities that exist in this area. I would love to carry out a masters in the subject, but first I prefer to get some classroom experience.”

(Sarah)

(d) Self-evaluation

This section of the reflective questionnaire was aimed to help students to self-evaluate and consequently grade their efforts in the EEP. The purpose of using self-assessment with the student-teachers was to enhance their learning and enable them to make value judgements about their own learning. Self assessment was seen as a tool allowing students to become more responsible and more involved in their own learning (Weeden *et al.*, 2002). However, students find it very difficult to assess themselves especially if they do not have a clear picture of the targets their learning is meant to achieve and hence need more guidance to go about it (Black & Wiliam, 1998).

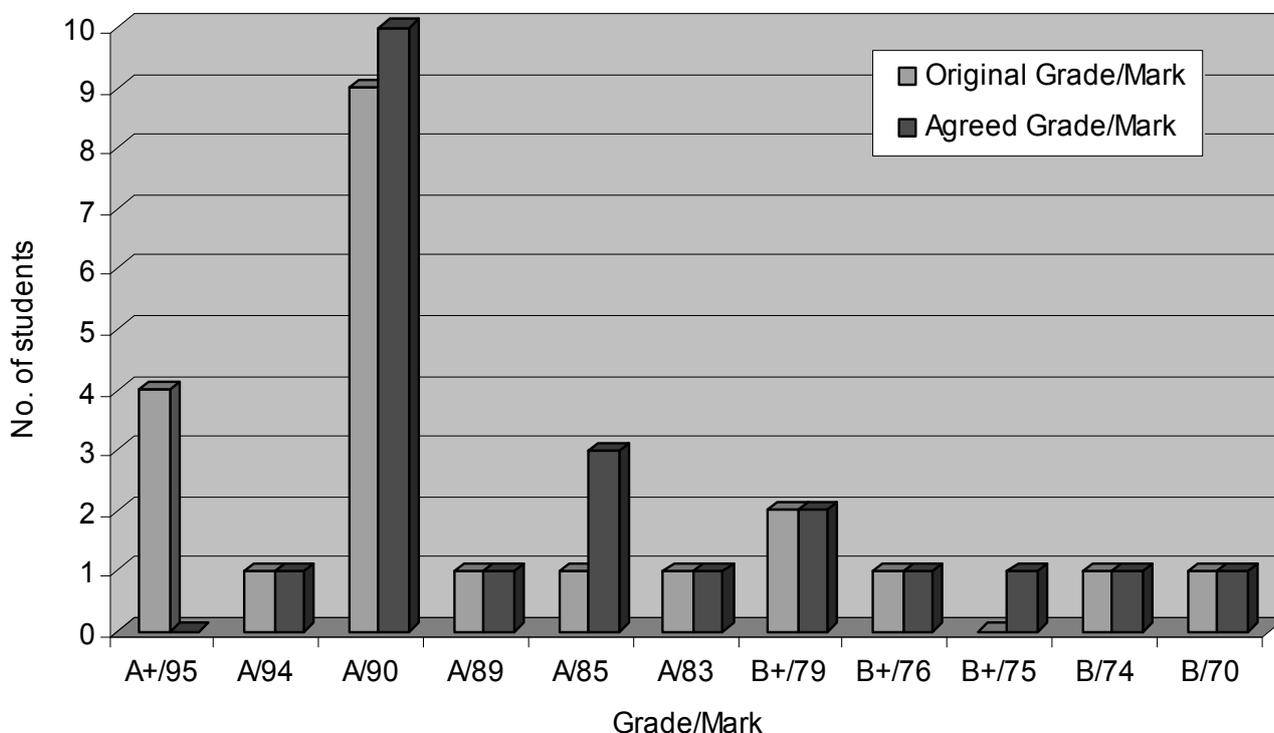
While claiming that students are capable of self-assessment, Weeden et al (2002) stress that they need to be familiar with the assessment criteria prior to the assessment and the learning objectives. They would also require examples of good practice and an opportunity to discuss their work. Consequently, EEP students were provided with (i) the Course Objectives and a 10-point Likert scale on which they could mark the degree to which they had achieved each objective, (ii) the Grade Descriptors, (iii) space to jot down the mark/grade that they feel they deserved, and (iv) space to provide evidence to substantiate their choice. Students could later discuss/defend their mark/grade choice during a small group (7) discussion chaired by a course tutor. (The group that I chaired was the group participating in the focus group interview).

Table II and Figure 1 show the distribution of the grades before and after the focus group interview. Quite understandably there was some degree of inflated grades proposed by the students. The agreed grades were the result of negotiations between students and lecturers and between students themselves during the focus group interviews.

Table II: Distribution of grade/mark

Grade/Mark	No. of students	
	Before small group discussion	After small group discussion
A+/95	4	0
A/94	1	1
A/90	9	10
A/89	1	1
A/85	1	3
A/83	1	1
B+/79	2	2
B+/76	1	1
B+/75	0	1
B/74	1	1
B/70	1	1

Figure 1: Distribution of Grades/Marks



This process resulted in the alteration of six grades, all of which were scaled down. Comments from the students whose grade was reduced included:

“I was sure that the grade would be reduced ... but I did not want to reduce it myself and lose the chance of getting a better grade because of my low expectations.”

(Amy - one-to-one interview)

“I really enjoyed myself during this programme and I also felt that I learned a lot as a teacher and an individual. My grade was based on these feelings. But when I heard what the other students were saying, that is, the mark that they had suggested, I decided to lower it and bring it more in line with those of the rest. It’s only fair!”

(Angela - one-to-one interview)

Although students’ participation in the process was satisfactory, some had second thoughts about this new form of evaluation and assessment as shown by this extract from the focus group interview:

Tania: *“I prefer the traditional way of assessment. Finding a suitable grade proved to be a hard task.”*

Amy: *“I agree with you, I found this method really stressful.”*

Researcher: *“In what way?”*

Amy: *“I felt awkward ... we are more accustomed to undervalue our work rather than to praise it.”*

Researcher: *“But don’t you think that this method is fairer?”*

Sarah: *“Personally I saw it as a challenge. I was given the opportunity to evaluate my efforts. (Addressing her mates) Have you forgotten how frustrated we get when, after spending days working on an assignment, the lecturer assigns a mark that is not a just one?”*

Researcher: *“After all isn’t this what you’ll be doing when you correct students’ scripts.”*

Tania: *“But when it’s YOUR work it’s different.”*

Researcher: *“How?”*

Tania: *“Because of what [Amy] said ... it feels funny and odd to say ‘I deserve an A or an A+’ ... because of what others might say or think about your pretensions.”*

Various students mentioned a combination of reasons to justify their mark/grade, but the awkward feeling was clearly reflected in the justifications given by the students. The majority of the students (14) tried to adopt an ‘objective’ approach by calculating the average mark/grade from the results of earlier assignments.

“Having been asked to substantiate the grade and mark I chose, I was very apt in doing so, as I found all the grades being awarded throughout this journey and drew up an average to safeguard my decision.”

(Jane)

This particular student also supplemented her argument by reproducing feedback remarks that course tutors had written on her assignment. Other ‘objective’ criteria used focused on their commitment towards the course requirements (10) and the degree of achievement of the course objectives (6).

“I have regularly attended lectures, participated in discussions and showed enthusiasm for the subject. I have obtained good grades in all assignments given. This reflects an understanding of the issues involved, reasonable reading and research in the subject and good team work whenever it was a group assignment. I took further interest in the subject and made additional research by opting to do my thesis in EE.”

(Denise)

“Looking back to where I have started this journey, I feel I have achieved or nearly achieved most of the objectives. I know that there is still a lot to be achieved, but so far I feel quite satisfied with my achievements.”

(Connie)

Having established these ‘objective’ and hence ‘undeniable’ reasons for their proposed grade/mark students felt safer to focus their attention on other ‘non measurable’ criteria such as (i) commitment towards integrating environmental education in their teaching, (ii) having a personal interest in environmental education, and (iii) having changed as a person.

“The most important thing in my opinion is that I don’t intend to stop here but I’m looking forward to having a class of my own so I can try to include environmental education and also educational outings.”

(Amy)

“I willingly chose to study this subject and as such I had more motivation to learn a subject in which I was particularly interested.”

(Rita)

“Throughout the EEP I worked upon myself as well as upon my own values and attitudes. ... I believe that this programme was really beneficial for me because ... it helped me go through a personal growth.”

(Debbie)

Discussion

Research results showed that the vast majority of the students enrolling for the EEP had no clear idea of what environmental education (or education for sustainable development for that matter) meant. Nevertheless, as the EEP progressed, their reflections evidence a gradual unfolding and development of attitudes and values that are in line with the declared objectives of both Environmental Education and Education for Sustainable Development. Their common denominator was a genuine interest in environmental issues (most commonly the natural environment) and a wish to safeguard it. Throughout the programme students developed this very basic notion to a much wider conceptualisation aligned with sustainable development principles.

This further stresses the futility of the anxieties some writers seem to have about the importance (sic) of finding the right term for the process. It is very evident that these semantic concerns do not feature high in the list of priorities of people working directly in the field. For example, Karameris *et al.* (2006) found that for teachers these subtle differences do not seem to be an issue since they use them interchangeably. What is important is that, whatever it is called, its principles are those identified over the years by conferences, which turn to education to re-establish sustainable modes of life. These protracted academic debates tend to generate confusion in people who are not directly involved in research and could prove problematic and exclusive (Leal Filho & Pace, 2006). In countries where environmental education is still struggling to get recognition, because governments have other seemingly more urgent socio-economic priorities; changing goal posts by introducing new terms, might throw years of negotiation and hard-won success down the drain (Leal Filho, 1996; Smyth, 2002). In fact even a cursory analysis shows that sustainable development has only been given lip service and a general lack of political will has been identified as the principal cause for its slow implementation (United Nations, 2002).

Lack of political support may explain why environmental education has trailed behind and why in many countries it is still a patchwork of initiatives rather than a well thought out strategy that targets specific objectives and specific audiences. A unifying national environmental education strategy fills in any lacunae in the formal, non-formal and informal sectors ensuring that environmental education is available as a continuous stream from early childhood education to adult education. This way sustainability issues are integrated in the everyday experiences of citizens. In

fact the majority of EEP students attributed their choice to join the EEP to their previous encounter with environment related subjects.

Exposing students to participatory methodologies is not enough. Student responses showed that there is an acclimatisation period during which students gradually adapt to this new style of learning that challenges the deeply rooted notion of student passivity that years of teacher-centred education engendered.

Adapting from an educational process, where students received every thing they need to an education in which they are shown how to do it and then expected to do it, takes time. Consequently, although this attitude changed as the programme progressed, it was still quite strong in some students – although some had finally realised the benefits of becoming autonomous learners.

Environmental education course designers are always faced with the dilemma about how much handholding is required. Since students have different learning needs, some may need more help than others, and therefore, in this case, what's good for the goose is certainly not good for the gander. To cater for the various learning needs, course tutors need to function on a more personal level. The use of peer tutoring and collaborative group work promotes increased interactions between the students themselves and with their tutors and could provide a solution. On the other hand, technological advances have also presented the possibility of developing Virtual Learning Environments that offer personalised support.

Student responses also highlighted the importance they attribute to hands-on practical sessions and field experiences as part of their education. Once again, their responses indicate that these experiences still need to be supported to ensure that maximum benefit is obtained. Results showed that, for some, experiencing the harsh realities of schools was discouraging and demotivating. Supervised practical/on-site experiences coupled with follow-up reflection sessions in groups might provide the support required to help students to function in the unsheltered environment of schools. Dealing with conflict within the safe environment of a student-group session could help students build up the self-confidence required to help them face the pressures to accept the status quo that they will encounter when they are qualified teachers.

If certain clichés are true, then the saying that “values are caught not taught” was proved right by the students’ responses. Students commented that the methodology used by lectures had a positive effect on their personal teaching styles. In fact, although student expectations initially revolved around their need to deepen their environmental knowledge; as the programme unravelled, their concern shifted towards discovering ways of improving their teaching and their teaching environment. If environmental education courses adopt in their praxis the accepted principles of environmental education (or education for sustainable development), rather than just teach about them, school practice will eventually change for the better (Pace, 1997b).

Van Petegem *et al.* (2005) point out that for any innovation to take root, teachers need opportunities during which they can familiarise themselves with the proposed new teaching technologies; time to develop a personal (and peer) vision about the innovation; and the possibility of airing their aspirations, needs, emotions and fears. This will progressively lead the whole educational institution to incorporate the innovation within its institutional ethos. For this to apply to environmental education there needs to be an initial commitment towards its principles, otherwise concern about sustainable development will only be superficial.

Helping learners to develop attitudes and values that promote sustainable development is not just an issue of what content matter to include in a course. It is more related to a methodological choice – a choice that allows learners to examine whether espoused values (considered appropriate) tally with their actual values that determine their lifestyles and consequently their teaching style. The EEP aimed to achieve this by adopting a two-pronged strategy: promoting systematic reflection and self-assessment.

The students’ comments showed that the EEP’s provisions for systematic reflection paid off. These provisions, besides helping students to develop their practice, also helped them in their professional

development. Moreover, their comments evidence the development of a readiness to challenge *conventional perspectives on teacher knowledge* (Cole & Knowles, 2000).

Adopting a sustainable lifestyle inherently implies making decisions based on specific criteria and objectives; and devising strategies to achieve them. Once again, student comments showed how the self assessment procedures adopted by EEP helped to empower students with their own assessment skills, allowing them to understand the learning objectives and leading them to success (Weeden *et al.* 2004).

Conclusion

Putting the learner back at the centre of educational discourse might sound rhetorical, but as the students' responses to the EEP show, it pays. Educational institutions (particularly universities) need to adapt their administrative structures to suit learner needs not the other way round. Until there is this paradigm shift in emphasis, the targets set for the UN Decade of Education for Sustainable Development will never be achieved. This radical shift may take time to materialise due to deeply set traditions. The EEP experience (and others such as those cited by Tal, 2005) evidences that change can also occur gradually and in small steps, if the individual learner is given a space to grow.

“Everything that is really great and inspiring is created by the individual who can labour in freedom.” (Albert Einstein)

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References

- Black, P., Harrison, C., Marshall, B. & Wiliam, D. (2003) *Assessment for Learning: Putting it into Practice*. Maidenhead: Open University Press.
- Black, P., & Wiliam, D. (1998) Inside the Black Box. London: Kings College.
- Buhagiar, M.A. (2007) Classroom assessment within the alternative assessment paradigm: revisiting the territory. *The Curriculum Journal*. 18(1) pp.39-56
- Cole, A.L. & Knowles J.G. (2000) *Researching Teaching*. Boston: Allyn and Bacon.
- Connelly, F. M. & Clandinin, D. J. (1988) *Teachers as Curriculum Planners: Narratives of experience*. New York: Teachers College Press.
- Fontana, A. & Frey, J. (1994) Interviewing: the art of science. In Denzin, N. & Lincoln, Y. (eds.) *Handbook of Qualitative Research*. Thousand Oaks: Sage.
- Hammersley, M. & Atkinson, P. (1990) *Ethnography. Principles in Practice*. London and New York: Routledge.
- Karameris, A.; Ragkou P. & Papanikolaou, A. (2006) “Study of primary and secondary school environmental educators’ understandings of sustainable development, education for sustainable development and its relation with environmental education”. In Manolas, E.I. (ed) *Proceedings of the 2006 Naxos International Conference on Sustainable Management and Development of Mountainous and Island Areas. Vol.I*. Greece: Dept. of Forestry and Management of the Environment & Natural Resources, Democritus University of Thrace.
- Leal Filho, W. (1996) “Furthering environmental education”. In Leal Filho, W.; Murphy, Z. and O’Loan K. (eds.) *A Sourcebook for Environmental Education: a Practical Review Based on the Belgrade Charter*. London: The Parthenon Publishing Group.

- Leal Filho, W. & Pace, P. (2006) "The UN Decade of Education for Sustainable Development: meeting the challenges or another missed opportunity?" In Manolas, E.I. (ed) *Proceedings of the 2006 Naxos International Conference on Sustainable Management and Development of Mountainous and Island Areas. Vol.1.* Greece: Dept. of Forestry and Management of the Environment & Natural Resources, Democritus University of Thrace.
- Moon, J. (2004). *A Handbook of Reflective and Experiential Learning: Theory and Practice.* London: RoutledgeFalmer.
- Moore, J. (2005a) "Barriers and pathways to creating sustainability education programs: policy rhetoric and reality". *Environmental Education and Research*, Vol.11, No.5, pp.537-555.
- Moore, J. (2005b) "Seven recommendations for creating sustainability education at the university level: a guide for chsnge agents". *Interntional Journal of Sustainability in Higher Education. Vol.6, No.4, pp. 326-339.*
- Pace, P. (1997a) Environmental education in Malta: trends and challenges. *Environmental Education Research. 3*(1), pp.69-82.
- Pace, P. (1997b) *Environmental Education and Teacher Education in Malta.* Unpublished doctoral thesis. Bradford: University of Bradford
- Pollard, A. (2005) *Reflective Teaching.* London: Continuum
- Tal, T. (2005) "Implementing multiple assessment modes in an interdisciplinary environmental education course". *Environmental Education and Research*, Vol.11, No.5, pp.575-601.
- Schleicher, K. (1996) "Environmental ethics". In Leal Filho, W.; MacDermot, F. & Padgham, J. (eds) *Implementing Sustainable Development at University Level.* UK: European Research & Training Centre on Environmental Education, University of Bradford.
- Scoullou, M.J. (1998) (ed) *Environment and Society: Education and Public Awareness for Sustainability.* Proceedings of the Thessaloniki International Conference. (8-12 December 1997). UNESCO & Government of Greece.
- Seidman, I.E. (1991) *Interviewing as Qualitative Research: A Guide for Researchers in Education and the Social Sciences.* New York: Teacher's College Press.
- Smyth, J.C. (2002) *Are Educators Ready for the Next Earth Summit?* Millennium Papers Series, Issue 6. London: Stakeholder Forum for Our Common Future
- UNESCO (1980) *Environmental Education in the Light of the Tbilisi Conference.* France: UNESCO
- UNESCO (2005) *Report by the Director-General on the United Nations Decade of Education for Sustainable Development: International Implementation Scheme and UNESCO'S Contribution to the Implementation of the Decade.* Paris: UNESCO
- UNESCO-UNEP (1988) *International Strategy for Action in the Field of Environmental Education and Training for the 1990s.* UNESCO - UNEP, Paris / Nairobi
- United Nations (2002) *Report of the World Summit on Sustainable Development. Johannesburg, South Africa, 26 August - 4 September 2002.* New York: United Nations.
- Van Petegem, P.; Blicq, A.; Imbrecht, I. & Van Hout, T. (2005) "Implementing environmental education in pre-service teacher training." *Environmental Education and Research*, Vol.11, No.2, pp.161-171.
- Weeden, P., Winter, J., & Broadfoot, P. (2002) *Assessment. What's in it for Schools?* London: RoutledgeFalmer.

Some practical solutions for achieving the ideals of sustainability: A case study of a technology teacher education program

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Abstract

This paper provides an analysis of the ways in which one teacher education program addressed the issue of sustainability. The Bachelor of Technology Education is an undergraduate teacher training program at Griffith University, Australia, that provides opportunities for students to study technical, pedagogical, design and graphics courses. Throughout the four-year program, students are involved in developing their technical and pedagogical skills, designing and making products, and developing teaching resources for their future employment.

Since 2004 a number of courses within the program have been re-designed and re-structured to focus on different elements of education for sustainability (ES). In this paper I analyse some achievements within this program which include: across-course approaches; links to communities outside the university; effective/practical approaches to sustainability issues; and relationships between research and teaching.

To develop coherent learning experiences these achievements have been planned on the basis of a theoretical analysis of what education for sustainability means for the technology education area. A curriculum development framework was created that was based on general considerations such as the ways sustainability could be conceptualised, the nature of knowledge, 'eight sustainability principles' for the university and particular issues specific to the area of technology education such as ES aims for technology education and principles of sustainable design. On the basis of student surveys the conclusion is made that due to the coherent approach adopted, visible results in students' learning and attitudes and program development were achieved.

Keywords:

Framework for ES for university program development, sustainable product design, students' sustainability survey, practical solutions.

Introduction

Wide-ranging discussions on the role of the university in the current world are closely related to the on-going revision of the relationships between education in general, university education and the labour market, higher education and society. The *economy-oriented view* (advocated by OECD, EU) and the *human-oriented approach* (supported by UNESCO) (Nikolaou and Papadakis, 2003) towards universities' role provide the opportunities to higher education to develop a vision on how a balanced contextualised position can be developed. The challenge of linking higher education with the constantly changing needs and opportunities of contemporary society is seen as an increasingly important issue by universities and politicians (European Commission 1995:21; Neave & van Vught, 1991). Creating a fruitful and dynamic partnership between higher education and society at large has become one of the basic missions (together with teaching and research) of universities (e.g. Griffith University, 2002; Dewar, 2005).

The higher education sector is increasingly being considered as one of the important components in the movement for Education for Sustainability * (ES). Universities' multiple roles in preparing graduates for sustainable economies and life styles as well as generating knowledge about sustainable solutions and visions provide universities a unique opportunity to incorporate sustainability in their programs. Since 1990 more and more universities have signed *The Talloires Declaration* to state explicitly their commitment to support sustainability efforts (http://www.ulsf.org/programs_talloires.html). As of May 2007, 342 universities from 48 countries have signed the Declaration (http://www.ulsf.org/programs_talloires_signatories.html).

This paper explores the approaches, conditions and results of incorporating sustainability into one particular teacher education program. It discusses a multidimensional approach to the creation of the framework for introducing sustainable development** (SD) into the university program. This analysis provides an example of how higher education can respond to SD as a major agenda for contemporary life.

Technology teacher training program

The Bachelor of Technology Education (BTechEd) is an undergraduate program at Griffith University, Australia, that provides opportunities for students to study technical, pedagogical, design and graphics courses. Throughout the four-year program, students are involved in developing their technical and pedagogical skills, designing and making products, and developing teaching resources for their future employment. Graduates are working as secondary school technology teachers. In 2007 there are around 120 students enrolled in the program.

In 2004 academic staff providing the BTechEd program at Griffith University made the decision to integrate sustainability across the program. The case study of the Bachelor of Technology Education program considered in this paper is an example of a comprehensive approach towards the introduction of SD at the university level. There were a number of starting points for the creation of the proposed framework for the Bachelor of Technology Education program. Some of these were general and could be applicable to all programs such as (i) humanity – nature relationship, (ii) the nature of knowledge, (iii) the eight ES principles for universities, however, some were specific to technology education, such as (iv) ES aims for technology education and (v) sustainable product design. These components of the proposed framework are examined below.

The framework and its development

Technical fix – value change

Traditionally the unity of humanity and nature was presented within the overall perception of the world by all cultures. Up till now some indigenous cultures have preserved this view by having a number of rules related to respect and protection of spirits and nature. However, the historical development of mankind, particularly in the West, led to accumulation of technically exploitable knowledge that became a threat to the authority of cultural traditions (Habermas, 1968/1971, p.95). Technological development and an increase of technocratic ideology that is interested in the expansion of human power of technical control (Habermas, 1968/1971, p113) greatly contributed to environmental and social problems and as a consequence to the emergence of the discourse on SD.

Literature on sustainable development records that the concept of SD emerged in the mid 1980 as an attempt 'to bridge the gap between environmental concerns about the increasingly evident ecological consequences of human activities and socio-political concerns about human development issues' (Robinson, 2004, p.370). Differences in views on sustainable development are rooted partly in different philosophical and moral conceptions of appropriate ways to conceive of the relationship between humanity and nature. A summary of environmental responses proposed by Robinson (2004) identified 'technical fix' and 'value change' as two major approaches towards SD. The

debate about the relative importance of technology and individual human responsibility has been an emerging theme in the environmental literature: individual attitudes towards nature vs. more pragmatic and collective approaches, oriented towards efficiency gains and improvements in technology.

These two views represent the beliefs on the level the issues of SD can be addressed. As argued by Pavlova (2006b) a dialectic position between these two views is essential for the effective conceptualisation of SD for educational purposes.

Nature of knowledge

The second starting point for the framework development is the nature of knowledge in the current era. On the level of knowledge generation, the discourse on what is knowledge, and what is worthwhile knowledge, is influencing the concept of university knowledge. The arguments in the philosophical and sociological literature demonstrate how new forms of economic, political and cultural relations influence the production and dissemination of knowledge, and on understanding of its changing nature.. Sharp disputes over what constitutes knowledge (see for example, Connell, 1995; Dewey, 1933; Habermas, 1968/1994; Lyotard, 1979/1984; Stehr & Ericson, 1992; Toulmin, 1972, 1995; Young, 1971) are important standpoints for both modern and postmodern projects. Modernist theories of knowledge aim to prevent interests, desires, and values from influencing the objective outcomes. Objectivity is obtained through carefully controlled scientific method, which leads to a unified system of knowledge. Thus, progress is generally viewed as “movement toward a single, absolute truth by revealing universal principles obtained by a unified method of science” (Connell, 1995, p. 2).

Postmodernity is not an alternative to modernism. It is rather a critique of it (Coulby & Jones, 1995; Green, 1994). The concept of postmodernity is very diverse, eclectic and non-systematic. It is a body of ideas, which demonstrate their scepticism “towards the ‘Enlightenment meta-narratives’ of universalism, unity, reason and progress”(Green, 1994, p. 68). One powerful aspect of a postmodernist critique concerns knowledge. “No truth system is seen as being superior. Individual taste and discrimination are encouraged, eclecticism prized and all canons subjected to furious attack ... modernist knowledge ... no longer carries any widespread legitimacy” (Coulby & Jones, 1995, p. 37).

As argued by Pavlova & Maclean (in press) the dichotomies presented in this discourse such as universal versus particular, formal versus experienced-based, value-neutral versus value-laden, bounded versus unbounded, search for truth versus utilitarian, context-free versus context-dependent, position university knowledge much more closely to the individual than the discipline, to *person’s subjectivity, needs and experiences*. In the modern world the focus is on capability development and considering the learner as a whole person. “The emphasis is on personal responsibility for learning through the provision of rich learning environments” (Staron, Jasinski & Weatherley, 2006, p.49).

Eight principles

The third starting point for conceptualising ES reform for the BTEchEd program is criteria for assessing the sustainability performance of a university, developed by The University Leaders for a Sustainable Future (ULSF). ULSF is a network of university academics and administrators who work cooperatively to implement a sustainability agenda. As University Leaders for a Sustainable Future has argued they have a responsibility to increase awareness, improve knowledge, create technologies and impart the moral vision that lead to a sustainable future and a high quality of life for future generations (Bekessy, et al, 2003, p.4). They identified seven criteria for assessing sustainable performance. A report on ESD in Australian and some international universities (Bekessy, et al, 2003, p.15) has developed them further and added one more criteria. A number of

characteristics that reflects university mature approach towards sustainability as defined in that report (Bekessy, et al, 2003) are as follows:

- Articulation of social responsibility in the institutional mission and structures;
- Integration of social, economic and environmental sustainability across the curriculum;
- academic research on sustainability, and consideration of social, economic and environmental sustainability issues in all other research;
- outreach and services, including the development of partnerships with schools, government, non-governmental organisations and industry;
- sustainable institutional operations, including effective monitoring and reporting;
- staff development and rewards;
- student opportunities;
- cultural inclusively.

These criteria present some structural requirements that can be viewed as appropriate at the program levels as well. Thus they were considered as the points to account for, for the ES program re-design and evaluation in the case study analysed below

Aims of technology education in relation to SD

The first particular consideration specific to technology education relates to the aims of TE. Technology education is a multifaceted learning area that is interpreted differently by different teachers: some of them put more emphasis on technical aspects of technology, some on its social or environmental impact, some on its engineering side, some on product design. Thus, students in the BTechEd program are encouraged to formulate their own philosophy of technology education. The author's definition of technology education is as follows:

Technology education is a learning area that provides an opportunity for students to understand the nature of technology and its relationships with society and the environment, and to design and make artifacts in accord with the principles of sustainable development which take into account different dimensions of development such as social, economic and environmental.

Through their studies students are encouraged to explore human needs and respond by using technology to transform materials, information and energy. Student-centred teaching strategies help students to develop personal qualities such as responsibility towards the current world and further generations, the ability to solve problems, demonstrate initiative and acquire required skills and knowledge. Technology education is fun!

In this definition sustainability and sustainable design held an important position. The following aims of technology education identified by Pavlova (2006a,b,c) provided a broad framework for incorporating sustainability through the program:

- To know and understand SD problems/issues;
- Contribute towards the promotion of and increasing awareness about ideas of sustainable development through projects/activities;
- Design and make products in accord with eco-design principles;
- Work in accord with SD practices.
- Discuss and appreciate the relationships between aesthetics and ethics for sustainability;
- Consider aesthetics as a powerful feature of product design closely related to sustainable consumption.

The above aims are closely related to the systematic framework for developing SD curriculum and teaching materials proposed by Pavlova (in press) that has a cognitive, practical and aesthetic dimensions. The cognitive dimension (the first two aims) relates to knowledge and understanding of the principles of sustainable design, understanding what SD is, why it is important to address. Practical aspect of social life (second two aims) is addressed through designing and making products, systems and the environment. Aesthetics (the last two aims) relate to the appreciation of aesthetics for sustainability (current style, appearance of the product) and reflects upon the important role it plays in influencing young peoples' identity.

Sustainable design

The second particular consideration specific to TE is the nature of sustainable design. Research into sustainable product design identified a number of practical approaches established within the profession. For example, the concept of appropriate technologies introduced by Schumacher in his book *Small is Beautiful* (1974) defined them as:

'technologies with a human face' aimed to enable people to earn a sustainable living. He proposed eight criteria to assess technology:

1. Appropriate technology best suits the needs and lifestyle of the people using it.
2. Appropriate technology should not damage the environment and ecosystem, and should be sustainable.
3. Appropriate technology should keep costs within the economic means of a community.
4. Appropriate technology should use locally available resources as far as possible.
5. Appropriate technology should enable local workers to earn a living.
6. Appropriate technology should increase self-reliance.
7. Appropriate technology should use renewable sources of energy wherever possible, and should be economical in its use of non-renewable resources.
8. Appropriate technology should fit with its social and cultural environment.

Professional designers developed the notion of appropriate technology into the sustainable design principles for their profession. For them the key aspect of 'sustainable product design' is the "addition and balancing of social and ethical issues, alongside environmental and economic issues, into the product design process – to achieve 'the quadruple bottom-line'" (Charter & Chick, 1997, p.5). Categories from the 'the quadruple bottom-line' concept such as economic, environmental, social and ethical aspects of design have been the topic of discussion in relation to corporate social responsibility since the 1970s and have gradually been translating into an agenda for the design profession. An example of the design sustainability principles developed through the Design for the Environment Multi-media Implementation (DEMI, 2003) approach includes consideration of:

- efficiency - doing more with less
- scale -the right size for the right place involving the right people
- systems - connections within and between society and nature
- appropriateness - choosing the right thing
- sufficiency - how much is enough? do I really need this?
- equity - fairness within and across all systems ... not just human

Similarly, the criteria that the sustainable product should met are:

- **Cyclic:** made from organic materials, and is recyclable or compostable, or is made from minerals that are continuously cycled in a closed loop;
- **Solar:** the product uses solar energy or other forms of renewable energy;
- **Safe:** non-toxic in use and disposal;

- **Efficient:** less materials, energy, water;
- **Social:** manufactured under fair and just operating conditions.

As the BTechEd students are being involved in design over a number of courses through the program, sustainable design principles have been considered as particularly important issues to be addressed as a consequence of the program change.

Case study

Five starting points for the framework development discussed above provided a broad basis for the program re-design on the basis of ES. It was accepted that students should be familiar with two possible approaches towards achieving sustainability, namely, technological fix and value change, and that they should formulate their own opinion on what the balance between these two should be. Through classroom activities and assignments students have an opportunity to formulate their understandings and attitudes. It was also accepted that knowledge developed by the students has a closer association with students' subjectivity, needs and experiences than to university disciplines, thus, cross-disciplinary and cross-courses approaches should be used to address sustainability through the program, through a number of pedagogical and workshop-based courses as well as active methods of learning including research on SD issues. Eight university principles were used as a checking list for the introduction of the ES changes and for evaluation of the results. Two specific for technology education areas are: ES aims of technology education and sustainable design were used to formulate goals for specific learning activities and criteria for assessing students' design. The framework for the ES approach within the Bachelor of Technology Education program is presented in Figure 1.

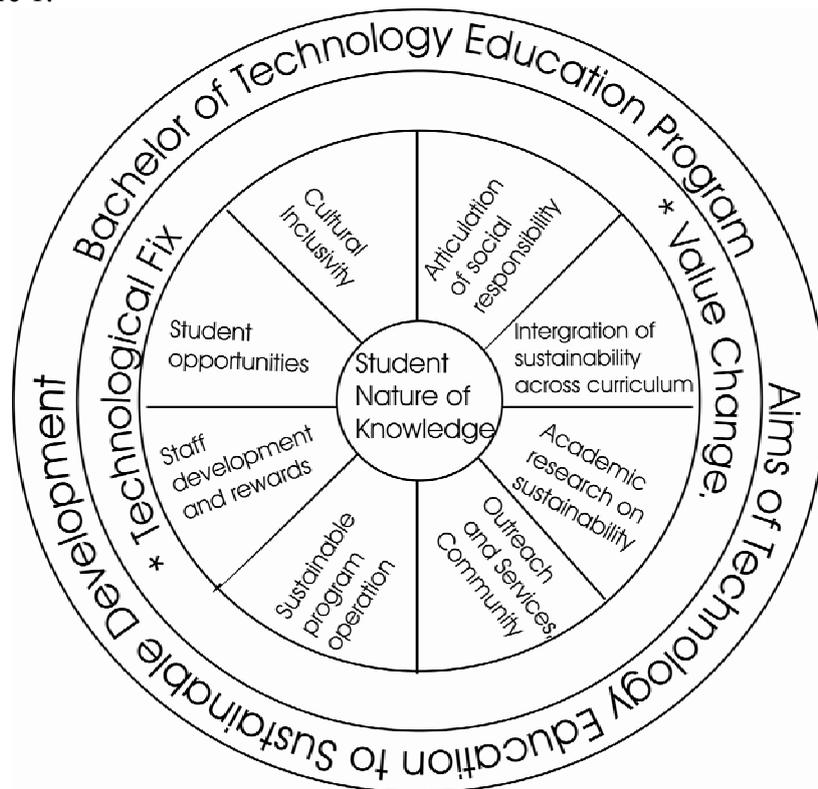


Figure 1. The Framework for the re-design of the university teaching program.

Analysis of some introduced changes

Some changes introduced to the program are analysed below under the eight criteria for evaluating ES performance of the program.

Articulation of social responsibility in the institutional mission and structures

Articulation of social responsibility has been formulated through a description of the graduate capabilities developed for the program, in particular, capabilities relevant for understanding design and the nature of technology and technology education. Another measure is an introduction of assessment items through a number of the courses that stimulate students' reflections on philosophy of education, the role of teacher and ES in technology education.

Integration of social, economic and environmental sustainability across the curriculum

The notions of SD and ES have been introduced through the pedagogical courses such as: *Technology Education: The context*; *Technology Education: Curriculum development*; *Issues in Technology education*; *Product Design (Wood)*; *Product Design (Plastics)*; *The Major Project*. The ES is the major focus for *Product Design (Plastics)*, one out of six major research themes for *Issues in Technology Education*; one out of three contexts for design in the *Major Project*. All three aspects of the ES are addressed through the courses.

For example, through the four hours per week over 13 weeks of the *Product Design (Plastics)* course, students are asked to design and make a Board Game for children of a particular age. Students are asked to design and manufacture all of the game components including a container to package the game. The emphasis is on both the development of designing and making skills and on learning about eco-technologies and the broad concepts of sustainable development. Through lectures a wide range of topics including, plastics for a sustainable future, recycling, product analysis, properties and uses of plastic and board game design are covered as well as manufacturing techniques, design and safety issues.

Through the process of teaching, the lecturer observes students' reactions to the issues discussed and the approaches they used for their design. This provided the basis for classroom reflections and discussions. A number of students have also been interviewed to clarify their perspectives on SD, their approaches to the task, reflections of their learning experiences, satisfaction with the task and on how a board game as a project may be used to develop an awareness about SD issues. Usually students are selected due to the differences in their approaches to the task observed by the lecturer. The two types of beliefs about the way to achieve SD (technical fix and value change) could be clearly identified among the students interviewed (Pavlova & Turner, 2007). In the subsequent course, *Issues in Technology education*, students are asked to research sustainability and education for sustainability to reflect on both positions. LCA is "a process of evaluating the effects that a product has on the environment over the entire period of its life, thereby increasing resource-use efficiency and decreasing liabilities. It can be used to study the environmental impact of either a product or the function the product is designed to perform. LCA is commonly referred to as a "cradle-to-grave" analysis" (www.dantes.info/Projectinformation/Glossary/Glossary.html). Such issues as use of energy or water, toxic emissions, transport implications, health and safety of workers as well as users can be discussed. The learning activity can be focused on the cognitive and moral/ethical aspects that relate mainly to protection of the environment or economic and social issues can also be part of the learning activities.

Academic research on sustainability, and consideration of social, economic and environmental sustainability issues in all other research

A research group had been established within the Faculty of Education Research Centre that included academics from technology, vocational and mathematics education to focus on the conceptualisation of ES and the ES research at primary and secondary school levels to provide case study materials and other resources for university students and staff. Research Honours students have been involved as research assistants and as researchers for the Honours research projects. The research projects have been focused at regional/national and international levels. The results of these research projects have been taken back into the program.

Outreach and services, including the development of partnerships with schools, government, non-governmental organisations and industry

Academic staff involved in the Bachelor of Technology Education are working closely with local schools. On a number of occasions we approached local schools for joint development and delivery of ES projects, monitoring students' and teachers' involvements, attitudes and learning. On one occasion a school approach us asking for help with their ESD project for Year 7 students. Another example is the program links with the Queensland museum. In 2006 two Year 4 students, through their final project course, designed and made a model of a sustainable house appropriate for the South East Queensland environment and developed teaching materials to be used with this model. Currently any Queensland teacher can book this kit through the museum website and use it in the classroom. Another example is the author's participation in the work of the Queensland Studies Authority in revising Technology Studies Syllabus for Year 10 – 12 high school students. Sustainable development issues were included as foundation knowledge required for this course and in assessment. Another service to the community is in-service training on ESD for technology teachers during the annual conference of the Queensland Industrial Technology and Design teachers association of Queensland (INTAD).

Sustainable institutional operations, including effective monitoring and reporting

At the program level the main issue that could be addressed through this criterion is supply and use of materials (wood, metal, plastic, etc.) and components. For example, students are always advised to minimise the use of materials through their design solutions and modelling procedures, through efficient cutting of materials. The latest technologies in 3D modelling provide the opportunity for our students to fix the majority of design problems prior to making their products. Thus, errors and wasted materials are minimised.

Staff development and rewards

Through staff meetings approaches towards the formulation and implementation of the ESD framework were discussed. Opportunities to be involved in research and be able to present at conferences were created.

Student opportunities

Students have the opportunity to receive a design award for their final project. In 2006 the award was presented to a student for the design of a dismountable foundation and building slab made from concrete, the mixture of which was re-designed as well as the structure to achieve two major benefits: the structure can be re-used again and again (due to the collapsible nature of the structure, the foundation of the existing building could be dismantled and used for a new building) and due to the arch shape of the blocks that make up the floor slab, the amount of concrete required and the percentage of cement in it were dramatically reduced.

Cultural inclusively

Through the learning activities, examples of design solutions from different cultures and for different cultures have been analysed with students. For some of them it was an eye-opening activity. These activities are mainly focused on the social aspect of sustainability through product analysis. The purpose of this analysis can be to understand how the product can *improve the quality of human life within earth's carrying capacity and conservation of the earth's vitality and diversity* (UN, 2001). This analysis can address questions such as: is the product really needed; how does the product make life better for people; is it culturally acceptable for people who use it; does it build on the traditional wisdom and technology of the community; what is the impact on social relations; does it bring people together in a friendly way; will it enhance or diminish cultural diversity; does it have a long-term impact on future generations; if so, is this impact positive or negative. A number of resources are available on the website (e.g. www.sda-uk.org ; www.stepin.org).

The above analysis demonstrated a coherent approach towards ES program changes. This comprehensive approach towards program re-design influenced upon some changes in students' attitudes and understandings of SD and ES in technology education as demonstrated in the results of students survey.

Results of student survey

All the above changes have been introduced into the program since 2004. In 2007 twenty-two fourth year students were surveyed at the end of semester 1. The results highlighted an important role the university played in increasing awareness of what sustainability is. The majority of students heard about sustainable development from the university (16); two from their family, two from the building industry and two from the media. Fourteen students heard about SD in year 2 and 3 of their university studies. Thus, the important role of the university in introducing a sustainability agenda to students' studies is apparent.

For fourteen students the concept of sustainable development did not attract their attention the first time they heard about it. However, when the students respond to the question: Do you see SD as an issue important for you now - 21 responded 'yes', for your future students - 22 responded 'yes'. Nineteen students indicated that they believe that you would be able to deal with SD through their teaching, one respondent said 'maybe', one responded 'no' and one did not respond.

These responses suggest that through the program, students changed their neutral or uninformed attitude towards sustainability into considering it as an important issue for them and their future professional activity.

Students described SD in a number of ways. Some examples of students' definitions are:

"Energy and material preservation, manufacturing a product that has long useful life and be recycle to allow for future generations to develop"

"The ability to exist without creating further difficulties for future generations"

"I see SD as an important part of current and future technology"

"Obtaining needed resources and materials in a sustainable way"

"Projects/activities/work programs in applicable subject areas that promote the process of using materials that are/or can be recycled and/or materials or processes that conserve energy and make persons aware of sustainability in products and living. Conservation of Earth resources with thought to pollution and future impact"

"The way we are stewarding the world resources"

"SD is the way in which products/processes are created to maintain the environment, social and economic justice. Or at least limit the negative impacts on these things"

“A global effort to solve the problems caused by the past generations”

These interpretations of sustainable development highlight students’ positions as they are trying to find the balance between technical fix and value change approaches.

Conclusions

This paper addressed the issue of how a particular university program can be re-designed to focus on ES to increase students’ awareness of SD issues, develop their own attitudes towards them and increase the probability of applying them in their future professional practice.

An approach developed to introduce and monitor the ES program changes is based on the framework that includes the following considerations: the ways sustainability can be understood and achieved (technical fix – value-change); the nature of knowledge in the modern world; sustainability criteria for the universities; ES aims for technology education and sustainable design.

Changes achieved through the program and students’ responses to the survey, identified the effectiveness of the measures taken in shaping graduates’ intentions to address sustainability through their professional life as technology teachers. A coherent and multidimensional approach for change together with problem-solving learning activities, help to bridge the gap between theoretical thinking and curriculum opportunities, between learning activities and professional practices.

Note

* , **

In this paper Sustainable development and sustainability; education for sustainable development and education for sustainability are used interchangeably, although the author acknowledged the discourses on the differences in terminology.

References

Bekessy, S., Burgman, M., Wright, T., Leal Filho, W. and Smith, M. (2003?). Universities and Sustainability. The Tela series, Issue 11, Australian Conservation Foundation, Melbourne, Vic.

Charter, M. and Chick, A. (1997) Welcome to the first issue of the Journal of Sustainable product design. *The Journal of Sustainable product Design*, 1, pp. 5-6.

Connell, J. (1995). Reconstructing a modern definition of knowledge: A comparison of Toulmin and Dewey. *Philosophy of Education. Yearbook*, 1-6. Retrieved August 4, 1998, from the World Wide Web: http://www.ed.uiuc.edu/EPS/PES-Yearbook/95_docs/connell.html

Coulby, D. & Jones, C. (1995). *Postmodernity and European education systems: Cultural diversity and centralist knowledge*. London: Trentham Books

DEMI (2003) *Design for sustainability: Demi principles*, retrieved from the web 2004

http://www.demi.org.uk/web/content_a.asp?token0=2&token7=HTML&type=demi%20principles&token2=demi%20principles&OP=lt&overNo=1.12&max=all

Dewar, J. (2005), E-mail to the university academics. Griffith University, June, 2005.

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process*. Boston : D. C. Heath and Company

European Commission (1995:21). *White Paper: Teaching and Learning. Towards a Learning Society* (Brussels, ed. E.C./ Directorate General Education, Training and Young)

Green, A. (1994). Postmodernism and state education. *Journal of Educational policy*, 9, 67-83.

Griffith University (2002). *The Griffith Project*. Brisbane: Griffith University

Habermas (1971). *Toward a Rational Society* (J. J. Shapiro, Trans.). London: Heinemann. (Original work published 1968)

Habermas, J. (1994). *Knowledge and human interests* (J. J. Shapiro, Trans.). Cambridge: Polity Press. (Original work published 1968)

Lyotard, J - F. (1984). *The postmodern condition: A report on knowledge* (G. Bennington and Massumi, B., Trans.). Manchester: Manchester University Press. (Original work published 1979)

Neave, G. & van Vught, F.A.(Eds.) (1991) *Prometheus Bound. The changing relationship between Government and Higher Education in Western Europe*. Oxford, Pergamon Press.

Nikolaou, C. & Papadakis, N. (2003), European Higher Education in the era of change: Context, values, politics and the stake of the new partnership between University and “Society at Large”. Proceeding of the 6th ESA Conference, University of Murcia, Spain, 23 – 26 September 2003. Research networks #21, Social Theory, (pp.1-9)

Pavlova, M. (in press) Technology and vocational education: a framework for the development of teaching approaches and resources for Education for Sustainable Development.

Pavlova, M. (2006a). *Do we value values in technology education?* The keynote address .The 4th International Conference on Technology Education Research December 7-9, Gold Coast, Centre for Learning Research, Griffith University.

Pavlova, M. (2006b) Education for sustainable development: the nature of the issue in the multicultural world. In P. Ruohotie and R. Maclean (Eds.) *Communication and learning in the multicultural world* (pp. 377 – 397). Hameenlinna: University of Tampere Press.

Pavlova, M. (2006c) Technology education for sustainable futures. *Design and Technology Education: An International Journal*, 11 (2), 41 –53.

Pavlova, M. and Maclean, R. (in press). Vocational and Higher education: some reasons to be together.

Pavlova, M. and Turner, S. (2007). It's never too early: education for sustainable development, *The International Journal of Environmental, Cultural, Economic and Social sustainability*

.Robinson, J (2004). Squaring the circle? Some thoughts on the idea of sustainable development. *Ecological Economics*, 48, 369-384.

Staron, M., Jasinski, M and Weatherley, R. (2006). *Life Based Learning: A strength based approach for capability development in vocational and technical education*. A report on the research project “Designing professional Development for the Knowledge Era”. TAFE NSW: Darlinghurst, NSW.

Stehr, N. & Ericson, R. V. (1992). The culture and power of knowledge in modern society. In N. Stehr & R. V. Ericson (Eds.), *The culture and the power of knowledge: Inquiries into contemporary societies* (pp. 3-19). Berlin; New York: Walter de Gruyter.

Toulmin, S. (1972). *Human understanding* (Vol.1). Oxford: Clarendon Press.

Toulmin, S. (1995). Foreword. In R. F. Goodman & W. R. Fisher (Eds.), *Rethinking knowledge: Reflection across the disciplines* (pp. ix-xv). Albany: State University of New York Press.

Young, M. F. D. (Ed.). (1971). *Knowledge and control : New directions for the sociology of education*. London: Collier-Macmillan.

The sustainability-oriented researcher's identity: Action research in doctoral studies

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Abstract

The researcher's identity means accepted self-reference to the social category of researcher, awareness about the interrelationships between this category and other categories of social identity, and continuous professional development. Researchers with the sustainability-oriented meta-content of identity use the peculiar frame of reference in their professional life.

The doctoral students in Pedagogy (N=14) joined an action research project based on self-reflection and a constructivist approach. The questions were concerned with the value of such research with the aim of defining the meta-content of identity and the state and orientation of students' researcher's identity.

Several stages of the research comprised the clarification of the individual researcher's identity and construction of frame of reference for the meta-content of the researcher's identity. Initially, the qualitative and quantitative methods permitted the collection of data for further reflection. It was followed by the students' theoretical elaboration on sustainability and group work on construction of different types of social identity oriented toward sustainability. At the third stage, the reflection on the previous results promoted the selection of the criteria for sustainability-oriented identity. Later, the common definition of the sustainability-oriented researcher's identity was created via group work and discussions.

The results confirm the value of action research to define the meta-content of identity. The researcher's identity of doctoral students is rigid and mainly cognitively oriented, asking for the extensive incorporation of the principles of sustainability in doctoral studies to make this identity more sustainability-oriented.

Keywords:

Identity, researcher's identity, sustainability, action research, doctoral studies.

Bonding the identity, sustainability, and research in higher education

The research on sustainability in higher education (HE) may consolidate the concepts from different disciplines, uncover unexpected issues, and show the future for education and HE specifically. This study aims to explore the sustainability-oriented researcher's identity of doctoral students using the approach of educational action research.

Education, in its deepest sense and at whatever age it takes place, concerns the opening of identities – exploring new ways of being that lie beyond our current state (Wenger, 1998, 263). According to Blumenthal (1999, 381), we have “a mobile, multiple self that emerges out of the inevitable consequence of relating to different people, in different situations and across time”. To characterize the identity in an educational situation, the approach describing it as 1) negotiated experience, 2) community membership, 3) learning trajectory, 4) nexus of multimembership, and 5) a relation between the local and the global (Wenger, 1998, 149) is relevant.

Learning communities could foster the development of identity by offering a past and a future experienced as a personal trajectory that could be performed by incorporating the temporal dimension of members in the practice of learning community and opening the new possibilities of participation oriented toward the common and valued future. In doctoral studies, the learning community should focus on the researcher's identity, as the identity politics is at the heart of becoming a researcher (Armstrong, 2001). Also, Green and Lee (cited in Malfroy and Yates, 2003, 127) suggest that "what is at stake in doctoral work and postgraduate supervision, over and beyond the much vaunted contribution to knowledge, is precisely the (re)production of an intelligible academic identity – a certain kind of (licensed) personage".

In the study by Pipere and Salite (2006), the researcher's identity was defined as the accepted self-reference to the social category of researcher, an awareness about the interrelationships between this category and other categories of social identity, and continuously becoming a better researcher as a way of professional development. Following Armstrong (2001), the only way to learn to be a researcher is through doing, and importantly being aware of how the doing has been constructed through praxis. Other authors (Merchant and Dupuy, 1996; Reisetter et al., 2004) imply that engagement in qualitative research is one of the possibilities to create and develop a powerful and integrated research identity.

As for the design of identity, the distinction between the identity content as a structural design and meta-content as a value and future oriented dimension (Pipere, 2007) serves the incorporation of sustainability in the milieu of identity or, in other words, elaborates the relation between the local and the global reflected in the identity within the learning community. Currently the interplay between the concepts of identity and sustainability becomes more viable (Porter, 2005) and the interaction between identity, sustainability, and research is critical. Even though the new field of sustainability science has emerged to promote the goals of a sustainability transition, it is just the beginning of the discourse signifying the figure of researcher for the sustainability science. The first steps in this direction show the necessary transformations in the activities, values and attitudes of any researcher to foster the sustainability-oriented researcher's identity (SORI) (O'Riordan, 2004, 37; CISE, 2006; Pipere, 2007).

The questions posed for the study are: 1) What are the qualitative and quantitative characteristics of doctoral students' identity in general and specifically their identity as researchers? 2) Do the students' beliefs on the meaning of researcher and their own researcher's identity is oriented toward sustainability? How does this orientation differ from the negotiated experience on SORI? 3) What are the benefits of action research in the construction and reflection of researcher's identity?

Methodology

Participants

The 14 doctoral students of Education in their 1st year of doctoral studies (one male and 13 female) participated in a workshop on researcher identity in October 2006. Participants were working as teachers at compulsory schools, universities or educational administrators and their age ranged from 28 to 54 years ($M=43.8$, $SD=8.62$). The data sheets were coded to protect the identities of participants, while confidentiality and feedback on the results were consented.

Educational action research and cascade approach

Action research investigates some social situation in order to improve the quality of performance, at the same time merging theory and practice in a holistic unity and continuous interplay of both (Pipere and Salite, 2006). Educational action research envisions the improvement of quality of action in education, while undertaking systematic exploration of praxis and reflecting on how the results might influence future endeavours (Action Research Network, 2005). Participatory

educational action research strongly emphasises transformation and reflectivity (Pipere and Salite, 2006). According to Hooley (2005), changed personal and professional thinking can be noticed both during the process of action research and in its results. Action research is a powerful tool for the development of identity of all those involved and, ideally, is an infinite journey that develops in the form of a spiral of experience (Kemmis, 1994). In the research presented, the educational action research was complemented with the cascade approach: starting from the first until the last stage of the research process, everything that is done provides the necessary holistic foundation for the activities of the next step. The following stages were completed: 1) qualitative and quantitative investigation of students' identity and specifically the researcher's identity; 2) construction of social identities oriented toward sustainability and selection of the criteria for sustainability-oriented identity, 3) selection of the criteria for the researcher's identity, and 4) production of a definition of the SORI.

Results

Stage 1. Qualitative and quantitative investigation of doctoral students' identity and researcher's identity

Three research methods were offered to participants as the tasks during the Stage 1: 1) modification of Kuhn and Macpartland (1954) Twenty Statements Test (TST); 2) inquiry on their beliefs on meaning of researcher, quantitative self-evaluation as a researcher, and its substantiation (Pipere, 2007); 3) personal construct method "Myself as a researcher" (Kelly, 1955).

Twenty Statements Test (TST): subjective self-definitions in the perspective of past, present, and future

The TST has the virtues of simplicity and of providing a relatively direct measure of one's self-concept (Alm, Carroll, and Welty, 1972). The instructions were as follows: *Using the blank space in three columns, please, write 20 answers to the question "Who I was before entering the doctoral studies?" in the left column, "Who am I today?" in the central column, and "Who will I be after graduation?" in the right column of data sheet.*

To analyse 819 self-definitions were collected. The categorization of the responses into a set of five analytical categories developed by Kuhn was initially accepted as a data analysis method. These categories can be described as (1) Consensual responses, i.e. statuses in social categories and social groups (CR) (2) Ideological beliefs, i.e. religious and philosophical orientations, etc. (IB) (3) Aspirations, i.e. future-tensed statements of personal goals and achievements (FA) (4) Preferences, i.e., the respondent's interests and aversions (IA) and (5) Self evaluation, i.e. evaluative statements assessing one's own mental and physical abilities and demeanor (SE) (Kuhn, 1960; Alm, Carroll, and Welty, 1972). The data were initially coded in terms of these five categories by two independent researchers in order to diminish the individual coder effect (Alm, Carroll, and Welty, 1972). Four other categories were discerned from the data and added to the previous five: (1) Professional skills, knowledge, and attitudes (PS), (2) Existential conditions (EC), (3) Features related to research (RF), and (4) Free categories (FC).

The three largest groups of categories were SE (34.8%), CR (30.3%), and IA (12.58%). These groups were followed by PS (9.65%), EC (4.64%), and FC (4.27%). Just a few items were mentioned for RF (2.32%), FA (0.98%) and IB (0.48%).

SE – the most frequent positive features in the past was *curiosity* and *thoughtfulness*. Regarding the present, students mentioned the same positive features, while among the negative characteristics the *limited social activities*, *stubbornness*, and *burnout syndrome* appeared several times. As to the future, the participants avoided negative features stressing *the helping others*,

confidence, and *purposefulness*. If past and present were described within an internal cognitive context (*curiosity* and *power of apprehension*), data relating to the future reflected an external behavioural perspective.

CR – the *family roles* (mother) and *professional roles* (teacher) dominated. Also, the roles of *master or doctoral students* were abundant. Entering doctoral studies, family and gender categories decreased and students became busier (*busier friend, hardly met neighbor*). Moving from past to future, the *doctoral students* and *doctoral degree* categories increased and definitions of social role changed positively (*wise woman*).

IA – the diverse interests outside the profession, family and studies were mentioned. The only category mentioned in every temporal dimension was *reading*: during the doctoral studies reading is more intensive, but, getting the degree, the reading is possible just for fun. After the studies students plan to redeem what is lost, doing what is interesting.

PS – the majority of categories related to cognitive skills, knowledge, and attitudes. This new know-how obtained during the doctoral studies is planned to be implemented in the teaching profession. The qualitative and quantitative development of professional knowledge and skills can be discerned.

EC – frequent categories were labelling self as infant, child, pupil, then growth into an adult, and even retirement after the graduation. After the studies – feelings of resurrection, real life, joy, finding one's place in life were expressed.

From all self-definitions 2.32% (1.1% past, 3.66% present, and 2.2% future) could be related to research-oriented group of categories. The results testify that doctoral studies have some impact on the increased perceived importance of the researcher's identity, which, however, is not planned to be maintained at this level until after the graduation.

ANOVA did not show any statistical difference in the distribution of categories among the nine groups between past, present and future perspectives of self-definition of doctoral students.

Beliefs on the meaning of researcher, quantitative self-evaluation and its substantiation, sustainability-orientation of researcher's beliefs

The participants were instructed 1) to provide at least five criteria by which a researcher can be distinguished from other people, 2) to mark the point on the scale (from 0 to 10 points) fitting best their self-evaluation of been researcher, and 3) to explain the reasons of marking the scale as they did.

- *The beliefs on the meaning of being a researcher, quantitative self-evaluation as a researcher*

The process of qualitative content analysis envisaged: 1) deciding the unit of analysis, 2) developing categories and coding scheme, 3) test coding on sample text, 4) coding all text, and 5) assess coding consistency. Altogether 75 researcher's criteria were collected and 59 distinct research categories were discerned from the pool of answers. The categories were analysed and evaluated as to develop the coding scheme which came from the data themselves and theories on identity. Finally, the coding consistency was tested.

The inductive qualitative analysis of categories led to the six main groups of the researcher categories distributed as follows:

- a. Knowledge, cognitive sphere – 37.3%
- b. Personal features of researcher – 30.7%
- c. Formal research activities – 21.3%
- d. Research motivation, needs – 9.33%
- e. Research ethics – 2.67%

f. Social presentation of research results – 1.33%

On 10-point scale, participants evaluated themselves by an average of 6.22 (SD=1.85). The most frequent categories were curiosity, setting questions and searching for answers, purposefulness, and power of apprehension. Also, *the lack of free time* and *inability to evade thoughts about work* were mentioned as the only negative criteria.

- *Sustainability-oriented beliefs among the categories of researcher*

The categories relating to the researcher (27.1%) were enlisted as oriented toward sustainability if they concurred with the trends suggested by O’Riordan (2004), the CISE (2006), and reasonably opposed the unsustainable features of the researcher. The categories were reviewed and organized according to their general meaning as related to cognitive, affective, conative, and ethical aspects of beliefs on identity:

- **Cognitive categories:** critical thinking, non-traditional problem solutions, creativity, originality in life, awareness of being a small part of global science, look into the future;
- **Affective categories:** longing to find the truth, benevolent naivety, passion to search for causes, joy of life, an interest toward the world;
- **Conative categories:** risk taking, making the world more cognizable, work toward the changes in the world;
- **Ethical categories:** research for the good of other people, non-harming others.

However, none of these beliefs appeared in the 14 substantiations of self-evaluation as a researcher. The more detailed description of findings as well as comparison of doctoral students with other groups of researchers is available in Pipere (2007).

Personal construct method “Myself as a researcher” (the repertory grid)

The instruction for this task suggested the creation of 10 elements regarding the topic “Myself as a researcher” and then to create at least 5-6 constructs choosing any three elements and asking in what way two of the three are similar to each other and different from the third. Afterwards, the participants were asked to locate each element on each construct, marking the element as connected to one or other pole of construct (Banister et al., 1994).

The elements were explored using the inductive qualitative content analysis approach complemented by quantitative measures. The analysis of personal constructs was based on the Classification System for Personal Constructs (CSPC) suggesting the division of constructs in six basic areas (moral, emotional, relational, personal, intellectual/operational, and values/interests) and two supplementary areas: existential and concrete descriptors (Feixas, Geldschläger, and Neimeyer, 2002).

- *Groups of categories elicited from elements of repertory grid*

Altogether 140 elements were obtained from the answers. Reiteration of elements allowed 112 distinct categories of elements to emerge. The inductive qualitative analysis led to the 11 groups of categories: 1) Personal features – 15.2%, 2) Persons engaged – 13.4%, 3) Cognitive sphere – 11.6%, 4) Social/personal means – 11.6%, 5) Concrete things – 9.82%, 6) Elements of research – 9.82%, 7) Activities of students – 8.93%, 8) Logistics and material conditions – 7.14%, 9) Affective sphere – 6.25%, 10) Research disciplines – 3.57%, and 11) Places – 2.68%.

The most frequent categories among the elements were *the advisor of thesis* and *research methods*.

- *The areas from CSPC dominating among the constructs*

Altogether 105 pairs of constructs were obtained, by an average of 7.6 constructs. From them, 19 pairs of constructs were omitted from the further data analysis (as not bipolar constructs). Among 86 pairs of bipolar constructs the constructs representing the intellectual/operational area (26.7%) and concrete descriptions (25.6%) related to the specific features of research work were dominating. Less frequent were constructs attributed to emotional (12.8%), relational (9.3%), personal (9.3%), and moral (8.14%) area. The smallest number of constructs related to values and interests (5.81%) and existential (3.49%) areas.

- *Evaluation of elements on bipolar constructs*

Analysing the evaluation of elements on the constructs provided, from 86 pairs of bipolar constructs 20 pairs were omitted, as they were not representing the positive and negative oppositions of the category but showed the neutrally valued poles of category (e.g. individual responsibility/collective responsibility).

Regarding the 66 pairs of bipolar constructs, the 62.1% of all evaluations were positive – the elements were located on the positive pole of constructs.

The range of evaluation for groups of categories is provided in Table I, except for groups *Research disciplines* and *Places*, which were omitted because of insignificant number of items.

Table I. Percentage of positive evaluations provided to elements of repertory grid on the constructs

	Group of categories (elements)	Percentage	Examples
1	Elements of research	78.8	Methodology, conclusions, research data
2	Activities of students	73.7	Public activities, work, studies
3	Persons engaged	67.0	Professors, advisors, respondents
4	Cognitive sphere	61.4	Knowledge, generalization, intellectual facilities
5	Concrete things	59.3	Family, dog, weekends
6	Affective sphere	58.5	Despair, joy, indifference
7	Personal features	57.3	Laziness, flexibility, courage
8	Social/personal means	53.3	Time, health, contacts
9	Logistics and material conditions	53.1	Money, laboratory, scientific literature

Stage 2. Construction of social identities oriented toward sustainability and selection of the criteria for sustainability-oriented identity

To create the context for further activities, this stage started with the theoretical presentation, group discussions and analysis of sustainability definitions, approaches, and conceptual description of sustainability-oriented identity.

Afterwards, groups of two or three worked on specific social identity categories providing an answer to the question: what does it mean to have this social identity category oriented toward sustainability? The following social identity categories were employed: gender, ethnicity, occupation, ecology/religion, family, social relationships, recreation, and learning (Pipere, 2003).

The groups presented their answers and the discussions resulted in the list of selected criteria of sustainability-oriented identity. The participants divided the criteria as follows: 1) the roots/sources (*permanent identity; natural functions*), 2) values and philosophy (*individual philosophy of sustainability; system of values; traditions*), 3) affective criteria (*excitement to change the world; benevolence; optimism; empathy; forgiveness; love; confidence*), 4) cognitive criteria (*curiosity; construction of experience; ecological thinking; specific thinking style*), and 5) communicative and behavioral criteria (*communication; language; activities related to changing the world; social activities toward sustainability; behaviour corresponding the faith, beliefs; ability to accept the novelty; not leading toward regress; openness; perseverance; "soul of child"*).

Stage 3. Selection of the criteria for the researcher's identity

Having an experience from previous stages of the research, groups of two or three continued their work on the same task – to construct the criteria for the researcher's identity. Each group provided their own criteria and all students joined in the creation of common list of criteria for the researcher's identity. During the discussions it was discovered that the largest part of this list comprises **cognitive criteria** (*critical attitude, thinking; skills to acquire information, search for data and play with them; skills to analyse and synthesise; observer*) and **personal features** (*curiosity, purposefulness, courage, patience, cooperation, selfishness, enthusiasm*). Other criteria mentioned were *anxiety, activities related to the change of the world, and risking in a name of idea*.

Stage 4. Creation of definition of the SORI

In this concluding stage, the doctoral students created the definition of SORI. From several definitions offered, the students selected the following:

SORI signifies the active person with an independent philosophy, value system, and ecological thinking, able to skillfully apply language as a means of communication in optimistically oriented social activities in order to create an empathetic and healthy social environment.

Discussion

The research reveals some crucial identity issues of the novice doctoral students and simultaneously tests the possibilities for the development of SORI in action research.

At Stage 1, the students evaluated themselves mostly in regard to their own mental and physical abilities and demeanour and statuses in social categories and social groups, which coincides with the findings from some other studies (Alm, Carroll, and Welty, 1972; Grace and Cramer, 2002). The large number of professional characteristics found in TST can be attributed to the attempt to preserve the positive self-concept and compensate the lack of awareness about the doctoral studies. The domination of family and professional roles as well as the role of student is an indication of problems with multimembership and collisions of these differently oriented roles. The move from past to future reveals the controversial picture where, on one hand, the graduates are going to mature to improve their professional performance and devote their life to active helping of other people, but, on the other hand, they are happy to liberate themselves from the heavy burden of studies and, for once, have a real life. This, to a certain extent, agrees with the stories of trauma and crisis as an outcome of creating the new identity of the licensed academic (Lee and Williams, 1999).

The small number of self-definitions (2.32%) related to the researcher's identity and self-evaluation by 6.22 on 10-point scale testifies the minor importance of the membership in the research community and lack of need to connect this sphere with the doctoral studies. The personal construct method facilitated the discovery of the elements that were directly connected with the doctoral students' researcher identity. The participants identified themselves in the majority with the

personal features and persons engaged in the research process, followed by the cognitive sphere and social/personal means for research. Though, as regards personal constructs the intellectual/operational area and concrete descriptions of the specific features of research work were dominating. Similarly, where the knowledge and cognitive sphere dominated, as was the case concerning the beliefs about a researcher, the personal features of researcher, and formal research activities followed (same observed in Stage 3). These contradictions show the incoherence between the real and ideal self of the researcher and the strain for pure cognitive excellence. They suggest that the students see the researcher more internally than externally oriented and do not discern the social and transformative function of research yet. The evaluation of elements on bipolar constructs points to the overall positive attitude toward the research. The distribution of positive evaluations shows that the highest value is attributed to the elements and activities of research that, possibly, could explain the entering of doctoral studies. The cognitive sphere is evaluated in middle, therefore coinciding with the awareness of need for the larger cognitive competence. The elements evaluated as the lowest can be interpreted as barriers in the development of the successful researcher's identity: those are the means for research (material and immaterial), personal features, and affective sphere of doctoral students.

Regarding the SORI, the only relevant feature that was discovered by TST was external behavioural perspective hoped for in future. Even though from the beliefs on the researcher 27.1% were sustainability-oriented categories, absence of this orientation in the substantiations of self-evaluation stresses the gap between the ideal and real values of participants. And again, the internal (cognitive and affective) categories dominate over the external (conative and ethical) ones.

Comparing the researcher's identity of doctoral students with the SORI, we can see the larger coherence of components in the later and constant inclusion of conative (behavioural) externally oriented criteria (in all stages of cascade approach) that is not the case in the current researcher's identity of doctoral students. The categories elicited from the beliefs on the researcher are quite different from those negotiated in Stage 2. The largest disparity is the emphasis on axiological aspects in the Stage 2, which was missing in individual assignments.

In definition of SORI (Stage 4) the external behavioural trend appears through denoting the "active" person and the wish to change the social environment, which comes from the epistemological and axiological orientation of identity. This definition shows the development of participants' vision and complements the several components most important for the meta-content of researcher's identity, though, it is just one of the feasible cases for the definition of SORI.

Examining the benefits of action research in the construction and exploration of the researcher's identity, we can refer to the three modes of belonging (Wenger, 1998, 173) in relation to identity formation and learning. Imagination that envisages the expanding of the self by transcending the time and space and creating new images of the world and ourselves was employed during the Stage 1. The Stages 2, 3, and 4 coincided with the mode of engagement – "active involvement in mutual processes of negotiation of meaning", as the students discussed the criteria of sustainability-oriented identity and created the definition of the researcher's identity. The mode of alignment that "requires the ability to coordinate perspectives and actions in order to direct energies to a common purpose" was evidenced, while the students joined their efforts toward the creating the meta-content of identity aiming to the sustainability as a common purpose.

The local context of the learning community – the study environment construed for the doctoral students in Education in this research, the attitude and orientation of university teachers who work with doctoral students, and forms and methods of learning that foster the development of this community and identity of students, could serve as an example of introducing the sustainability in HE for other institutions.

References

- Action research network (2005), University of Kansas. Available <http://actionresearch.altec.org/>
- Alm, R.M., Carroll, W.F., and Welty, G.A. (1972), "The internal validity of the Kuhn-McPartland TST", Proceedings of the American Statistical Association (Social Statistics Section), Washington, ASA, pp. 190-193
- Armstrong, P. (2001), "Becoming and being a researcher: doing research as lifelong learning", Paper presented at SCUTREA, 31st Annual Conference, 3-5 July 2001, University of East London. Available <http://www.leeds.ac.uk/educol/documents/00002429.htm>
- Banister, P., Burman, E., Parker, I., Taylor, M., and Tindall, C. (1994), *Qualitative Methods in Psychology: A Research Guide*, Open University Press, Buckingham, Philadelphia
- Blumenthal, D. (1999), "Representing the divided self", *Qualitative Inquiry*, Vol. 5, pp. 377-393
- CISE (2006), "Education for Sustainability Framework", The Cloud Institute for Sustainability Education. Available http://www.sustainabilityed.org/what/education_for_sustainability/documents/EFSFramework_000.pdf
- Feist, G.J. (2006), *The Psychology of Science and the Origins of Scientific Mind*, Yale University Press, New Haven & London
- Feixas, G., Geldschläger, H., and Neimeyer, R.A. (2002, January), "Content analysis of personal constructs", *Journal of Constructivist Psychology*, Vol.15 No 1, pp. 1-19(19)
- Grace, S.L. and Cramer, K.L. (2002), "Sense of self in the new millennium: male and female student responses to the TST", *Social Behaviour and Personality*, Vol. 30, pp. 271-280
- Hooley, N. (2005, April), "Participatory action research and the struggle for legitimation", *The Australian Educational Researcher*, Vol. 32 No 1, pp. 67-82
- Kelly, G. (1955), *The Psychology of Personal Constructs*, Norton, New York
- Kemmis, S. (1994), "Action research", in Husen, T. and Postlethwaite, T.N. (Eds.), *International Encyclopaedia of Education*, London, Pergamon Press, pp. 42-49
- Kuhn, M.H. (1960), "Self-attitudes by age, sex, and professional training". *The Sociological Quarterly*, Vol. 1 No 1, pp. 39-54
- Kuhn, M.H. and MacPartland, T.S. (1954), "An empirical investigation of self attitudes", *American Sociological Review*, Vol. 19 No 1, pp.68-76
- Lee, A. and Williams, C. (1999), "'Forged in fire': narratives of trauma in PhD supervision pedagogy", *Southern Review*, Vol. 32 No 1, pp. 6-26
- Malfroy, J. and Yates, L. (2003, November), "Knowledge in Action: doctoral programmes forging new identities", *Journal of Higher Education Policy and Management*, Vol. 25 No. 2, pp. 119-129
- O'Riordan, T. (2004), "Education for sustainability", in Scott, W. and Gough, S. (Eds.), *Key Issues in Sustainable Development and Learning: A Critical Review*, Routledge Falmer, Taylor & Francis Group, pp. 33-37

Pipere, A. (2003), "Identity of learning teacher: examining structural variations and interactive "self"", *The Irish Journal of Psychology*, Vol. 24 Nos.3-4, pp. 143-161

Pipere, A. (2007), "Becoming a researcher: interplay of identity and sustainability", in Pipere, A. (Ed.), *Education and Sustainable Development: First Steps toward Changes*, Volume 2 (in press).

Pipere, A. and Salīte, I. (2006), "Educational action research in teacher education: fostering research skills", Full papers of APERA International Conference 2006 "Educational Research, Policy and Practice in an Era of Globalization: The Asia-Pacific Perspectives and Beyond", CD format

Porter, T. (2005, December), "Identity subtexts in the discursive construction of sustainability", *Electronic Journal of Radical Organisation Theory*, Vol. 9 No 1. Available http://www.mngt.waikato.ac.nz/ejrot/Vol9_1/Porter.pdf

Wenger, E. (1998), *Communities of Practice: Learning, Meaning, and Identity*, Cambridge, Cambridge University Press

Knowledge, Sources of Information and Priorities on Sustainable Development in Higher Education

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Abstract

In this article, the importance of university organisation structures, knowledge and sources of information as well as priorities on sustainable development are discussed in the context of sustainable development education. An important issue in policy and developing educational programmes is whether economic issues receive priority over social and environmental issues. This issue will be discussed in a theoretical and empirical context (questionnaire results from Poland, Lithuania and Greece).

Keywords:

Sustainable Development, Education, Priorities on Sustainable Development, Knowledge and Information, University organisation

Introduction

Institutions of higher education play an important role in the achievement of sustainable development (SD) by way of their educational and scientific function. Proper understanding of the concept of SD may be an important condition for developing education and research programmes that support SD. In this context, sources of information and the perceived liability of these sources are crucial for curriculum development as well as knowledge transfer and the informational base used by students for their studies.

First, the development of education on SD at institutions of higher education is discussed in the context of organisational models. An important issue is what type of model is “proper” for SD education, what difficulties exist in introducing educational programmes and which issues are likely to receive priority in the programme. Next, questionnaire results from Poland, Lithuania and Greece are presented on knowledge of the concept of SD and sources of information used by students, which may be important for developing teaching methods for communicating course contents. In Finally, priorities on SD are discussed. Theoretical arguments are given that economic issues receive priority over social issues, while social issues receive priority over environmental issues, which will be compared with questionnaire research on the topic. This information is also relevant for developing SD education, as a fundamental problem is that issues which are of less direct interest to the student or other stakeholders often are excluded from study programmes or neglected. The mental model that “what we cannot see or measure, does not count” seems often to prevail. However, in history much pollution could not be measured, while many illnesses were not discovered. This does not mean that people did not suffer. A task for science and education for SD is to stimulate awareness and knowledge creation in these fields.

University organisation and sustainable development education

The demand for education related to issues of SD is likely to increase as a result of the increasing importance of sustainability strategies in the European Union on the local, national and international level (Platje, 2006a, 177). Concerning education for SD, a question is not only what approach is

chosen, but also the focus of the programme. First of all, do SD issues receive priority in educational programmes? As is discussed in Section on priorities, it is quite likely that economic and social issues remain the prime issues (e.g. in studies such as economics, law, sociology, etc.), while environmental protection will be a “niche” in many cases. This is also likely to be the case for studies on SD.

Following Veblen (1965), in a time when connections with business and the obtaining outside funding becomes more important, the focus will rather be on “marketable” programmes. An important issue is whether students are prepared for the labour market. As mentioned, in EU policy and national and local policy, SD is formally becoming more important, creating demand for such studies. Also companies are more and more stimulated to take sustainability issues into consideration.¹ This may create good opportunities for developing sustainability education at universities. However, taking into consideration the organisational structure of universities, a question remains whether such programmes receive priority, and when they receive priority, a question remains whether the focus will be on economic, social and/or environmental issues.

Ellström (1983; see also Platje, 2006a) discusses four organisational models that can be applied to university structures: the rational model, the political model, the social system model and the anarchistic model (see Table 1). These models are not only useful in analysing different difficulties that arise when introducing SD education, but also for supporting knowledge generation.

Table 1. A typology of Four Organizational Models

Organisational Processes / Technology	Organisational Goals and Preferences		
		Clear and shared (consensus)	Unclear and / or disagreed upon (conflict)
	Transparent / Clear	The Rational Model Keywords: Truth, Thinking, Task-orientation	The Political Model Keywords: Power, Conflict, Struggle
Ambiguous / Unclear	The Social System Model Keywords: Trust, Learning, Collaboration	The Anarchistic Model Keywords: Foolishness, Randomness, Play	

Source: Ellström (1983)

Clear organisational goals and preferences and transparent governance structures are features of the rational model. Thus, it would be clear “who wants to do what”, “who is allowed to do what”, “who is able to do what”, etc. Furthermore, it implies that there are no conflicting goals within the organisation, which is very unlikely to be the case. The formal mission statements and goals are often broadly defined, such as “providing education for students on the highest level”. However, different studies, by definition, have different goals and priorities. For example, studies of economics focus on development of other abilities and skills and is more likely to be oriented towards changes in the labour market than in the case of philosophy. The study of business and research in this field has other aims than the study of history of economic thought or ecology. Furthermore, different groups within the university (tenured scholars, young scholars, students, administration) are also likely to have different goals. Thus, it may be that the rational model applies to a small group within the university, but it is very unlikely to apply to the whole organisation.

¹ However, as Milton Friedman argues, “the business of business is business.” By definition economic issues receive priority for business as their main goal, profit, should be achieved for reasons of survival.

In case of ambiguous goals and different interests (priorities) but clear organisational structures, the political model is an interesting approach. Keywords are power, conflict and struggle. In this case an important question is which priorities “win” in the battle. As will be argued later in this paper, economic issues are likely to receive priority over social issues, while social issues are likely to receive priority over environmental issues. What does this mean for creating SD education? A new approach implies innovation and change, while SD by its nature is interdisciplinary. When SD elements are introduced in a certain course, it is likely that the focus remains the same. For example, when introducing social and environmental issues in an economics course, the focus will still be on economics. When introducing economic and social elements in environmental studies, focus will remain on environmental issues.

When e.g. bringing different faculties together in order to create SD studies, an analysis of stakeholders is important. There is often a large group defending “vested interests”, not willing to change, as change implies effort to do something new (e.g. using new materials, new teaching methods). Another question is which group is most powerful. Larger and richer faculties are more likely to influence the curriculum than small and poor faculties. This is, among other things, related to labour market requirements and funding for science. When there is funding from the private sector, it is likely that the focus will be on economic issues. Without research and educational funds from local, national and EU authorities, social and environmental issues will rather be of secondary importance.

The assumption of the rational and political model, the existence of clear and transparent governance structures, can be disputed. Organisational structures and decision-making procedures may be fuzzy or poorly described, making the process of taking decisions cumbersome, while strong individuals or interest groups may set “informal decision-making procedures” or become informal leaders. Scholars are a specific type of people with often strong personalities, where many of them may have their own idea of what is the best way an organisation should function. Unclear or ambiguous organisational structures are features of the social and anarchistic model. The social model assumes that there are clear goals, and that these goals can be achieved by consensus. Such an organisational structure would, in theory, probably be the best for SD education. When people themselves have clear and shared goals, in a situation of trust they can learn from each other and adjust to new challenges in a complex, ever changing world. Although this model may apply to small, strongly motivated groups (Platje, 2006a), organisational reality may be best represented by the anarchistic model (Cohen et al., 1972; see also Cohen and March, 1991; Baldrige, 1983).

The anarchistic model is a way of describing and analysing different aspects of university life. Although formally goals are defined, in reality they are often broadly defined, leaving room for ambiguity. Many staff members may not understand the goals, often formulated by small groups within the university. Furthermore, as discussed before, many scholars have different goals and hidden agendas, while staff is not necessarily fully attached to the university goals (e.g. part-time and short-term contracts or focus on income and an easy life (see also Smith, 1776, 425; Schopenhauer, 2003, 407) may lead to different priorities).

Following the anarchistic model, the development of SD studies is often an accidental process without much discussion and consultation and not taking reality into consideration (Cohen et al., 1972; Ellström, 1983; Cohen and March, 1991). Questions that appear are: To what extent does the development of studies depend on the funder and market demand? Shouldn't we leave room for opportunities in the future? Is there proper communication between different stakeholders within the organisation? Are the decision-makers (e.g. rectors, senates) well-informed or do they have to rely on the opinion of experts or interest groups? Following Baldrige (1983), people may agree relatively quickly on a general programme, in particular when goals are abstract and ambiguous. However, when the programme has to be realised, often a struggle may begin concerning dividing teaching hours and research funds, and an issue is which priorities “win” in reality.

When governance structures are unclear, competencies are poorly defined, enforcement mechanisms slow and inefficient and goals ambiguous, there is much room for people to try to

realise their own agenda, while mental models and ideology become more important. This may imply that old methods and approaches are important in creating new programmes. As a consequence, there exists a threat that change remains superficial. Furthermore, such a situation creates opportunities for strong interest groups to realise their agenda. Thus, analysis of priorities is relevant in such a situation. As mentioned, private companies focus more on economic issues while government and European funds, although theoretically supporting SD, in reality often focus on issues of technological development and innovation, which not always stimulates SD.²

Concluding, the anarchistic model helps to explain why it is difficult to introduce SD programmes and why the focus will rather remain on economic issues in SD. It is very difficult to change old ways of thinking, and these ways of thinking become more important in an unclear, turbulent environment. However, the other models also describe parts of university reality. For example, SD education may be supported by small, dedicated groups which are able to convince other stakeholders in the university hierarchy and make a project a success. This may be an example of the social model, but also of an interest group having enough influence to facilitate change into a positive direction and to stimulate knowledge generation and application.

Knowledge and sources of information

Transfer and creation of knowledge and information is not only a mean for achieving SD, it is also a factor of development itself (see Todaro, 1997; Platje, 2006b). The extend to which people can read, speak and write is important for the possibilities for communicating about sustainability issues. However, e.g. access to education not only influences these abilities, but is also an important factor for the opportunities people have on the labour market, the ability to innovate, etc.

A questionnaire on priorities on SD was carried out between 623 students in Poland, Lithuania and Greece.³ This as a part of a more extensive research project. Although the sample is relatively small and not representative for whole society, some interesting issues come up. Students are expected to play a leading role in future research and economic life. When they do not know what SD is about, what then can be expected from the rest of society? Furthermore, the sources of information they use and the perceived reliability of these resources may be an important factor for developing educational methods.

Table 2. The meaning of the concept of sustainable development

No.	Meaning of sustainable development	Total (N=623)
1.	Producing more without deterioration of the environment	47 (7.5%)
2.	Environmental protection	5 (0.8%)
3.	Achieving balanced and continuous economic growth	114 (18.3%)
4.	Achieving economic growth which can be used to relieve poverty and solve problems of unemployment	51 (8.2%)
5.	Leaving similar possibilities for development for future generations, while assuring a good life for ourself and fellow human beings, not negatively influencing the state of the environment	282 (45.3%)
6.	Increasing the quality of life	21 (3.4%)
7.	Stable economic development	40 (6.3%)
8.	I don't know	23 (3.7%)
9.	No answer	22 (3.5%)

² See e.g. Woźniak (2000) for a discussion on negative effects of technological change. A well-known example is the development of Information Technology which, while creating opportunities for economic growth without necessarily harming the environment, may lead to social exclusion of groups within countries or even a large part of the African continent (see Castells, 1996)

³ I am indebted to Bartosz Fortuński, Evangelos Manolas, Donatas Pilinkus and Diana Rokita for their help with carrying out the questionnaire.

10.	More definitions given	18 (2.9%)
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Source: Author's own research

As is presented in Table 2, about 45% of the students give a definition similar to the “traditional” definition from the Bruntland Report (definition 5). This may be related to the fact that SD is part of the curriculum of many of the researched students. Focus on economic growth (definitions 3 and 7) is indicated by almost 25% of the sample. Environmental focus (definition 1 and 2) and social focus (definition 4) is indicated by 8.3% and 8.2% of the sample respectively. The results provide some support for the argument that economic issues receive priority in development over social and environmental issues. Furthermore, the understanding of the concept of SD differs, which creates a challenge in developing sustainability education, as knowledge and interpretation may be important for activity into the direction of SD.

The results of the questionnaire show that students may possess better knowledge on the concept than the population in general. For example, a small questionnaire carried out in Opole (Poland) among 253 people shows that about 42% did not know what is SD (Platje et al., 2006).

Table 3. Main sources of information on economic, social and environmental issues (3 answers possible)

Nr.	Source of information	Total (N=623)	Poland and Lithuania (N=448)	Greece (N=175)
1.	TV	453 (72.7%)	331 (73.9%)	122 (69.6%)
2.	Internet	433 (69.5%)	345 (77.0%)	88 (50.3%)
3.	Newspapers	245 (39.3%)	175 (39.1%)	70 (40.0%)
4.	Radio	165 (26.5%)	142 (31.7%)	23 (13.1%)
5.	Lectures	93 (14.9%)	68 (15.2%)	25 (14.3%)
6.	Other people	85 (13.6%)	52 (11.6%)	33 (18.9%)
7.	Magazines	85 (13.6%)	51 (11.4%)	34 (19.4%)
8.	Scientific publications	47 (7.5%)	28 (6.3%)	19 (10.9%)

Source: Author's own research

TV and the Internet are the most important sources of information for students on social, economic and environmental issues, followed by newspapers and radio. Only 15% of the respondents indicate lectures. This may be related to the fact that many lectures are rather about theory. An interesting issue for further research, which is relevant for SD education, is whether lectures relate to actual social, economic and environmental issues. The local / central government and meetings of the local community were mentioned only a few times. The difference in use of the Internet as a source of information between Polish and Lithuanian students on the one side and Greek students on the other side may be the result of the specificity of the groups researched. However, it shows that when the Internet will be more and more used in sustainability education, success will depend on the number of students using and having access. On the one hand, Internet facilitates study for e.g. the handicapped and people living a long distance from educational centres. On the other hand, people having no access to or not using the Internet for different reasons, e.g. lack of money for access, lack of knowledge, lack of IT infrastructure, may be excluded.

Information on sources of information used by students may be useful for developing educational strategies. However, important in this context is the perceived reliability of the sources of information (see Table 4). Scientific publications are highly trusted, while lectures and the Internet receive a medium-high level of trust. This implies that the Internet may be a good medium for SD education.

Table 4. Perceived reliability of different sources of information on economic, social and environmental issues

Nr.	Source of information	Mean	Median	Mode
1.	Internet	6.8	7	7/8
2.	Television	6.1	6	8
3.	Radio	6.4	7	6
4.	Newspapers	6.3	7	7
5.	Magazines	5.3	5	5
6.	Scientific publications	8.4	9	9
7.	Other people (<i>e.g.</i> neighbours, family, friends)	4.5	5	5
8.	Information provided by the local government	5.3	5	5
9.	Information provided by the central government	5.4	5	5
10.	Meetings of local community	5.2	5	5
11.	School classes / lectures	7.3	8	8

Source: Author's own research

N=623. Scale of assessment – between 0 (extremely unreliable) and 10 (extremely reliable)

Priorities

Some arguments for the identification of priorities were discussed earlier in this paper. Identification of priorities is important not only for SD policy, but also for SD education, as it facilitates *e.g.* preparation for discussion and the focus of educational material. For example, when it turns out that many people think economic issues and employment are more important than environmental issues, an important question is whether to focus on a change in the way of thinking, which may be quite effective for achieving SD but takes a lot of time (see Meadows, 1999), or to focus on a practical problem-solving approach, where it is important to find so-called win-win solutions.

In Table 5, some theoretical arguments are presented which issues are likely to receive priority in sustainable development. The approach is a simplification, as categories are broadly defined. It will be argued that economic issues receive priority over social and environmental issues. However, there may be differences between specific issues. The main argument is that people look at their own, short-term, direct benefits (see Ben-Ner and Putterman, 1998). Thus, employment and work are likely to receive high priority as they are often closely connected with income generation, while income is necessary to fulfil basic needs. A locally-specific problem like clean water is also important, as it is of direct relevance for survival.

Table 5. Priorities in sustainable development – theoretical arguments

<i>Priority</i>	<i>Example</i>	Priority	Reason
Economy	GDP growth, growth of disposable income, growth of consumption, etc.	Main priority.	People seem first to look at easily measurable, direct, short-term benefits. E.g. income is a condition for satisfying demand for food, housing, education etc. Strong interest groups such as large companies have funding to protect their interests and rights.
Social	Unemployment, income distribution, poverty, social exclusion, education, health care, etc.	Importance increases when economic priorities are achieved. Many social issues, such as unemployment, are strongly related to economic priorities and as such may receive similar priority as economic issues. However, some social issues are often less visible (e.g. poverty).	The poor and the unemployed have lack of funding to protect their rights. The poor and unemployed in developing countries do not have a voice in policy of developed countries, thus development aid is likely to receive less priority and to be focused to support own interest.
Environment - Locally-specific issues	Problems where cause and consequence can be found in one area (e.g. city), such as traffic jams, air pollution and noise.	Expected to receive least priority as the problems are the least measurable and effects most long term, while often indirectly influencing welfare. Locally-specific problems are expected to receive priority over transboundary and global problems.	Locally-specific environmental problems most directly affect people, while in this case for local authorities it is relatively easy to find solutions compared to transboundary and global problems.
Environment – Transboundary issues	Problems where cause and consequence can be found in different areas / regions / countries, such as acid rain and pollution of some rivers.	For developed countries global environmental problems may receive priority over global social problems (e.g. poverty). ⁴	May directly affect a certain group of people. However, it is more difficult to find a solution as the source lies in an area where the victim region does not have direct power. This increases the information and negotiation costs of establishing “who has the right to what” (property rights) and the control costs (in particular when different countries are involved).
Environment – Global issues	Problems where cause and consequence can be found everywhere on the planet, such as greenhouse effects, biodiversity and climate change.		The victims and polluters are dispersed. This makes establishing property rights very costly, while there are no real mechanisms of enforcing established agreements. Effects of climate change or destruction of biodiversity or ecosystems are less direct and more long-term. Global environmental resources (e.g. ecosystems, biodiversity) may be recognised by developed countries as an important factor of production, while the costs of global warming may be significant.

Source: Van der Gaast and Platje (1997), Platje (2006a; 2006b; 2006c; 2007a; 2007b).

The reasons given for priorities are economic, psychological, social and institutional. For example, the power of multinational companies may lead to an “economy-first” approach in reality (Platje, 2007a), while individuals may be more interested in work and clean water. The empirical research presented below is directed towards individuals, thus more related to mental models and preferences, while it may give a picture of the priorities of students as a stakeholder group.

⁴ See Bass and Dalal-Clayton (2004).

Table 6. Some economic, social and environmental priorities

Nr.	Issue	Mean	Median	Mode
1.	Family	9.47	10	10
2.	Friends	8.89	10	10
3.	Clean air	8.85	10	10
4.	Fighting unemployment	8.81	9	10
5.	Work	8.76	9	10
5.	Clean water	8.76	9	10
7.	Social welfare	8.60	9	10
8.	Leisure time	8.53	9	10
9.	Increasing my own income	8.41	9	10
10.	Assuring access to information	8.39	9	10
11.	Fighting corruption	8.33	9	10
11.	Fighting poverty	8.33	9	10
13.	Stimulating economic growth	8.15	8	8
14.	Protecting the environment	8.05	8	10
15.	Climate change	7.62	8	10
15.	Disappearance of biodiversity	7.62	8	10
17.	Interest rates	7.13	7	8
18.	Religion	7.08	8	10
19.	Aid to developing countries	6.99	7	8
20.	Stable exchange rate	6.77	7	7
21.	Birdflu and mad cow disease	6.73	7	8
22.	Having a car	5.98	7	10

Source: Author's own research

N=623. Scale of assessment – between 0 (extremely unimportant) and 10 (extremely important)

From the preliminary research presented in Table 6 and 7 some general preliminary observations can be made, which need further empirical research. There is some evidence that issues that more directly touch the individual receive priority. Theoretically it was argued that economic issues receive priority over social issues, and that social issues are likely to receive priority over environmental issues. Work and fighting unemployment receive high priority, as they are related to income generation. Increase in income itself receives less priority. Interesting is that some locally-specific environmental problems receive similar priority as social issues. Generally formulated issues such as economic growth, environmental protection and fighting poverty are lower on the list. Locally-specific environmental problems receive priority over global environmental problems, while fighting poverty in less developed countries receives relatively low priority.

Interesting is the role in fighting poverty respondents see for the government, while modern science may solve environmental problems. Economic growth is more often considered to be good for solving problems of unemployment, while not necessarily be harmful to the environment. These mental models are of importance for developing SD education. For example, often it is argued that the level of consumption is so high that it is unsustainable. How, then, to discuss such issues when a majority is convinced economic growth, which often implies an increase in consumption, is good?

Table 7. Priorities – comparison of issues

Nr.	Question	Disagree strongly	Disagree	Neither agree nor disagree	Agree	Agree strongly	Median	Mode
1.	The less the government intervenes in the economy, the better it is for our Country	39	117	191	127	50	Neither agree nor disagree	Neither agree nor disagree
2.	The government should take measures to reduce differences in income levels	15	53	88	232	149	Agree	Agree
3.	Economic growth always ends up harming the environment	30	202	196	79	18	Neither agree nor disagree	Disagree
4.	Economic growth solves problems of poverty and unemployment	10	115	142	204	52	Neither agree nor disagree	Agree
5.	Modern science can be relied on to solve our environmental problems	7	30	123	268	99	Agree	Agree
6.	Economic growth is more important than solving environmental problems	79	198	179	57	16	Disagree	Disagree
7.	Economic growth is more important than solving the problem of unemployment	71	224	177	54	16	Disagree	Disagree
8.	Solving the problem of unemployment is more important than solving environmental Problems	23	153	208	121	28	Neither agree nor disagree	Neither agree nor disagree
9.	It is more important to solve the problem of poverty in my country than in the poor African countries	43	105	164	140	74	Neither agree nor disagree	Neither agree nor disagree
10.	The problem of global warming is more important than making drinking water in our region cleaner	31	125	231	103	32	Neither agree nor disagree	Neither agree nor disagree

Source: Author's own research

N=623

Concluding remarks

The analysis of organisational models shows that in a situation where organisational structures are unclear and goals generally defined and/or ambiguous, interest groups are very likely to influence the priorities in SD education. As a result, it becomes more difficult to introduce SD education and change ways of working. Changes are needed as not only SD is becoming more and more important, but also the development of Information Technology creates new challenges in education, as it is one of the most important sources of information for students, with a medium-high perceived level of reliability. Scientific publications are considered to be very reliable, according to students. This creates opportunities for e-learning and the use of modern communication technologies in education.

However, it is likely that in SD education the focus will be on one of the three pillars – economy, social issues or environment. As was theoretically shown, in practice, economy seems to be more important than social and environmental issues. Global environmental problems seem to be more important than poverty in e.g. Africa. Government policy and the “external demand” from firms are likely to strengthen such priorities in study programmes. For students, work and income as well as locally-specific environmental problems are important. Economic issues are not necessarily the most important compared to social and environmental issues that have direct influence on the quality of life of the students. Such factors may also influence the development of study programmes, in particular when courses are optional.

An interesting issue for further research is to what extent which stakeholders influence the development of curriculum in a university which organisationally may be characterised by goal ambiguity and unclear governance structures. There is a great challenge in this respect to introduce SD education. For this, probably a strong dedicated group is needed, but also a continuous discussion on the introduction of elements of SD education in different programmes. However, it should be kept in mind that the market, by its nature, will set economic priorities. As a result, science and education may fail to search for solutions of more general problems and research the issues that are more difficult to measure.

References

- Baldrige, J.V. (1983), “Organizational Characteristics of Colleges and Universities”, In: Baldrige, J.V., Deal, T. (eds.), *The Dynamics of Organizational Change in Education*, Berkeley, McCutchan Publishing Corporation, pp. 38-59
- Bass, S., Dalal-Clayton, B. (2004), “National Sustainable Development Strategies”, In: Bigg, T. (ed.), *Survival for a Small Planet - the sustainable development agenda*, London, Earthscan, pp. 101-120
- Ben-Ner, A., Putterman, L. (1998), “Values and Institutions in Economic Analysis”, In: Ben-Ner, A., Putterman, L. (eds.), *Economics, Values, and Organization*, Cambridge, Cambridge University Press, pp. 3-69
- Castells, M. (1996), *The Rise of the Network Society*, Cambridge, Blackwell Publishers
- Cohen, M.D., March, J.G. (1991), “The Processes of Choice”, in: Peterson, M.W., Chaffee, E.E., White, H. (eds.), *Organization and Governance in Higher Education, An ASHE Reader*, fourth edition, Needham Heights, Simon & Schuster Custom Publishing, pp. 175-181
- Cohen, M.D., March, J.G., Olsen, J.P. (1972), “A Garbage Can Model of Organizational Choice”, *Administrative Science Quarterly*, Vol. 17, No. 1, pp. 1-25
- Ellström, P.-E. (1983), “Four Faces of Educational Organizations“, *Higher Education*, Vol. 12, pp. 231-241
- Meadows, D. (1999), *Leverage Points – places to intervene in a system*, Hartland, The Sustainability Institute
- Platje, J. (2006a), “Challenges in Introducing Sustainable Development Education at Universities - Examples of Poland”, In: Leal Filho, W. (ed.), *Environmental Education, Communication and Sustainability*, 24, *Innovation, Education and Communication for Sustainable Development*, Frankfurt am Main, Peter Lang verlagsgruppe, pp. 177-193

Platje, J. (2006b), "Who is Interested in what Kind of Sustainable Development? Time-horizons and stakeholder interests", In: Platje, J., Słodczyk, J., Leal Filho, W. (eds.), *Economic and Environmental Studies 2006/8, Current Issues of Sustainable Development*, Opole, Wydawnictwo Uniwersytetu Opolskiego, pp. 13-20

Platje, J. (2006c), „Nowa Ekonomia Instytucjonalna jako „narzędzie” analizy i implementacji zasad i celów zrównoważonego rozwoju”, paper presented at conference on „Zrównoważony rozwój w teorii i praktyce”, Wrocław 29-30 June

Platje, J. (2007a), *Good Governance as a Condition for Urban Sustainable Development*, unpublished paper

Platje, J. (2007b), "Institutional Capital" as a Factor of Sustainable Development – the importance of an institutional equilibrium", article will be published in *Economic and Environmental Studies 2008/11*

Platje, J., Czarnecka, A., Dembicka, A., Najgebauer, L., Rokita, D. (2006), „Zrównoważony rozwój oraz poziom jakości życia w świetle opinii mieszkańców Opola”, In: Słodczyk, J., Rajchel, D. (eds.), *Polityka zrównoważonego rozwoju oraz instrumenty zarządzania miastem*, Opole, Wydawnictwo Uniwersytetu Opolskiego, pp. 99-104

Schopenhauer, A. (2003), *W poszukiwaniu mądrości życia (Parerga und Paralipomena)*, Tom 2, Kęty, Wydawnictwo Antyk

Smith, A. (1776), *An Inquiry into the Nature and Causes of the Wealth of Nations*, Reprint edited with an introduction by Kathryn Sutherlands, Oxford University Press, Oxford, 1998

Todaro, M.P. (1997), *Economic Development*, sixth edition, London, Longman

Van der Gaast, W., Platje, J. (1997), "Industrial Development in Poland, the Environment as a Boundary Condition", In: Olszewski, L., Mozrzyk, J. (eds.), *Struktury Przemysłowe w Gospodarstwie*, Wrocław, Wydawnictwo Uniwersytetu Wrocławskiego, pp. 161-182

Veblen, T. (1965), *The Higher Learning in America; a memorandum on the conduct of universities by business men*, Kelly, New York, Kelly [Reprint of the original edition: Huebsch, New York, 1918]

Films as an Environmental Education Tool in Higher Education

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Abstract

Academic institutions face the challenge to demonstrate the interconnection of Environmental Education to economic, social and technological issues and related environmental solutions. The ultimate goal of Environmental Education is to reach all citizens and assist them in the development of critical evaluation and active participation in the environmental decision making process. The field of Environmental Communication has focused its attention on public participation, while participatory communication is one of the major theoretical frameworks of sustainable development. Entertainment Education is a development communication strategy for social change that can be applied in higher education, thus entertainment media, films in particular, can provide learning opportunities that would be difficult or impossible to create through traditional means.

Keywords:

Environmental education, environmental communication, citizen participation, entertainment education, films

1. Introduction

Academic institutions face the challenge to demonstrate the interconnection of Environmental Education (EE) to economic, social and technological issues and related environmental solutions (Skanavis, 2002). EE, since the earliest days of proclaiming an ecological crisis, has been called by environmentalists as a means towards the solution of environmental problems (Gough, 1995). EE programs focus on promoting responsible citizenship behavior - by providing citizens with the appropriate skills for critical thinking and with the ability to actively participate in environmental decision-making processes (Skanavis, et al., 2005).

The Entertainment Education, also known as “enter-educate” or “edutainment”, approach has been identified as one that most effectively combines these “best practices” elements by disseminating information through the media in a combination of entertainment and education (U.S. Centers for Disease Control and Prevention, 2004).

This paper suggests that Entertainment Education can be used as a strategy for the implementation of EE in higher education. In this framework, the role of EE and Environmental Communication towards citizen participation, the Entertainment Education practice and research and the prospects of films as educational tools will be examined in higher educational struggles for empowerment and public participation in the environmental policy decision-making.

2. Environmental Education, Environmental Communication and Participation

The idea of EE was developed in the decades of '60s-'70s, during the evolution of the environmental movement and it was considered as one of the most effective measures for environmental problems. EE focused on education for all citizens and it was aiming in fundamental changes in environmental attitudes, behaviors and values of citizens of all age groups. The objectives for EE from the 1977 UNESCO-UNEP Tbilisi Intergovernmental Conference on EE (UNESCO, 1978) - awareness, knowledge, attitudes, skills, and participation - provide major guidance for building environmentally effective human behavior. According to Hungerford et al (1980), the "super ordinate goal" of EE is to aid participants in becoming environmentally knowledgeable and, above all, skilled and dedicated citizens who are willing to work, individually and collectively, towards achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment.

Environmental concern and the resulting environmentally responsible behavior are affected by a complex interaction of attitudes, beliefs and socio-demographic variables. In an effort to detect, which characteristics make citizens participate in the protection and restoration of the environment, several researchers have attempted to develop models and techniques for assessing responsible environmental behavior (Hines et al., 1986, Hungerford and Volk, 1990) and have shown how a behavioral manipulation of many variables can result in people's participation in desirable environmental behaviors. According to Sia (1984), Sivek (1989) and Marcinkowski (1989) there are five predictors of Responsible Environmental Behaviour: individual and group locus of control, knowledge of and skills in using action strategies and environmental sensitivity. Their findings were supported by Lierman (1996), Hsu (1997) and were included in the "Guidelines for Excellence" of the National American Association of Environmental Education (NAAEE), (Marcinkowski, 1998).

EE aims to facilitate active, environmentally literate citizens to participate in a responsible way (NAAEE, 1996). As active participants, people will recognize, support, and raise local issues at national policy planning levels (Scriabine, 1996).

Citizen participation has been demonstrated as one of the main EE objectives in 1975, at the declaration of the UNESCO-UNEP Belgrade workshop and in 1977, at the Tbilisi Declaration (Skanavis, et al., 2005). In 1987, at the UNESCO-UNEP Tbilisi + 10 international congress in Moscow it was agreed that EE should promote awareness, knowledge, attitudes and values, provide criteria and directives for decision-making and resolution of environmental problems (UNESCO-UNEP, 1988) and in 1992, at the United Nations Conference on Environment and Development in Rio de Janeiro it was formulated that the environmental issues are better resolved with the participation of all interested citizens (UNCED, 1992). At the United Nations World Summit on Sustainable Development, held in Johannesburg in 2002, it was reported that sustainable development requires wide participation in the decision-making process (UN, 2002).

Participation is usually defined as the involvement of citizens in the decision-making process (Fiorino, 1996, Fulop, 1999, Siouti, 1998, Brohman, 1996, Osler, 1997). Participation might be seen as an intervention in the administrative processes of decision-making (Skanavis et al., 2005). It is expressed through legal procedures, letters of protest, nongovernmental organization (NGO) activities and the individual actions of citizens (Fiorino, 1996). Public participation is a core concept in the environmental policy decision-making (Skanavis et al., 2005, Walker, 2007).

Social goals (Beirle, 1998, 1999) as education and information of public, incorporation of values of citizens in the process of decision-making, improvement of essential quality of decisions,

strengthening confidence in the institutions, alleviation of conflicts and pursuit of cost-effectiveness, can lead to the development of public participation programs, support the evaluation of innovative methods, and promote the comprehension of citizen participation process.

Environmental Communication (EC) scholars recognize the importance of dialogue, deliberation, and learning as important features of public participation (Walker, 2007). The role of EC should be to increase the quality of enlightened decision-making, so that societies can be more fully functional in their identification, assessment, and management of risks (Heath et al., 2007).

EC is an open, give-and-take between interested parts about an environmental issue, the dissemination and exchange of environmental information, a strategic use of communication processes and media aiming at the effective support of environmental policy formation, citizen participation and application of sustainable development programs (Harrison, 1993, Bolli, 1999, OECD, 1999). The framework of EC is broader than the field of EE, so that EC encompass EE (OECD, 1999). EC influences the sentimental and spiritual aspects of human behaviour, resulting to a positive feeling towards the environment. All these lead to the Environmental Sensitivity, an important factor for the shaping of a responsible environmental behaviour. Sensitivity to environmental issues is one of the key aspects for triggering the society's response to pressures on the environment (Marletta et al., 2004).

Today, access to information and information services, accumulated knowledge and learning opportunities is fast, cheap and efficient and can be done without any significant spatial and temporal constraints (Marletta et al, 2004). This modification is having a strong influence on human behaviour and the changes induced can have a significant effect on the environment (Greiner et al., 1996, Jokinen et al., 1998). Environmental information now, more than ever, can have strong influence in human behaviour towards the environment. For Heath et al.,(2007) the main product of EC "is not informed understanding as such, but the quality of the social relationship it supports, becoming a tool for communicating values and identities as much as being about the awareness, attitudes, and behaviours related to the risk itself".

3. Entertainment Education

While the field of EC has focused attention on public participation, the international development community has promoted participatory communication (Walker, 2007). Development is achieved by the development of communication strategies and principles in the developing world (Waisbord, 2001). Communication has become an important aspect of development initiatives in health, nutrition, agriculture, family planning, education and community economics (Chang, 2006, Servaes and Malikhao, 2004). Diffusion theory and participatory communication are two major theoretical frameworks in development communication.

Diffusion theory explains beneficiaries' adoption of an innovation that results in their behavior change and subsequent societal change as the aggregation of individual change (Chang, 2006). Mass media are important in spreading awareness of new possibilities and practices (Servaes and Malikhao, 2004). One characteristic of diffusion theory criticized by participatory scholars is its one-way information flow (Chang, 2006). They argue that this diffusion model is a vertical or one-way perspective on communication, and that development will accelerate mainly through active involvement in the process of the communication itself (Servaes and Malikhao, 2004). Jacobson (2003) observes that participatory communication places its highest value not on transfers of knowledge from outside developing societies, but rather on reliance on local knowledge and local capability. Tonn and Petrich (1998), assert that robust public participation methods help citizens build citizenship capabilities, establish identities, craft ideologies, better understand governance, construct and maintain social networks, and receive rewards for their effort. The impossibility to combine the two approaches does not influence their important role in development; it just suggests that these two models can be applied to achieve different development goals. The participation

model cannot replace diffusion processes in every situation, nor can diffusion be always privileged over participation (Chang, 2006).

Walker (2007) demonstrates that EC and sustainable development communication have much in common, and deserve attention from scholars and practitioners of both. Walker believes that pluralistic public-participation advocates can use to engage citizen stakeholders meaningfully in environmental policy decision situations.

According to the 8th United Nations Roundtable on Communication and Sustainable Development (Nicaragua, November 2001), communication strategies for the implementation of sustainable development could be identified at three levels: *behavior change communication* that explains individual, interpersonal and community or societal behavior, *advocacy communication* targeted primarily at policy-makers or decision-makers at national and international level and *communication for social change* that combines behavioral change and advocacy communication with aspects of the wider environment that influences and constrains structural and social change (Servaes and Malikhao, 2004).

Behavior change models have been the dominant paradigm in the field of development communication. Different theories and strategies shared the premise that problems of development were basically rooted in lack of knowledge and that, consequently, interventions needed to provide people with information to change behavior (Waisbord, 2001). Behavior change is a complex process motivated by multiple factors, including an awareness of the need to change, an understanding of the benefits of such change, a belief in one's ability to put the required skills into practice in different settings, and confidence in one's ability to maintain new behavior in light of changing circumstances. Behaviour change communication must move people from awareness to action by instilling the belief that desired outcomes will be obtained by changing behavior and by increasing individuals' sense of control over their own behaviour (Fatusi and Jimoh, 2006).

Communication scholars and media practitioners around the world began to be interested in and recognize the effect of entertainment education on individuals' behavioural change and social change (Bae and Lee, 2004). According to Singhal and Rogers (1999), "Entertainment-Education is the process of purposively designing and implementing a media message both to entertain and educate, in order to increase audience member's knowledge about an educational issue, create favourable attitudes, and change overt behaviour". Entertainment education is not a theory of communication, but rather a strategy used to disseminate ideas to bring about behavioural and social change (Singhal and Rogers, 2002).

Entertainment education was originally labelled as ally of diffusion theory, as a one-way transmission of information to generate behaviour change (McCee, 1994, Waisbord, 2001, Morris, 2003). However, it is argued that entertainment education has the potential to move from the manipulation-end to the empowerment-end in the diffusion-participation spectrum, in that entertainment education is audience interest-oriented and require beneficiaries' feedback of their needs, desires, and perceptions of development problems in formative research, (Gumucio Dagon, 2001, Jacobson, 2003, Jacobson and Storey, 2004).

Singhal and Rogers (2002) at their article for the special issue of *Communication Theory*¹ on Entertainment Education suggest that Entertainment Education interventions are likely to see more integration with participatory communication approaches. They introduce the work of Brazilian theater director Augusto Boal, who invited audience members up onto the stage to suggest and enact different actions for the actors. Boal's techniques have been used by community organizers and facilitators as participatory tools for analyzing social problems and transforming reality through direct actions (Singhal, 2001). Sustainable development projects have featured participatory communication through visual activities such as participatory photography and participatory video (Singhal and Devi, 2003), and participatory theatre (Harter et al., 2007).

¹ 12(2), May 2002

Entertainment education is a widely used strategy in health communication (Elkamel, 1995, Montgomery, 1989, Singhal and Rogers, 1989, Steckler et al., 1994, Winsten, 1994). The use of entertainment media favours a storytelling approach to health awareness campaigns, in contrast to the dissemination of specific messages or points of view through advertising, news programs, or documentaries (McGuire, 1984, Rice and Atkins, 1989, Wallack, et al., 1993). The development of Entertainment Education reflects the growth and development of the commercial entertainment industry, particularly film and television (Glik et al., 1998). Entertainment film and television productions have attained high market penetration (Finney, 1994) and have been effective in shaping audience response (Bryant, 1989), setting specific agendas (Dearing and Rogers, 1996), and shaping culture more generally (Gerbner, et al., 1994). The fact that mass media programming is largely entertainment (Postman, 1985) makes the use of entertainment education strategies eminently logical (Glik et al., 1998).

As applied in development communication, Entertainment Education was originally developed in Mexico in the mid-1970s and has been used in 75 countries, including India, Nigeria, the Philippines, Turkey, Gambia, and Pakistan (Backer et al., 1992, Elkamel, 1995, Kincaid et al., 1993, Nariman, 1993, Singhal and Rogers, 1989, Waisbord, 2001).

Singhal and Rogers (2002) suggest that in the future “entertainment education will also go beyond the boundaries of its mainstay messages – reproductive health, family planning and HIV prevention – to include other pressing social issues such as peace, conflict mediation, race relations and reconstruction”. Servaes and Malikhao, (2004) at their background paper for the 9th United Nations Roundtable on Communication and Sustainable Development, list entertainment education as one of the approaches in relation to sustainable development.

4. Films in higher education

Entertainment media can provide learning opportunities that would be difficult or impossible to create through traditional means (Forney, 2004). Brookfield and Preskill (1999) note the value of concrete images for visual learners and the general value of changing pace and format to accommodate different learning styles. Champoux (1999) indicates that some research suggests that individuals learn abstract, new and novel concepts more easily when presented in both verbal and visual form.

Cinema is one of the most influential mediums of modern culture, the dominant art form of the twentieth century (Jameson, 1991). As the most massive and most revealing forum for social attitudes and assumptions, where popular images are projected twice real life-size (Larabee and Riesman, 1957), movies provide an important insight into the public perception of environmental issues and the public’s role towards their solution. Moreover, research suggests that visual images are a particularly powerful medium for conveying information to the viewer (Epstein, 1998, Goleman, et al., 2002).

Films are now widely available for inexpensive rental or purchase, making them an accessible resource for classroom use. The nature of film as a device for storytelling and for the communication of information has ensured its presence in a teaching context. In the last few decades, in particular since the availability of video, film has become accepted as an object of study and an effective teaching aid in a range of subject areas, including language teaching, literary studies, history, sociology, and the sciences (Hughes, 2005).

Since the 1970s, educators experienced in using film as a teaching tool have urged its adoption by others (Culkin, 1970, Maynard, 1969, 1971, 1977). Wegner (1977) described various film types and how to use them in the classroom. Many others have reported successfully using films in teaching a broad range of disciplines or topics, such as political science, American Studies, French, group dynamics, science, and anthropology (Bloom, 1995, Dubeck, 1990, Foreman and Thatchenkery, 1996, Funderburk, 1978, Johnson and Iacobucci, 1995, Kranzendorf, 1980, Michaud, 1997, O'Meara, 1976, Ruby, 1976, Sanchez, 1976).

Film is unequalled in its ability to hold and direct the attention of the viewer (Champoux, 1999). Lens techniques, camera movements, camera angles, framing of shots, and film editing can create gripping views not found in reality (Carroll, 1985). Viewers are not simply passive observers of images on a screen (Champoux, 1999). They can have many different responses, some of which come from film's unique features (Allbritton and Gerrig, 1991, Gerrig and Prentice, 1996).

Films can help students find a personal connection to course material (Baxter Magolda, 2001), thereby situating learning in the students' own experiences; connect themes to their own lives, thereby validating students as knower and facilitate their making meaning together with their teachers (Forney, 2004). Wedding and Boyd (1999) observe that film is an integral part of our culture, a mirror in which we see ourselves. Boyatzis (1994) maintains that movies tell a story and offer a powerful aesthetic experience and for these reasons alone can be an effective teaching tool. Films can provide common images and a common framework to support discussion of difficult subjects; they also grab the audience's attention viscerally and quickly (Seyforth and Golde, 2001), holding and directing the attention of the viewer (Champoux, 1999). Films often address the affective realm (Hesley and Hesley, 1998), engaging students' feelings in addition to their thinking capacities. Films can aid in gaining insight into self and relationships, which can lead to altered thoughts, feelings, and behaviours (Heston and Kottman, 1997). Films can energize a group (Koch and Dollarhide, 2000), encourage engagement in discussion (Anderson, 1992), and enhance rapport between the group and instructor (Koch and Dollarhide, 2000). They can improve students' skills in taking different or new perspectives (Anderson, 1992).

Inexperienced students will likely benefit from the use of film because of a greater feeling of reality, while showing concepts through different film scenes also shows the application of these concepts in different situations (Champoux, 1999). Films can give a longitudinal perspective or build a bridge to the world of action (English and Steffy, 1997).

Films can serve many functions in a teaching program, according to the teaching style, goals, and course content. The ways of using film in a teaching program are as case analysis, experiential exercise, metaphor, satire, symbolism, meaning, experience and time (Champoux, 1999). According to Hughes (2005), there are two distinct ways in which film features in higher education courses, as a primary focus, and as a secondary means to an end. The primary focus involves the study of core films as self-contained texts in their own right. The primary material for such courses is a selection of set films, which may be linked by a broader historical or thematic context (such as the silent era, or modernism). The second way advocates the use of film not as the primary object of study, nor as a means of communicating core information; instead the motivation is simply to engage the interest of students, to encourage an interest in the subject that can be developed and/or corrected in the 'actual' class.

5. Conclusion

According to Skanavis (2002), "we are confronted in Greek academia with the difficulty that is experienced all over the world. EE isn't well understood. The majority of researchers are coming from natural sciences (chemists, biologists, geologists etc) and environmental engineering disciplines probably because they can more easily understand the nature of environmental mechanisms, functions and consequences." Universities have the resources, vision, opportunity, and responsibility to lead themselves and their societies towards sustainability, one step at a time (Breyman, 1999). Universities should implement an environmental studies course requirement for all graduates, or the development of an integrated general education program that accomplishes environmental literacy through its integration in a variety of courses (Wilke, 1995).

Environmental education can constitute a dynamic means of stimulating environmental behavior. Entertainment education uses the universal appeal of entertainment to contribute to social change. Films can foster environmental sensitivity, awareness, and attitude and encourage participation in the environmental-decision making process. The dissemination of environmental information

through films can reinforce critical and creative thinking, participation skills and action towards the solution of environmental problems. This study contributes to an understanding of the significance of films as agents of environmental information, teaching tools and entertainment education interventions in higher education in order to foster environmentally responsible citizens. Future research may be important to look more closely at gender differences as they interact with other demographic factors as age, in order to measure the impact of environmentally themed entertainment education interventions, such as environmentally themed films, in higher education.

References

- Allbritton, D., and Gerrig, R. (1991) "Participatory responses in prose understanding" *Journal of Memory and Language*, Vol. 30, pp. 603-626.
- Anderson D. (1992) "Using feature films as tools for analysis in a psychology and law course" *Teaching of Psychology*, Vol. 19, pp. 155-158
- Backer, T.E., Rogers, E.M., and Sopory, P. (1992), *Designing health communication campaigns: What works?* Newbury Park, CA: Sage.
- Bae Hyuhn-Suhck and Lee Byoungkwan, (2004) "Audience involvement and its antecedents: an analysis of the electronic bulletin board messages about an entertainment-education drama on divorce in Korea", *Asian Journal of Communication*, Vol. 14, No. 1, pp. 6-21
- Baxter Magolda M.B. (2001), *Making their own way*, Sterling, VA: Stylus
- Beierle T.C. (1999), *Evaluating Public Participation in Environmental Decisionmaking*, Resources For The Future
- Beierle T.C. (1998), *Public Participation in Environmental Decisions: An Evaluation Framework Using Social Goals*, RESOURCES FOR THE FUTURE, Discussion Paper 99-06
- Beierle, T.C. and Cayford, J.C. (1999), *The Determinants of Successful Public Participation in Environmental Decisionmaking*, Resources For The Future
- Beierle, T.C. and Cayford, J.C., (2001), *Evaluating Dispute Resolution as an Approach to Public Participation*, Resources For The Future
- Beierle, T.C. and Cayford, J.C. (2002), *Democracy in Practice: Public Participation in Environmental Decisions*, RESOURCES FOR THE FUTURE
- Bloom, M.E. (1995) "Using early silent film to teach French: The language of cinéma muet", *ADFL-Bulletin*, 27, pp. 25-31
- Bolli A. (1999), *Environmental Communication and Competitiveness - Case Study in the Car Industry*, M.Sc. Thesis, International Institute for Industrial Environmental Economics, Lund University
- Boyatzis C.J. (1994) "Using feature films to teach social development", *Teaching of Psychology*, Vol. 21, pp. 99-101

- Breyman, S.(1999) “Sustainability through Incremental Steps? The Case of Campus Greening at Rensselaer”, in Filho, W.L. (ed), Sustainability and University Life, Peter Lang, Frankfurt am Main, pp. 79-88
- Brookfield, S.D. and Preskill, S. (1999), Discussion as a way of teaching, San Francisco, Jossey-Bass
- Bryant, J. (1989) “Message features and entertainment effects”, in Bradac J.P. (Ed.), Message effects in communication science, Newbury Park, CA: Sage, pp. 231- 262
- Brohman, J. (1996), Rethinking the Theory and Practice of Development, Blackwell Publishers
- Carroll, N. (1985) “The power of movies”, Daedalus, Vol. 114, pp.79-103.
- Champoux J.E. (1999) “Film as a Teaching Resource”, Journal of Management Inquiry, Vol. 8, pp. 206-217
- Chang Li-Yuan, (2006), Rethinking Participation in Development Communication:
A Dialogue with the Diffusion Model, International Association for Media and Communication Research Conference, Cairo, Egypt, July 23-28
- Culkin, J.M. (1970) “Films deliver”, in Schillaci A. and Culkin J.M. (Eds.), Films deliver: Teaching creatively with film, New York, Citation Press, pp. 19-29
- Davies, J.C. (1998), Public Participation in Environmental Decision-Making and the Federal Advisory Committee Act, Resources For The Future
- Dearing, J., and Rogers, E.M. (1996), Agenda setting, Newbury Park, CA: Sage.
- Dubeck, L. (1990) “Science fiction aids science teaching”, Physics Teacher, Vol. 28, pp. 316-318.
- Elkamel, F. (1995) “The use of television series in health education”, Health Education Research, Vol. 10, pp. 225-232
- English F.W. and Steffy B.E. (1997) “Using film to teach leadership in educational administration”, Educational Administration Quarterly, Vol. 33, pp. 107-115
- Epstein S. (1998), Constructive thinking – the key to emotional intelligence, Pragger Publishing
- Fatusi A.O., and Jimoh A., (2006) “The roles of behaviour change communication and mass media”, in Olusoji Adeyi, Phyllis J. Kanki, Oluwole Odutolu, John Idoko (eds), AIDS in Nigeria, A Nation on the Threshold, Harvard University Press, pp. 323-348
- Finney, R.G. (1994) “Television”, In Handbook on mass communication, Westport, CT: Greenwood, pp. 167- 188
- Fiorino, D.J. (1996) “Environmental policy and the participation gap”, in Lafferty W. M., Meadowcroft J., (Eds), Democracy and the Environment, Problems and Prospects, Edward Elgar, Cheltenham UK, Lyme, US

- Foreman, J., and Thatchenkery, T. (1996) "Filmic representations for organizational analysis: The characterization of a transplant organization in the film *Rising Sun*", *Journal of Organizational Change Management*, Vol. 9, pp. 44-61.
- Forney D. (2004) "Introduction to Entertainment Media Use", *New Directions for Students Services*, no.108
- Fulop, S. (2002) WHY DO WE WANT PUBLIC PARTICIPATION IN ENVIRONMENTAL DECISION-MAKING?, Fifth Guta Conference, Budapest Accessed at [http://www.osi.hu/infoprogram/commworkshop Presentations/PPCIKK.htm](http://www.osi.hu/infoprogram/commworkshop/Presentation/PPCIKK.htm) on January 2005
- Funderburk, C. (1978) "Politics and the movie", *Teaching Political Science*, Vol. 6, pp. 111-116.
- Gerbner, G., Gross, L., Morgan, M., and Signorelli, N. (1994) "Growing up with television: The cultivation perspective", in J. Bryant and D. Zillmann (Ed.), *Media effects: Advances in theory and research*, Mahwah, NJ: Erlbaum, pp. 17- 42
- Gerrig, R.J., and Prentice, D.A.(1996) "Notes on audience response", in D. Bordwell and N. Carroll (Eds.), *Post-theory: Reconstructing film studies*, Madison, WI: The University of Wisconsin Press.
- Glik, D., Berkanovic E., Stone K., Ibarra L., Connell Jones M., Rosen B., Schreibman, M., Gordon L., Minassian, L., Richardes D., (1998) "Health Education Goes Hollywood: Working with Prime-Time and Daytime Entertainment Television for Immunization Promotion", *Journal of Health Communication*, Vol.3, pp. 263-282
- Goleman D., R. Boyatzis and A. Mckee (2002), *Primal leadership: realizing the power of emotional intelligence*, Boston, Harvard Business School Press
- Greiner C., Raidermaker F.J. and Rose T.(1996), *Contribution of the Information Society to Sustainable Development, Report of the Working Circle: A DGXIII-Initiated Group on Sustainability and the Information Society.*
- Gough, A. (1995) *Recognising women in environmental education pedagogy and research: Towards an ecofeminist poststructuralist perspective*, Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA, April 18-22.
- Gumucio Dagnon, A. (2001), *Making waves: Stories of participatory communication for social change*, New York: Rockefeller Foundation.
- Harrison B. (1993), *Going Green: How to communicate your company's environmental commitment*, Homewood (USA), Business One, Irwin
- Harter, L., Sharma, D., Pant, S., Singhal, A., and Sharma, Y. (2007) "Catalyzing social reform through participatory folk performances in rural India", in L. Frey & K. Carragee (Eds.), *Communication activism: Communication for social change* (Vol. 2). Cresskill, NJ: Hampton Press.
- Heath R.L., Palenchar M.J., Proutheau S., Hocke T., (2007) "Nature, Crisis, Risk, Science, and Society: What is Our Ethical Responsibility?", *Environmental Communication*, Vol. 1, No. 1, pp. 34-48
- Hesley J.W. and Hesley J.G. (1998), *Rent two films and let's talk in the morning: Using popular movies in psychotherapy*, New York, Wiley

- Heston M.L. and Kottman T. (1997) "Movies as metaphors: A counseling intervention", *Journal of Humanistic Education and Development*, Vol. 36, pp. 92-99
- Hines, J., Hungerford, H. and Tomera, A. (1986-87) "Analysis and synthesis of research on responsible environmental behaviour", *Journal of Environmental Education*, 18, 1-8
- Hughes J., (2005), *Teaching Film, Film in Teaching: A Critical Survey of Current Theory and Practice*, Capital Papers Database, Educational Development Center, Royal Holloway, University of London, accessed at http://www.rhul.ac.uk/Educational-Development/Centre/new_lecturers/capital-papers.htm on June, 2007.
- Hungerford, H., Peyton R., and Wilke R., (1980) "Goals for Curriculum Development in Environmental Education", *Journal of Environmental Education*, Vol.1, No.3, pp. 42-47
- Hungerford, H. and Volk, T. (1990), "Changing Learner Behavior through Environmental Education", *Journal of Environmental Education*, Vol. 21, No, 3, pp. 8-21
- Jacobson, T. L. (2003) "Participatory communication for social change: The relevance of the theory of communicative action", in P. J. Kalbfleisch (Ed.), *Communication yearbook 27*, Mahwah, NJ: Lawrence Erlbaum, pp. 87-123
- Jacobson, T.L., and Storey, J.D. (2004) "Development communication and participation: Applying Habermas to a case study of population programs in Nepal", *Communication Theory*, Vol.14, No 2, 99-121.
- Jameson F. (1991), *Postmodernism or the cultural logic of late capitalism*, Durham, North Carolina, Duke University Press
- Jokinen, P. (et al.) (1998) "The Environment in an Information Society", *Futures*, Vol. 30, No 6
- Johnson, S. D., and Iacobucci, C. (1995) "Teaching small group communication with The Dream Team", *Communication Education*, Vol. 44, pp.177-182.
- Kranzdorf, R.I. (1980) "Political science film courses: More than meets the eye", *Teaching Political Science*, Vol. 7, pp. 345-352.
- Kincaid, L., Yun, S. H., Piotrow, P., and Yasar, Y.(1993) "Turkey's mass media family planning campaign", in R. Backer, E. Thomas, and E. M. Rogers (Eds.), *Organizational aspects of health communications campaigns: What works*, Newbury Park, CA: Sage, pp. 68- 199
- Koch G. and C.T. Dollarhide (2000) "Using a popular film in counselor education: Good Will Hunting as a teaching tool", *Counselor Education and Supervision*, Vol. 39, pp. 203-210
- Larabee E. and D. Riesman (1957) "Company-Town pastoral: The role of Business in 'Executive Suite'", in B. Rosenberg and D. Manning (eds.), *Mass Culture: The Popular Arts in America*, London: The Free Press of Glencoe, Collier-MacMilan Limited, pp.325-337
- Marcinkowski, T. (1998) "Predictors of Responsible Environmental Behavior: A Review of Three Dissertation Studies", In *Essential Readings in Environmental Education*, The Center for Instruction, Staff Development and Evaluation, The Center for Instruction, Staff Development and Evaluation

- Marcinkowski, T.J. (1989), An analysis of correlates and predictors of responsible environmental behaviour, Unpublished doctoral dissertation, Southern Illinois University, Carbondale.
- Marletta P., A. Pasquini, G. Stacey and L. Vicario (2004), The environmental impact of ISTs', Final Project Report, e-living project, accessed at www.eurescom.de/e-living on January 2005
- Maynard, R.A. (1969) "The social studies and media", *The Social Studies*, Vol. 60, pp. 327-329.
- Maynard, R.A. (1971), *The celluloid curriculum:How to use movies in the classroom*. New York: Hayden Book Company, Inc.
- Maynard, R. A. (1977), *Classroom cinema*, New York, Teachers College, Columbia University.
- McKee, N. (1994). "A community-based learning approach: Beyond social marketing", in S. A. White, K. S. Nair and J. Ascroft (Eds.), *Participatory communication: Working for change and development*, New Delhi: Sage.
- McGuire, W.J. (1984) "Public communications as a strategy for influencing health promoting behavior change", *Preventive Medicine*, Vol. 13, pp. 299- 319.
- Michaud, G. (1997) "Class Conflicts: Teaching the war film", *Radical Teacher*, 22, 12-16.
- Monroe, M. C., Day, B. A. and Grieser, M. (2000) "GreenCOM Weaves Four Strands", in Day, B. A. and Monroe, C. M. (Eds), *Environmental Education & Communication for a Sustainable World*, GreenCom, accessed at <http://www.usaid.gov/environment/greencom> on March 2007
- Montgomery, K. (1989), *Target: Prime time*, New York , Oxford University Press.
- Morris, N. (2003) "A comparative analysis of the diffusion and participatory models in development communication", *Communication Theory*, Vol.13, No 2, pp. 225-248.
- NAAEE, (1996), *Environmental Education Materials: Guidelines for Excellence*, Washington D.C., North American Association for Environmental Education
- Nariman, H. N. (1993), *Soap operas for social change*, Westport, CT: Praeger.
- OECD (1999), *Environmental Communication: Applying Communication Tools Towards Sustainable Development*, OECD
- O'Meara, P.(1976) "The use of full length commercial films in political science undergraduate education", *Teaching Political Science*, Vol. 3, pp. 215-221.
- Osler, A. (1997), *The Contribution Of Community Action Programmes In The Fields Of Education, Training And Youth To The Development Of Citizenship With A European Dimension*, Final Report to the European Commission, The University of Birmingham
- Postman, N. (1985), *Amusing ourselves to death*, New York, Viking.
- Rice, R. E., and Atkins, C.J. (1989), *Public communications campaigns* (2nd ed.). Newbury Park, CA: Sage.
- Ruby, J. (1976) "Anthropology and film: The social implications of regarding film as communication", *Quarterly Review of Film Studies*, Vol.1, pp. 436-445.

Sanchez, J. M. (1976) "Hollywood comes to class: A course on the American political film" *Teaching Political Science*, Vol. 4, pp. 93-100.

Scriabine, R. (1996), *Putting People into Policy: The Role of Environmental Education and Communication*, GreenCom

Servaes J., and Malikhao P., (2004), *Communication and Sustainable Development*, Background Paper, 9th United Nations Roundtable on Communication for Development, 6-9 September, Rome, Italy

Seyforth S.C. and C.M. Golde (2001) "Beyond the paper chase: Using movies to help students get more out of college", *About Campus*, Vol. 6, pp. 2-9

Sia, A.P. (1984), *An investigation of selected predictors of overt responsible environmental behaviour*, Unpublished doctoral dissertation, Southern Illinois University, Carbondale

Singhal, A., (2001), *Facilitating community participation through communication*, New York, UNICEF

Singhal, A., and Devi, K. (2003) "Visual voices in participatory communication", *Communicator*, Vol. 38, No 2, pp. 1-15

Singhal, A., and Rogers, E.M. (1989) "Pro-social television for development in India. in R. E. Rice and C. Atkins (Eds.), *Public communications campaigns*. Newbury Park, CA: Sage.

Singhal, A., and Rogers, E. M. (1999). *Entertainment-education: A communication strategy for social change*. Mahwah, NJ: L. Erlbaum Associates.

Singhal, A., and Rogers, E. M. (2002), *A theoretical agenda for entertainment-education*, *Communication Theory*, Vol. 12, No 2, pp. 117-135

Siouti, G. (1988), *Citizens participation in the environmental protection*, (in greek), Athens, General Secretary of Youth

Sivek, D. J. (1987), *An analysis of selected predictors of environmental behavior of three conservation organizations*, Unpublished doctoral dissertation, Southern Illinois University, Carbondale.

Skanavis, C. (2002), "Approaching the Issue of Teaching for Sustainable Development at the University of Aegean, Greece" in *Teaching Sustainability at Universities-towards curriculum greening*, published by Lang Scientific Publishers pp.105-120.

Skanavis, C., Sakellari, M. and Petreniti, V. (2005) "The potential of free-choice learning for environmental participation in Greece", *Environmental Education Research*, Vol. 11, No 3, pp. 321-333

Steckler, A., Allegrante, J.P., Altman, D., Brown, R., Burdine, J.N., Goodman, R.M., and Jorgensen, C. (1995) "Health education intervention strategies: Recommendations for future research", *Health Education Quarterly*, Vol. 22, pp. 307- 328.

Tonn, B., and Petrich, C. (1998) "Can government public participation programs foster environmental citizenship?", *Interact*, Vol. 4, No 1, pp. 83-105.

UN, (2002), World Summit on Sustainable Development, done at Johannesburg, South Africa

UNCED, (1992), Agenda 21: Programme of Action for Sustainable Development. Rio Declaration on Environment and Development. New York: United Nations

UNESCO (1978) Final Report Intergovernmental Conference on Environmental Education, Organized by UNESCO in cooperation with UNEP, Tbilisi, USSR, 14-26 October 1977, (UNESCO ED/MD/49, Paris)

UNESCO-UNEP, (1988) International strategy for action in the field of environmental education and training for the 1990s, International Congress on Environmental Education and Training, Moscow 1987, Publ. NAIROBI, Paris

U.S. Centers for Disease Control and Prevention, Global AIDS Program Strategies, (2004) accessed at www.cdc.gov/nchstp/od/gap on January 10, 2005

Waisbord, S. (2001), Family tree of theories, methodologies and strategies in development communication: Convergences and differences: Prepared For The Rockefeller Foundation.

Walker G.B., (2007), Public Participation as Participatory Communication in Environmental Policy Decision-Making: From Concepts to Structured Conversations, *Environmental Communication*, Vol. 1, No. 1, pp. 99-110

Wallack, L., Dorfman, L., Jernigan, D., and Themba, M. (1993), Media advocacy and public health, Newbury Park, CA: Sage.

Wedding D. and Boyd M.A. (1999), *Movies and Mental Illness: Using films to understand psychopathology*, Boston: McGraw-Hill College

Wegner, H. (1977), *Teaching with film*, Bloomington, IN, The Phi Delta Kappa Educational Foundation.

Wilke, R. (1995), "Environmental Literacy and the College Curriculum", *EPA Journal* Vol. 21 No 2, pp. 28-30. Spring 1995

Winsten, J. A. (1994) "Promoting designated drivers: The Harvard Alcohol Project", *American Journal of Preventive Medicine.*, 10(Suppl. 3), pp. 11- 14.

The Effectiveness of Informal Ecological Education in the Protection of Underground Water – A Case Study

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Abstract:

The effectiveness of ecological education is based on social efficiency. In the article, the effectiveness of a programme for the protection of underground water in the Opole Region (Poland) is discussed, based on questionnaire research by students. As a result of the programme, environmental awareness among the parties involved in the research increased.

Keywords:

Ecological education, environmental protection, environmental awareness

Introduction

The aim of this article is to show the effectiveness of the programme for the protection of underground water of the main reservoir for underground water GZWP 333 in the county of Tarnow in the Opole region in Poland (Słodczyk, 2005). In order to increase the environmental awareness of inhabitants, a program for ecological education titled “Measurement of clean water” was carried out by students, and has become an important element of environmental education for engineers (Słodczyk, 2002a). Questionnaire research carried out before implementation of the programme showed a low level of environmental awareness among inhabitants, a lack of familiarity with environmentally-sound management methods and a lack of knowledge on the importance of the area. The programme resulted in an increase in environmental awareness of both the students and the local population (Słodczyk,2002). The method used may be a model for protecting water resources.

The research

The relation between inputs and results is the basis for measuring the effectivity of economic ventures. However, the effects of ecological education are often not only difficult to measure, they are also long-term and sometimes invaluable. The effectiveness of ecological education is a broader category than traditional economic efficiency, and takes difficult to measure issues into consideration such as increase in environmental awareness, health care and protection of biodiversity. Social efficiency should be the base for assessment of the effectiveness of ecological education (Górka, Poskrobko, Radecki, , 1995).

Description of the problem. Reservoir 333 is the main drinking water reservoir in the Opole region. Concern about water quality is reflected in the priorities of the programme for environmental protection. Opole’s water supply comes from two wells. The wells make water from limestone shells available, and the water changes its chemical composition, in particular the concentration of nitrogen, iron and manganese. In one of the wells, the concentration of nitrogen has increased and currently almost exceeds the norm. There are many spots of non-point pollution on the area of the reservoir related to rural land management. It is necessary to regulate the water

household and sewage treatment as well as to change the habits of land management (Slodczyk, 2003).

Description of the programme. In order to increase the environmental awareness of inhabitants, an ecological education programme was developed and implemented, which for marketing reasons was named “Glass of clean water.” The programme was carried out by students from the Ecological Academic Association “Ecoengineers’ Club” from the Opole University of Technology. The ecological education programme was preceded by the following activities (EPA, 1993):

1. Defining the area to be researched and protected.
2. Lobbying and fund raising.
3. Data collection on the social and economic structure of the area.
4. Listing the local and spatial linear sources of underground water pollution.
5. Estimation of the amount of nitrogen that reaches the surface of the area per year.
6. Carrying out a questionnaire in order to assess the level of environmental awareness of the inhabitants of the area.

It was the intention of the programme to increase the environmental awareness of the inhabitants by internalising the environmental problems and by environmental resource management. No restrictive measures were used in the programme, only encouraging and educational methods. Methods of programme was described by Slodczyk K.(2004). The following methods were used:

1. Training of local leaders.
2. Workshops with small children and schoolchildren.
3. Meetings with the village councils and council of parents in secondary schools.
4. Discussions with inhabitants.
5. Contest for the environmentally-sound household.

Teaching materials were especially designed for the programme, such as especially prepared transparencies used during meetings. Three brochures to be used for training were prepared, and distributed among all households in the area. The first brochure contained information on the localisation of the areas of protected water resources. The second brochure concerned water and sewage treatment, while the third presented proper waste management for the area. An educational film on the issue of water protection, made by students, was shown. The methods and tools used facilitated understanding of the importance of the issue by the inhabitants. The assumption of the programme was that each inhabitant obtains the following information facilitating understanding of the following issues:

1. Why is good water quality important?
2. How does water circulate in the environment?
3. What is the relation between the state of underground water, surface water and quality management?
4. What can we do to improve the quality of water? What is forbidden, what should be done, and how to manage the area with the protected water resources?

Results of the programme

The programme was evaluated with help of questionnaires used for assessing the environmental awareness of Poles. The responded answered questions at the beginning and at the end of the project. The questionnaire research carried out at the beginning of the project showed a low environmental awareness among inhabitants, unfamiliarity with environmentally-sound management methods and a lack of knowledge on the importance of the area. The programme resulted in an increase in environmental awareness of both the students and the local population, while also influencing attitudes and consumption patterns.

Concluding remarks

The programme "Glass of clean water" fulfilled the expectations and the effects can be assessed as good, especially taking into consideration that the programme only costed PLN 34,000 (about 9,000 euro). The costs were low due to the participation of student-volunteers (Słodczyk, 2001). The programme was very well received by the local society, which is an indicator of a high level of ecological effectiveness of the programme. The programme also is an example of partnership / co-operation between a city (where the university is located and the demand for water is the highest) and the countryside (the main supplier of drinking water).

The inhabitants of the area and the participating students consider the problem of environmental pollution as an important threat for Poland and Poles, after drug addiction, cancer, AIDS and terrorism. The majority thinks environmental protection should receive priority for health and aesthetic reasons, while being convinced of the necessity to preserve the environment for future generations. People are convinced that stricter control and enforcement of existing laws is necessary, while legal changes are not necessary. Co-operation with authorities is considered to be essential for effective environmental protection. Authorities should obtain larger financial resources, but do not need more competencies. Clean environment should become an important issue for local government and the inhabitants. People see opportunities for environmental protection by changing their own behaviour and are willing to pay regularly some money for environmental protection in their region.

The goals of the programme were mainly achieved through the engagement of the local community. The new knowledge contributed to a change in attitudes and consumption patterns. In other words, it helped to enlarge human capital, which is an important factor of sustainable development.

References

EPA/625/R-93/002: Wellhead protection: A guide for small communities. 1993

Górka K., Poskrobko B., Radecki W: Ochrona środowiska , problemy społeczne, ekonomiczne i prawne, PWE, 1995

Słodczyk K. 2005, Źródła azotu w wodzie zbiornika GZW 333 na przykładzie wody pitnej ujęcia Grotowice, III Konferencja Zasoby wodne triasu opolskiego i ekologia jezior Turawskich, Opole-Strzelce Opolskie 2-3 czerwiec 2005: s.49-59

Słodczyk K. 2003 Uncontrolled Waste Dumps as Threat to Underground Water Quality. In: Sustainable Waste Management. Economic and Environmental Studies No 3. s.297-303

Słodczyk K. 2004 Metodyka ekologicznej edukacji społeczeństwa lokalnego na przykładzie programu ochrony wód. W: Środowisko lokalne a edukacja red. M.Śmigielska. Wydawnictwo Uniwersytetu Opolskiego, 2004, s.27-35

Słodczyk K. 2002 The Realisation of Drinking Water Improvement Project by Student Scientific "Eco-Engineer Club" in: Environmental Challenges in the Process of Eastward Expansion of the European Union. Economic and Environmental Studies No 2, 289-295

Słodczyk K. 2002a .Nieformalna edukacja ekologiczna niezbędnym instrumentem programu ochrony ujęć wody dla miasta Opola. Europejskie Stowarzyszenie Ekonomistów Środowiska i Zasobów Naturalnych, Biblioteka „Ekonomia i środowisko” nr 29 "Instrumenty rynkowe w ochronie środowiska" Jugowice- Wrocław, s. 387-406

Słodczyk K 2001. The actions of the student's Club of Ecoengineers on improvement of drinking water quality in: Environmental Challenges in the Process of Eastward Expansion of the European Union., Papers and Abstracts for the First International Conference . 22-23 March, Opole University,p.74-79

Education for Sustainable Development and Teachers' Training in Greece

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Abstract

Sustainable development as a current issue calls for comprehensive change in the way society, and thus education, operates. Sustainability is perceived as a process of change in the relationships between social, economic and natural systems. We claim that sustainability is mainly a moral issue: a moral command according to which cultural differentiations and traditional knowledge must be acceptable and respected. The concept of active learning is crucial towards a sustainable future and it requires for education to be as broad as life itself, aiming to empower everyone to make decisions and act in culturally appropriate and locally relevant ways in order to confront the major environmental problems of our days. An holistic approach to environmental learning necessitates working at the interface of disciplines in order to answer the complex issues of today's world. The needs and orientations of environmental educators in Greece were examined via a questionnaire, completed by teachers of primary and secondary education after a series of Training Seminars implemented all over Greece between February 2005 and May 2006. The major aim was to describe the current learning needs, focusing mainly on issues concerning academic knowledge and teaching methodology useful in achieving the transformation from environmental education to Education for Sustainability.

Keywords:

Education for Sustainability, holistic approach, transdisciplinarity, teachers' training

In recent years, in considerations of the epistemology of Environmental Science the concept of the environment defined as both a physical and socio-cultural procedure is predominant. This holistic perception of the environment is transforming, since the environment seems inevitably linked with the concept of development. For many years the main goal of all countries and political systems had been a mono- dimensional development, where the focal point was the economic sector and where nature and biodiversity were of little interest for governments and citizens. Reflective and critical thinking were needed in order for an alternative concept to be constructed, that of sustainability and sustainable development.

After the definitions of the Brundtland committee, development is supposed to fulfill current needs without producing any harm to the fulfillment of the needs of future generations. Other definitions have extended the notion of equity between the present and the future to equity between countries

and continents, races and classes, genders and ages. In the language of sustainable development, natural resources including biodiversity, the natural capital of the planet, should not be used or exploited in such degree or way that does not allow natural renewal and reproduction. The definition of the environment as an holistic frame consists of complex procedures at the level both of social and ethnic identities as well as at the level of environmental, developmental and educational strategies.

The idea that the environment embodies social value is a recent perception for governments and institutional authorities. By social and cultural value we mean a whole system of beliefs, values, attitudes, customs, actions, institutions and social relations: culture shapes the perception of the world and the ways of social interaction with it. To the extent that the current global environmental crisis is a reflection of contemporary collective values and behaviour, the environmental crisis may be described merely as a cultural crisis. As pointed out in the report of the World Commission on Culture and Development set up jointly by UNESCO and the United Nations, culture is not only the “servant of needs but ... the social basis of the needs themselves”, a factor of development but also the “fountain of our progress and creativity”.

Sustainable development calls for comprehensive change in the way society and thus education operates. An ecologically responsible way of production and consumption, a broader view on all matters traditionally described as strictly environmental, is currently variously re-defined and re-described. Sustainability is not perceived as a concrete, stable notion, but mainly as a process of change in the relationships between social, economic and natural systems and processes. We claim that Sustainability is mainly a moral issue, a moral command according to which cultural differentiations and traditional knowledge must be acceptable and respected.

The power of education in supporting this new developmental human activity should not be neglected. The connection of traditional Environmental Education with economy and society, through an evolutionary frame of continuous transformation towards Education for Sustainability is a key element. It is our concern that the presentation of an environmental perspective reveals important messages linked with the future of the planet, as they deal with the production of self-conscious citizens and the promotion of good practices. So, environmental messages have to be articulated at a national level of formal and non-formal education. Environmental discourse provides the necessary cognitive frame for the re-evolvement of environmental education towards sustainability, whereas the object of the educational strategies is to be the act of embodying new concepts, totally different from the consumption pattern upon which the current socio-economic model is constructed.

Education for sustainability should incorporate social and developmental education aiming to support educational at local, national and global level which is concerned with:

- Knowledge of natural procedure

- Knowledge of integrated management of natural resources aiming to the preservation of the environment

- Support of social values such as, participation, coherence solidarity, justice and multiculturalism.

Education for Sustainability is a process of learning, a procedure for creating meanings and knowledge on the concepts of respect, protection, rational evaluation, quality of life, safety, self-knowledge, self-esteem, responsibility and active participation at locally and at a nationwide level.

The concept of sustainable development emerged in the 1980s in response to a growing realization of the need for balance, and, since then, there has been growing understanding of the complexity and interrelationships of problems such as poverty, wasteful consumption, environmental degradation, urban decay, population growth, gender inequality, health promotion, water and energy conflict, violation of human rights. Education is referred to as an important tool for promoting greater consciousness and awareness, bringing about desired changes in behaviours and lifestyles,

and for developing the knowledge and skills needed for a sustainable future. Education may not only be concerned with disciplines that improve understanding of nature - despite their undoubted value - but with the study of the political economy, social sciences, and the humanities. State education should emphasize aspects of learning that enhance the transition to sustainability.

Education through school activities and programmes towards environmental awareness involves objectives, content themes, learning and assessment processes to encourage changes in moral sensitivities, attitudes and behaviours. Responsibility for creating a sustainable future presupposes that classroom practices emphasize the development of critical and creative thinking, collaboration and cooperation, decision-making, problem-solving and planning, civic participation and action, evaluation and reflection. This concept of active learning towards a sustainable future requires that education has to be as broad as life itself, aiming at the same time to empower everyone, young and old, to make decisions and act in culturally appropriate and locally relevant ways to redress major contemporary problems.

An holistic approach to environmental learning necessitates working at the interface of disciplines in order to address the complex problems of today's world. While the natural sciences provide important knowledge of ecological processes, they do not, just by themselves, contribute to the values and attitudes that are the foundation of sustainable development. Transdisciplinarity involves going between, across, and beyond different disciplines. While interdisciplinarity refers to the links between knowledge and models available in different disciplines, transdisciplinarity moves beyond this point to develop a new vision and a new experience of learning. The move towards transdisciplinarity is closely linked with changes in the ways of thinking and teaching about environmental and cultural challenges. Transdisciplinary and inter-sectoral approaches provide people with the tools to confront the changes taking place around them, to make future-oriented decisions, to transform information to knowledge, to improve skills and to support the commitment to a world of socially just and peaceful development. Environmental education departments and institutions have to be not only sectors that appoint the technical, methodological elements of projects and activities, but organised spaces in the service of social awareness, critical of themselves and critical of the past, and involving future communities.

The **Decade of Education for Sustainable Development (2005-2014)** offers an opportunity for educational institutions to make advances in education and training to ensure results in meeting current and future needs. For Greece, a highly active pedagogy based on environmental values and ethics has been flourishing for over fifteen years, where emphasis is driven upon learning the local environment through field studies and classroom projects. Environmental education has found original ways of looking at and measuring human impact on the environment, and these efforts may be reused in the humanities and history study fields in order to support the building of historical sense, as a key element of environmental awareness. Environmental education attempts through school programmes to meet the challenges of pluralism and enable every child to find its place in the community to which it primarily belongs, whilst giving children the means to be open to other communities and cultures. In this way, current Hellenic educational environmental strategies, such as *the Environmental Week for schools, Environmental Classes, Centers of Environmental Education, Educational programmes and projects, Environmental Networks, Teachers' and Students' Activity Packs, Pilot Interactive Schools e-projects, Teacher-Training* are implemented at a nation-wide level, both as a means of dialogue and as case studies for potential reforms.

The Hellenic Ministry of Education's **National Action Plan** called **Environmental Activities-Activities for Life, Education towards Sustainability** is appealing to teachers, students and local communities to embrace all actions implemented throughout the year, transmitting the message that the school as a model of human cultural evolution takes a leading role to the moral initiative of the

protection of the planet.

The broad outline of the National Action plan are:

All academic years of the Decade 2005-2014 are nominated after sustainability issues : 2006 *Water – Blue Planet*, 2007 *Consumption and environment*, 2008 *Forest – Green Planet*, 2009 *Agriculture, Nutrition and Quality of Life* , 2010 *Energy- Environmental friendly energy resources and local community*, 2011 *Education for Human rights* , 2012 *Health and Productive procedures*, 2013 *Human Environment and Sustainable Management*, 2014 *Active Citizens*

Moreover, fifty six **Environmental Education Centers (EECs) are established and function at a regional level covering the whole country.** The objectives of the Centers are to stimulate young people to be aware of environmental issues, so positive attitudes and co-operational behaviour may be developed towards the protection of the ecological balance and sustainable development.

For the achievement of the above aims, the E.E.C.s cooperate with each other as well as with institutions from other countries for the exchange of information, and for this purpose they function within national and international thematic educational nets. The substructure of every E.E.C. consists typically of accommodation provisions for pupils and young audiences, restaurants, conference halls, laboratories, computer halls, work halls and libraries.

Environmental Education Teachers' Training

Research data

This research took part during the academic year 2005-06 and concerned the educational community involved at the Environmental Education National School Activities Scheme. A sample of 320 educators of primary and secondary education and members of the Centers of Environmental Education participated. The needs and orientations of environmental educators in Greece were examined via a questionnaire, completed by the teachers after a series of Educational Seminars implemented all over the country between February 2005 and May 2006. The major aim was to describe the needs concerning updated knowledge and teaching methods in the development of Education for Sustainability.

The environmental educators comprising the research sample are characterized by a long term participation in planning, implementation and development of environmental educational programmes for school groups and young audiences. Taking part in training seminars on Education for Sustainable Development was considered of major importance to produce a creative dialogue between the educational community for redefinitions and reorientations needed. In this context, the questionnaire from the Department of Environmental Education was a valuable resource for assessing beliefs and needs at this point of the effort of transformation of Environmental Education to Education for Sustainable Development.

Concerning the cognitive fields of natural environment / environmental problems, energy, disposal management, water resources and biodiversity, 90% of teachers are confident. However, questions were made about how sustainability could be incorporated into the fields. Additionally, issues such as the involvement of social sciences and humanities have to be supported, since, 45% of teachers asked for more training on social scientific fields and human environment matters, mainly those from a natural science or science background.

The research shows that all educators agree that there is a need for training in areas other than those included in the traditional frame of Environmental Education. This was expected, since, as in the Thessaloniki Conference in 1997, discussions on Environmental Education had taken place and teachers of both primary and secondary education were questioning the ways social themes may become part of environmental programmes.

Other dominant needs of all teachers from the research data concerned the methodology, pedagogy and the didactics of Education for Sustainability. They focus on teaching methods, active learning, collaborative learning, design of curriculum modules via the use of trans-disciplinary educational material, implementation of inter-disciplinary projects and the building of efficient and friendly learning environments.

In more detail, the educators asked for further qualification and training on methods such as:

Role playing 65%

Problem solving 25%

Case study 12%

Other innovative methods 8%

85% of teachers reported a need for support in order to instruct school groups on how to recognize and recall former gained knowledge, how to facilitate interpretation and thus promote the creation of meaning and understanding, how to support analytical and constructive cognitive functions, how to enhance cognitive taxonomies and how to provide the students help in order to reorganize environmental and social information at a new, collectively evaluated, synthesis.

94% of teachers asked for further training in order to learn ways to support education for value selection and perception, the enhancement of self-cognition and self-esteem, the cultivation of collaborative ethics, as well as the motivation for correspondence and, finally, the cultivation of imagination.

90% of the environmental instructors were also interested in further training on educational methods used for the strengthening of each pupil's representation for his/her body and the kinetic abilities, the development of concentration and of focused attention.

It may seem contradictory that teachers requested further training and support on methodological aspects such as the use of project methods and collaborative learning highly, since these approaches are the most widely used for several years. This need is probably explained by the fact that all educators had been educated and function in a teacher-centered learning environment.

In conclusion, the factors needed for the transformation of environmental education to education for sustainability are the enforcement and perhaps the re-orientation of the national and regional teachers' training programmes to include broad sustainability modules, as well as the development of modern pedagogical and didactic means. Moreover, support needs to be given to scientific research on inter - and trans- disciplinary didactic approaches and how they can be integrated with traditional curricula and school activity projects.

References

Bjarne Bruun Jensen (2005), *Education for Sustainable Development - Building Capacity and Empowerment*, Austrian Federal Ministry of Education, Science and Culture, Vienna, Austria

Breiting Soren, Mayer Michela and Mogensen Finn (2005), *Quality Criteria for ESD-Schools, Guidelines to Enhance the Quality of Education for Sustainable Development*, Austrian Federal Ministry of Education, Science and Culture, Vienna, Austria.

Elliott John (Ed) (1998), *Environmental Education: On the Way to a Sustainable Future*, ENSI International Conference, Linz, Austria.

Huckle John and Sterling, John, (Eds) (1996), *Education for Sustainability*, Earthscan Publications, London.

OECD (1997), *Sustainable Development. OECD Policy Approaches for the 21st Century*, OECD, Paris.

UNESCO (1997) *Educating for a Sustainable Future: A Transdisciplinary Vision for Concerted Action, Report of the International Conference: Education and Public awareness for Sustainability*, Thessaloniki, Greece.

UNESCO (1997), *Teaching and Learning for a Sustainable Future*, <http://www.unesco.org/education/tlsf/>

UNESCO (2002), *Education for Sustainability. From Rio to Johannesburg: Lessons learnt from a Decade of Commitment*.

UNESCO (2004), *United Nations Decade of Education for Sustainable Development: Draft Implementation Scheme*, <http://portal.unesco.org/education/en/>

Komisar, B. Paul (1968), "Teaching: Act and Enterprise", in *Concepts of Teaching: Philosophical Essays*, in MacMillan, C. J. B. and T. W. Nelson, T. W. (Eds), Rand McNally, Chicago, pp. 63-88.

Randall, William E. (1996). "Why Interpretation: Motivations, Justifications and Values." INTERSCAN 23, No.3.

Barnes, Douglas (1992), "The Significance of Teachers' Frames for Teaching". In: *Teachers and Teaching: From Classroom to Reflection*, T. Russell and H. Munby (Eds), TheFalmer Press, London, pp. 9-32.

Connelly, M. F. and Clandinin, J. D. (1988), *Teachers as Curriculum Planners*, OISE Press, Toronto.

Words and worlds: New Directions for Sustainability Literacy

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Abstract

Sustainability Literacy is a term which is usually used metaphorically to refer to the knowledge and skills necessary to contribute to a more sustainable society. This paper takes the term literally, describing an approach to sustainability literacy based on the powerful role that language plays in forming social structures and the consequent impact of those structures on the sustainability of the society. The approach has already been put into practice in the *Language and Ecology* course taught at the University of Gloucestershire, which was highly commended in the Green Gown awards (2007) for its contribution to education for sustainability. The paper describes the theoretical approach to sustainability literacy the course is based on, some details of the course itself, and the reaction of students. The conclusion is that an approach to Sustainability Literacy based on critical awareness of discursive construction has potential to help students understand the ways that society is structured (reading the society) and contribute to the transformations necessary for society to become more sustainable (writing the society).

Keywords:

Human ecology, education for sustainability, sustainability literacy, language and ecology

Introduction

In September 2006 the University of Gloucestershire launched a new first year module entitled *Language and Ecology*. The idea of a sustainability course focusing on language and ecology is often met with blank stares of incomprehension – just what is the connection between language and ecology? It does not take many steps to get to that connection, however. Ecology is the interaction of organisms with each other and with the natural environment. If we are interested in the sustainability of human societies, then the focus is on the interaction of *humans* with each other, other organisms, and the physical environment, i.e, human ecology (Moran 2006, Steiner 2002, Marten 2001). The primary way that humans interact with each other is through language, and language persuades people to behave in ways which have differing impacts on the ecosystems which support life.

On one hand, the language of advertising is persuading people to purchase unnecessary material products, and the language of economics is backing this up by suggesting that in doing so they are improving the economy, giving people jobs, and generally improving the quality of life. On the other hand, the language of environmentalism is telling people about the impact that over-consumption is having on the ability of the earth to support life in the future, and a range of different forms of language are persuading people that they can enjoy life more through non-damaging pursuits like appreciation of friendship and nature. Charting a course in life between the differing persuasive messages that surround us requires critical awareness of the powerful interests

operating behind those messages, and the ecological consequences of following them. This provides an important new dimension to the emerging concept of ‘sustainability literacy’.

Sustainability literacy

The term ‘Sustainability literacy’ follows in the footsteps firstly of ‘environmental literacy’ and then ‘ecological literacy’. The trajectory has been away from a narrow focus on environmental pollution, towards wider concerns with how the environment can provide basic necessities for current and future generations. As a consequence, the trajectory has also been for definitions of the new form of ‘literacy’ to become increasingly less specific and more general in scope. To illustrate, consider Orr’s characterisation of ‘ecological literacy’, which represents a half-way point:

Ecological literacy...implies a broad understanding of how people and societies relate to each other and to natural systems, and how they might do so sustainably...[It also implies] an understanding of concepts such as carrying capacity, overshoot,...thermodynamics, tropic levels...magnitudes, rates, trends of population growth, [and] species extinction...Ecological literacy requires a comprehension of the dynamics of the modern world. (Orr 1992:92-95)

This is both quite specific in detailing the concepts from ecological science that students should be familiar with, as well as being general in insisting on a ‘broad understanding of how people and societies relate to each other and to natural systems’. In contrast, the more recent *Forum for the Future* ‘definitional framework’ of sustainability literacy is at a far more general level. The highest overview of the framework is as follows:

- Understand the need for change to a sustainable way of doing things, individually and collectively
- Have sufficient knowledge and skills to decide and act in a way that favours sustainable development
- Be able to recognise and reward other people’s decisions and actions that favour sustainable development (Forum 2004)

Although there is a danger that over-generalised definitions can lose their meaning by being all-encompassing, there is the benefit that students from more and more disciplines can be included in the common quest for a sustainable future. The term ‘literacy’ itself helps reflect this broad application, because *all* students, no matter what subject they study, are required to leave university being ‘literate’. The HM Government’s *Securing the Future* plan states that ‘We need to make “sustainability literacy” a core competency for professional graduates’, which represents sustainability skills as a universal requirement in the same way that reading and writing skills are. There is, however, an important interrelationship between the two forms of literacy.

Taking literacy literally

Stirling (2005) asks the question of ‘why this debate has picked up the word ‘literacy’ which is of course normally associated with reading and writing skills’ and answers it by stating that ‘It is of course a metaphorical use, employed to connote the ability to understand (‘read’) and influence (‘write’) society’. There is, however, an important sense in which the statement is not metaphorical, since so much of our understanding of society comes from things that we read, and writing is one of the primary ways that society can be influenced.

Literacy, as it is defined in modern linguistics, is not a binary category of can/cannot read and write, but a question of the different forms of reading that people engage in, and the different forms of writing they are capable of (Barton 2006, Maybin 1994). Sustainability literacy taken literally means an ability to read critically, in ways which connect what is being read with the ecosystems

which support the lives of current and future generations. It also means being able to write in engaging and creative ways which can contribute to social transformation towards a more sustainable society.

Some brief examples are as follows: a) when reading a newspaper article which represents a 'disappointing' drop in pre-Christmas sales, or the 'good news' that airline companies have increased profits, a reader literate in sustainability will be able to interpret the underlying model of unlimited economic growth behind the evaluative language used, and be aware of its ecological consequences. b) a sustainability literate person will recognise that a tag line in an advertisement which reads 'Live life to the full' contains the presupposition that the reader of the advertisement is not currently leading a fulfilling life, and understand how this links to the general role of advertising in creating dissatisfaction and encouraging purchase of unnecessary products. c) when reading agricultural discourse which represents nature linearly and mechanistically, the literate reader will be able to recognise the oversimplification of complex ecosystems involved, and know about the unsustainable agricultural practices which are often premised on such oversimplifications. Critical reading along these lines could help readers resist ideologies and social models which have negative impacts on the sustainability of society, and start them on a journey towards discovering and promoting more sustainable models.

When it comes to writing, a sustainability literate person will have the skills to write in ways which avoid some of the simplistic and damaging social models which underlie unsustainable societies. And more than this, they will be able to write in ways which instantiate new constructions which have the power to encourage people to act in more sustainable ways. As St Claire (2003) writes, 'In the case of environmental literacy for adults, this means developing and participating in the social practices likely to change the way our societies think about and act upon ecological issues.'

Rachel Carson, for example, was a marine biologist who presented the facts about DDT and other pesticides not in the usual dry jargon of objective science, but in powerfully lyrical ways which captured people's imagination. Her message was simultaneously an accurate and scientific description of the destruction that was occurring, and an evocation of the beauty and preciousness of the life that was under threat. Carson's (1962) book *Silent Spring* was instrumental in turning environmentalism into a widespread popular movement, partly because of the revelations it contained, but mostly because the writing style appealed to people's deeply held value systems as well as their intellect.

Although *Forum for the Future* mentions the ability 'to talk to others in positive and engaging ways' about sustainability (Forum 2004), and GEES (2007) mentions the importance of 'skills in communication', critical reading and creative writing skills rarely play an important role in ESD in practice. Despite the term 'literacy', the reason why literacy practices themselves tend to be relegated to the margins may be because of the artificial distinction between 'doing' and 'talking' which is often drawn by sustainability educators. For instance, Orr (1992:92) writes that 'Environmental education ought to change the way people live, not just how they talk.'

Language, however, can be seen as a form of 'doing' - as a social practice (Fairclough 1992). International treaties, climate conferences, laws, economic transactions, and advertisements all revolve around language, as does the structuring of the institutions that make up society. Through changes in language, institutions can be altered, treaties can come into force, boundaries can be redrawn, and the structure of systems such as economic systems can be transformed.

To give just one example, the word 'cost' in economic discourse is used primarily as a financial variable, but there is pressure now on economic discourse to use the term with a wider scope to include the relatively new concepts of 'environmental costs' and 'social costs', i.e. the 'triple bottom line'. These linguistic changes can have an impact on decision making, with potential social and ecological benefits as a consequence.

Beyond language

In addition to language, other semiotic modes have consequences for sustainability, including drawings, photography, music, material objects such as toys, and multimodal texts such as films and computer games. Other semiotic modes can be analysed in much the same way as language, as Kress and van Leeuwen (2006) show for visual images and van Leeuwen (2005) shows for a range of social semiotic systems.

An example of an important visual image is the photograph of planet Earth taken by Apollo 8 in 1968, which shows the curve of the moon in the foreground and the Earth small in the background, surrounded by a black void. This image helped start the sustainability movement, because it forced the viewer into a radically different way of viewing the planet, both literally and metaphorically (Sachs 1999). On the other hand, there are images representing consumerism as the path to happiness in advertising, computer games which glorify cars, speed, and weapons, and toys such as Barbie and her accessories which introduce children into the world of consumerism. It is important, then, for students to become critically aware of visual images and other semiotic forms in addition to language.

In expanding the notion of text to include visual images and other semiotic modes it is essential not to go too far, as certain post-modern theories seem to have done, and start to claim that everything in the world is ultimately text. Stables and Bishop (2001:90), in their discussion of environmental literacy, have perhaps gone too far in offering 'a view of the environment itself as text'. They propose that:

The environment, insofar as it only 'is' what it 'means to us', is a cultural/social construct. (p93)

Insofar as the features of the biophysical world reveal themselves through the signs we attribute to them, we could be said to read the environment. (p90)

The word 'insofar' in both these sentences is a tricky one, because it glosses over a history of debate about semiotic determinism. If human signs influence how aspects of the biophysical world 'reveal themselves' to such an extent that there are important consequences for sustainability, then this implies a strong form of linguistic determinism along the lines of the Sapir-Whorf hypothesis – something which has been almost universally rejected by linguists (Stroinska 2001, Gumperz and Levinson 1996). The over-extension of semiotic determinism has also led to strong attacks by ecologists:

the world, including its living components, really does exist apart from humanity's perceptions and beliefs about it...certain contemporary forms of intellectual and social relativism can be just as destructive to nature as bulldozers and chain saws (Soulé and Lease 1995:xvi)

Sociology...[has]...often taken for granted a biological world that is viewed...as possessing only a discursive reality, located within the realm of human language - surely the ultimate in anthropocentric hubris. Kidner (2001:9)

An essential part of sustainability literacy is therefore the ability to distinguish aspects of the world which are created discursively by social convention, and can therefore potentially be transformed through alternative representations, and those aspects of biophysical reality which are beyond semiotic systems.

The *Language and Ecology* module

The Language and Ecology module, taught in the Humanities Department at the University of Gloucestershire for the first time in 2006, attempts to put the concept of sustainability literacy described above into practice in a Higher Education context. This section briefly describes the course itself, the feedback from students, and subsequent developments.

The socio-linguistic aspects of the course are based on social construction theory (Burr 2003, Gergen 2000, Bourdieu 1991), theories of language and social change (Fairclough 2003, 1992, 1989), Critical Language Awareness (Fairclough 2003, Ivanic 1993), and ecolinguistics (Stibbe 2005, 2004, Mühlhäuser 2003, Fill and Mühlhäuser 2001, Goatly 2000, Harré et al 1999). Discussion of the impact of social structures on ecosystems is conducted within a human ecology framework based on a wide range of works including Moran (2006), Daly and Farley (2004), Steiner (2002), Capra (2002) and Naess (1990).

The course, however, does not begin by ‘presenting’ students with a theoretical framework, because it would be disingenuous to suggest that there was one ‘right’ framework for sustainability, and confusing and time-consuming to present advanced debates in social construction theory and human ecology. Instead, students are encouraged to develop their own frameworks over time as they come across new perspectives and gain experience of social and natural systems for themselves in the changing conditions of the 21st century. Imaginative exercises are used to help them start to build a framework. The first exercise is as follows:

Imagine the world from the perspective of an eagle – sharp eyes and no language. The eagle flies across borders, over the heads of presidents, peers into the windows of court rooms and class rooms. The eagle has very sharp eyes, but what can she not see? In other words, what aspects of the world belong to social reality constructed through language and consensus, and what aspects are part of biophysical reality beyond symbols? [from *Language and Ecology* course materials]

To the eagle, of course, there are no national borders; there is nothing to distinguish the president from any other humans; the judge, defendant and lawyers are just animals making noises, and there is no distinction between teacher and student. In this way students start to get an idea of how language constructs intuitions, positions, hierarchies, and nations. This is, of course, highly simplistic, but together with other imaginative exercises provides a starting point in understanding the complex relationship between words, symbols and social structures.

Sustainability literacy requires not only a social framework to analyse the role of language in building social structures, but also an ecological framework to assess the impact of those social structures. Imaginative exercises are again used to help students start to build their framework. The first of these involves asking the students the simple question ‘What is wrong with artificial grass?’ A few typical responses to the question are as follows:

- a) It does not allow plants, bees, birds and other life forms to grow and live
- b) It requires large amounts of fossil fuels to produce, and involves waste during production and disposal
- c) It is uniform in shape and colour and does not change in the seasons. It therefore does not allow humans to appreciate the beauty and variety of nature.

Students are then encouraged to translate their insights into a normative form, for example:

- a) The flourishing of life is important for its own sake, and should not be unnecessarily stifled

- b) It is important not to waste resources or produce unnecessary waste, particularly in cases where natural systems could supply all the energy and materials required.
- c) The appreciation of the natural world around us is important for human wellbeing

The statements that the students come up with form the beginning of a framework which they will continuously adapt and evolve in the light of their direct experience with human and natural systems, and, importantly, in response to texts they read and analyse.

After establishing the foundations of a theoretical framework, the course moves on to present students with a series of case studies of critical awareness in action. The case studies are analyses of discourses which play a role in shaping the social world and have an important impact on the sustainability of society (some of these case studies are available online at www.ecoling.net/journal.html).

The case studies are presented under three titles: a) ‘destructive discourses’, which are common ways of representing the world which encourage unsustainable behaviour such as consumerism or damaging agricultural practices, b) ‘counter discourses’ which are mainstream discourses such as environmentalism and ecology, which attempt to ameliorate ecological destruction but are often based on similar assumptions to destructive discourses, and c) ‘alternative discourses’ which are drawn from a wide range of sources and represent the world in ways which break free of the assumptions of destructive discourses (including lyrical science writing, indigenous sources, nature poetry, journalistic texts, and ecologically-based business writing). Discourses are categorised as ‘destructive’, ‘counter’ or ‘alternative’ according to how hidden messages within the discourse align with the normative assumptions of the ecological framework.

Students carry out their own critical analysis of a wide range of everyday texts, classifying them according to their own ecological framework, in a series of active learning exercises conducted in class and for assignments. Evaluation of the module suggests that students found the process ‘eye-opening’, that they felt that they had gained new awareness of the texts which surround them, and had gained insights into the implication of those texts for ecosystems. Feedback included the following comments:

fascinating, made me think more deeply, definitely changed how I look at things around me, valuable, enjoyable, relevant to everyday life and my life in the future, changed the way I perceive language, I am now more critical about language, it has changed the way I read, eye-opening, I'll be able to really apply what I've learnt in my job later, I read newspapers differently now, this course has made me realise the power and impact that language can have, I've learned a lot, insightful, this course has really captured my interest, I am more aware, I think EVERYONE should take this module, a positive surprise, excellent, a great insight into how language and ecology come together, really opened my eyes, I was amazed, really useful, It has made me take notice of the effects on the environment of language used in a range of discourses that I wouldn't have noticed otherwise

In addition, although there was no explicit advice in the module about living sustainability, all students indicated that the module had already affected their lifestyle or may potentially affect it in the future. Comments include the following:

caused me to look at ways to change the world, more conscious of my own impact on the environment, made me think more about the environment and what I can do to help, will become more environmentally friendly and sustainable, more aware of my responsibility to our environment, will take more care in everything, [start] a more sustainable lifestyle, [start] consuming ethically, do more to help environment, begun to shop differently already, am much more aware of my surroundings, will be more aware of what products I am buying in the future, this course has opened my eyes to a certain extent and will influence my lifestyle, I will... promote

/encourage environmentally friendly behaviour to all people I know!, this course has changed my attitudes

Subsequent Developments

A unique feature of the Language and Ecology course was that students were invited to contribute feedback, comments and articles to an international research forum (the *Language and Ecology Research Forum* www.ecoling.net/courses.html). This resulted in publication on-line of a range of comments and articles by students, and three of the students' articles were later published in the on-line journal *Language & Ecology* (Gargan 2007, Slater 2007, Williams 2007).

Insights on the role of active learning in Education for Sustainability from the *Language and Ecology* course were shared in the *Centre for Active Learning* 'Active Learning and Sustainable Development' swapshop in January 2007 at the University of Gloucestershire. This swapshop brought together active learning perspectives on sustainability from a wide range of modules taught at the University and led to the publication of the book *Greener by Degrees* (Roberts and Roberts 2007). The book includes a chapter on active learning for sustainability literacy based on the principles of *Language and Ecology* (Stibbe 2007), as well as a chapter co-written by students about their experience of the module (Gargan et al 2007). The student chapter includes the following comment on active learning for sustainability:

The active learning in the module made it interesting, lively and inspiring. We discovered links between ecology and language in many different sources, such as popular magazines, the food industry and literature from across the world. The diversity was amazing: every week, a new façade of our own culture and of cultures worldwide was revealed. (Gargan et al 2007)

In 2007, the contribution of the course to Education for Sustainability was recognised by the HEEPI Green Gown awards, in which the course was highly commended.

Conclusion

Although the *Language and Ecology* course has only run once, the initial signs are that an approach to sustainability literacy which includes a focus on the ways that texts construct society, and the consequences for the sustainability of that society, has potential in helping students to become more aware of sustainability issues in their everyday life, and more actively engaged in contributing towards sustainability. The long-term impact of the course on successive groups of students who take it will be monitored carefully and the approach refined in response. Of particular interest is whether the students have developed the theoretical frameworks they started to build, whether they have applied them in other areas of their study and life, and what practical consequences this has led to.

References

- Barton, D. (2006) *Literacy, an introduction to the ecology of written language*. London: Blackwell
- Bourdieu, P. (1991) *Language and Symbolic Power* (translated, original 1982). Mass.: Harvard University Press
- Burr, V. (2003) *Social Constructionism*. London: Routledge
- Capra, F. (2002) *The Hidden Connections: A Science for Sustainable Living*. New York: Harpercollins

- Carson, R. (1962) *Silent Spring*. Harmondworth: Penguin
- Daly, H. and Farley, J. (2004) *Ecological Economics: Principles and Practices*. London: Island Press
- Fairclough, N. (1989) *Language and Power*. London: Longman
- Fairclough, N. (1992) *Discourse and Social Change*. Cambridge: Polity
- Fairclough, N. (2003) *Analysing Discourse: Textual analysis for social research*. London: Routledge
- Fairclough, N. (2005) *Critical Language Awareness*. London: Longman. (pp. 305 - 331)
- Fill, A. (ed) and Mühlhäuser, P. (ed) (2001) *The Ecolinguistics Reader: Language, Ecology and Environment*. Continuum
- Forum (2004) *Sustainability literacy: knowledge and skills for the future*. (available http://www.forumforthefuture.org.uk/publications/literacy_page256.aspx)
- Gargan, M, Slater, P., and Williams, R. (2007) "Language and ecology: three student perspectives". Roberts, C. and Roberts, J. 2007 (eds) *Greener by degrees: exploring sustainability through Higher Education curricula*. Gloucestershire: Geography Discipline Network
- Gargan, M. (2007) "Magic romance: on perfume language and the environment." *Language & Ecology 2:1* (available <http://www.ecoling.net/journal.html>)
- GEES (2007) *Education for Sustainable Development for GEES students in UK higher education*. Higher Education Academy Subject Centre for Geography, Earth and Environmental Science. (available <http://www.gees.ac.uk/projtheme/esd/briefing.doc>)
- Gergen, K. (2000) *An Invitation to Social Construction*. London: Sage
- Goatly, A. (2000) *Critical reading and writing: an introductory coursebook*. London: Routledge
- Gumperz, J. and Levinson, S. (1996) *Rethinking linguistic relativity*. Cambridge University Press
- Harré, R., Brockmeier, J., Mühlhäusler, P. (1999). *Greenspeak: A Study of Environmental Discourse*. Thousand Oaks, CA
- HM Government (2005) *Securing the future - UK Government sustainable development strategy* (available <http://www.sustainable-development.gov.uk/publications/>)
- Ivanic, R. (1993) "Critical language awareness in action." In Carter, R. (ed.) *Knowledge about language and the curriculum: the LINC reader*. London: Hodder and Stoughton (pp. 122 - 132)
- Kidner, D. (2001) *Nature and psyche: radical environmentalism and the politics of subjectivity*, State University of New York Press
- Kress, G. and van Leeuwen, T. (2006) *Reading images: the grammar of visual design*. London: Routledge

- Marten, G. (2001) *Human Ecology: Basic Concepts for Sustainable Development*. London: Earthscan
- Maybin, J. (1994) *Language and literacy in social practice*. Clevedon: Multilingual matters
- Moran, E. (2006) *People and Nature: An Introduction to Human Ecological Relations* London: Blackwell
- Mühlhäuser, P. (2003) *Language of environment, environment of language: a course in ecolinguistics*. London: Battlebridge
- Naess, A. 1990. *Ecology, Community and Lifestyle : Outline of an Ecosophy*. Cambridge University Press
- Orr, D. (1992) *Ecological Literacy: Education and the Transition to a Postmodern World*. State University of New York Press
- Roberts, C. and Roberts, J. (2007) *Greener by degrees: exploring sustainability through Higher Education curricula*. Gloucestershire: Geography Discipline Network
- Sachs, W. (1999) *Planet Dialectics: Explorations in Environment and Development*. London: Zed books
- Slater, P. (2007) "The gadgeteer: sex, self and consumerism in Stuff." *Language & Ecology 2:1* (available <http://www.ecoling.net/journal.html>)
- Soulé, M. and Lease, G. (1995) *Reinventing Nature?: Responses to postmodern deconstruction*. Washington: Island Press
- St Claire, R (2003) "Words for the world: Creating critical environmental literacy for adults." *New directions for adult and continuing education 99:67-79*
- Stables, A. and Bishop, K. (2001) "Weak and strong conceptions of environmental literacy: implications for environmental education." *Environmental Education Research 7:1:89-97*
- Steiner, F. (2002) *Human Ecology: Following Nature's Lead*. Washington: Island Press
- Stibbe, A. (2004) "Environmental education across cultures: beyond the discourse of shallow environmentalism." *Language & Intercultural Communication 4:4*
- Stibbe, A. (2005) "Counter-discourses and harmonious relationships between humans and other animals." *Anthrozoös 18:1*
- Stibbe, A. (2007) "Developing critical awareness language skills for sustainability: a transdisciplinary approach." In Roberts, C. and Roberts, J. 2007 (eds) *Greener by degrees: exploring sustainability through Higher Education curricula*. Gloucestershire: Geography Discipline Network
- Stirling, S. (2005) "Sustainable literacy: skills for living well into the future." *Ethos 6:May* Available <http://csf.plymouth.ac.uk/files/sterlingFull.html.txt>
- Stroinska, M. (2001) *Relative Points of View: Linguistic Representation of Culture*. Oxford: Berghahn

Van Leeuwen, T. (2005) *Introducing Social Semiotics*. London: Routledge

Williams, R. (2007) "On voit grand. Très grand : Language and the construction of nature across cultures." *Language & Ecology 2:1* (available <http://www.ecoling.net/journal.html>)

**Building environmental awareness:
The Case of Forestry Students in a Greek University**

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Abstract

The present research examines the views of students from the Department of Forestry and Management of the Environment and Natural Resources, at the Democritus University of Thrace, concerning the active involvement of citizens in issues linked to environmental protection. According to this study, which was conducted through the use of self-managed questionnaires, students believe that most citizens (73.1%) participate in relevant activities to a minimum extent, and are not well-informed about environmentally-related issues (64.6%). In evaluating the factors which shape environmentally-minded persons, they consider as most important the teaching provided through the educational system and family upbringing. Other important factors include visits to environmental education centres, special programmes on TV and radio, and contact with environmental organizations. Lesser importance is attributed to information found on the Internet, articles in newspapers and magazines, relevant books and, finally, multimedia (CDs and DVDs) related to the topic. When asked about what environmental education offers to young people at the various levels of education, the students' answers were discouraging. The majority believe that environmental education in primary school, lower and upper secondary school is lacking, at a percentage of 60.6%, 65.7 and 49.8% respectively. The situation shows some improvement in higher education (University and Technical Education Institutes), where 42.4% of the students find it is adequate, while 47.8% and 37.7% respectively believe that their own department deals with the topic fully or adequately.

Keywords:

Environmental awareness, environmental education, environmental behaviour, reliability analysis, factor analysis

Introduction

More and more citizens are called upon to make decisions that are directly or indirectly linked to the environment. This implies that through their decisions, citizens can exert influence regarding the application of an effective environmental policy in numerous ways, on many levels and at suitable points in time. Their decisions can have an effect both on the legislative work of governments and in the direction of resolving various problems on a local and national scale (Skanavis, 2004).

One of the demands of our day is the participation of citizens in decision-making processes, particularly those concerning the environment, as this is considered one of the most effective means of involvement. Consequently, citizens on the one hand need to be aware of the participation processes available and on the other hand must be conscious of both ecological principles and environmental problems, in order to be able to make the appropriate decisions. Thus, a change of people's attitude towards the environment is considered of imperative importance, through the provision of further knowledge on this issue. In this way, people will be better prepared to take action in an effective, responsible manner. The participation of young citizens in particular in environmental protection and sustainable development actions is of utmost importance, since it will have an impact both on their current life but also on the future of the world. It has also been recognized that one's attitude towards the environment is moulded at an early age (Bryant & Hungerford, 1977). Under these circumstances, it is vital to expose young people to environmental education, in a way that will allow them to acquire the substantial skills required for the future preservation and protection of the environment (Bradley *et al.* 1999). Given that environmental problems are becoming more complex and that the challenge and need to take measures is becoming more urgent, students must be equipped with the necessary skills that will help them make the best decisions and choices (Joseph *et al.*, 2004).

Environmental behaviour is linked to environmental knowledge, attitudes, awareness, activities, and demographic factors (Bartkus *et al.* 1999; Gambro & Switzky, 1996; Simmons, 1998; Franzen, 2003; Tikka *et al.* 2000). If people's perception, knowledge, awareness and attitude toward environmental issues are high, this means that the peoples' environmental literacy rate is also high (Sigit Sudarmadi, *et al.*, 2001). According to Hungerford and Volk (1990), Palmer *et al.*, (1999) and Finger, (1994), environmental knowledge has an impact on environmental behaviour but does not suffice in itself. Scientific knowledge does not always lead to a responsible attitude towards the environment, but nevertheless, knowledge of environmental issues does lead to positive results. In conclusion, we could say that the aim of education and environmental education in particular, is to teach students how to become responsible citizens (Volk, 1984). Environmentally-aware citizens have a specific perception of the environment and sensitivity towards environmental issues. However, in order to achieve this goal, which is a primary objective of environmental education, citizens must be aware both of ecological principles and environmental concerns.

One of the main variables that determine the formulation of environmentally responsible conduct in people, i.e. the changes required in human behaviour so that people possess the necessary skills to protect and resolve environmental problems, is environmental awareness. Public awareness concerning the protection of the environment is feasible through a process of non-formal and informal training. Thus, radio, TV, newspapers, magazines, the Internet, the family, non-governmental environmental organizations etc., can possibly affect the perceptions and opinion of the public, and contribute to its environmental awareness (Nitz, 2000; Howe & Disinger, 1988; Tsantopoulos, 2003; Piperopoulos & Tsantopoulos, 2006).

The aim of the present paper is to explore the views of students of a Department dealing with the Environment, regarding citizen participation in issues related to environmental protection, the provision of information on environmental issues and to carry out an assessment of the environmental training offered at various educational levels. In addition, possible ways in which we can create environmentally-aware citizens are also evaluated.

Research Methodology

The research area was the Department of Forestry and Management of the Environment and Natural Resources, of Democritus University in Thrace, which is located in Orestiada. As it was important to choose a suitable time to conduct the research (Daoutopoulos 1994), the latter was carried out during the examination period of June and September 2005. Those participating were the students being examined in at least one course during the examination periods of the academic year 2005, i.e. those regarded as active students (297 persons). The reason for this choice was that we were interested in the opinions of students and how they differ from year to year after having attended specific courses.

The research was carried out by using self-managed questionnaires (Oppenheim 1973 and Siardos 1997). The questionnaires were nominal and were given to the students before their exams; new students were approached during their initial classes. Generally speaking, the students took part in the survey willingly. Those who neglected to reply were contacted personally (announcement, phone call). The time required for filling in the questionnaire was 10 to 15 minutes.

The reliability analysis is conducted in the polythematic variable that refers to the way in which environmentally-aware persons are formed. The evaluation of the reliability of any measurement process depends on determining the degree of variance in the persons' grading, which is due to real differences (and standard errors), and the degree of variance that is owing to inconsistencies of measurement (Siardos 1999, Filias et al 2000).

More specifically, the alpha coefficient (or Cronbach's α reliability coefficient) is used, in order to find the internal reliability of the questionnaire (Frangos 2004), i.e. if the figures tend to measure the same thing (Howitt and Gramer 2003). It also expresses the square of the correlation between the grading (observed) that a person gets on a given scale and the grading that they would have got (real) if they had been questioned on all the topics (Siardos 1999). A precondition for its use is that the questions (variables) must be equivalent (Frangos 2004).

An α -coefficient of 0.70 or more is considered satisfactory (Howitt and Gramer 2003). If it is over 0.80 it is considered very satisfactory, but very often in practice lower reliability coefficients are accepted, with values up to 0.60 (Siardos 1999).

The test must be reliable in order to be of use. Nevertheless, reliability is not sufficient, it must also be valid, and this is achieved through the application of factor analysis (Siardos 1999).

Factor analysis is a statistical method that aims to find the common factors within a group of variables (Sharma 1996). It tries to interpret the structure rather than the variability (Karlis 2005). Its goal is to reproduce the correlations between the variables to the highest degree, by using the smallest possible number of factors and thus lead to a solution that is "unique" and can easily be interpreted (Siardos 1999).

More specifically, the principal components method was used, which is based on a spectral analysis of the variance table (correlation) (Karlis 2005). Selecting the number of components is a dynamic process and presupposes repeat assessments and evaluations of the model. More specifically, we can use the Kaiser rule, the percentage of variance that is explained or the scree plot (Karlis 2005). In the present paper, the three-factor solution was applied.

The rotation of the principal components matrix was performed by using the maximum variance rotation method by Kaiser (Harman 1976). The latter attempts to show the principal components

with high-value loadings and loadings with zero or near zero values, i.e. to maximize the variance in each factor (Siardos 1999).

Finally, we examine the components that can explain the correlations between the variables of our data and attempt to provide an interpretation (if possible) (Dzoufras and Karlis 2001). According to Frangos (2004), the variables that “belong” to each factor are those whose loading, on the table indicating the loadings of the factors after rotation, is over 0.5 for that factor. The data analysis was performed with the help of the statistical package SPSS.

Results

The students of the Department of Forestry and Management of the Environment and Natural Resources do not believe that there is citizen participation in issues related to environmental protection. More specifically, 73.1% believe that citizens participate on a minimal basis. The option “quite a lot” or “not at all” is selected by 16.8% and 17.8% respectively, while “a lot” and “very much” are assigned the same percentage of just 0.7%.

However, in order to have any form of active involvement in the environment, there must initially be some information provided on environmental issues. The view of the students regarding this point can be considered equally disheartening. While 64.6% state that citizens have little information on issues of environmental interest, 17.8% and 16.8% respectively believe that they are quite well or not at all informed, and only 0.7% of the students believe that citizens are well-informed.

The students were also asked to evaluate the ways in which we can shape environmentally-aware persons. Table 1 shows that the most appropriate, effective way to do this is by teaching people through education (mean 8.55), and then by one’s family upbringing (mean 8.28). Further down the list are visits to environmental education centres (mean 7.86), special programmes on TV and radio (mean 7.36) and contact with ecological organizations (mean 7.29). Lower grading is given to searching for information on the Internet (mean 6.90), articles in newspapers and magazines (mean 6.88), relevant books (mean 8.45) and, finally, multimedia (CDs and DVDs) related to the topic (mean 8.38). The low grading of multimedia by students could possibly be related not to their capabilities, but to the fact that they are considered to be new technologies that have not yet found their place in society.

Table 1. Evaluation of ways to shape environmentally-aware persons

Variable	New sts.		1 st yr	2 st yr	3 st yr	4 st yr	5 st yr	Total
	n	54	50	48	46	41	57	296
Family upbringing	mean	7.83	8.12	8.00	8.35	9.10	8.44	8.28
	s.d.	2.860	2.115	2.552	1.828	1.446	1.946	2.217
Teaching through education	mean	7.96	8.38	8.19	8.83	8.83	9.14	8.55
	s.d.	2.533	2.194	1.887	1.610	1.642	1.342	1.950
Special programmes on TV and radio	mean	6.93	6.92	7.31	7.52	7.83	7.72	7.36
	s.d.	2.561	1.759	1.835	1.871	1.447	1.740	1.936
Articles in newspapers and magazines	mean	6.81	6.58	6.62	7.22	7.22	6.91	6.88
	s.d.	2.481	2.186	2.228	1.699	1.492	1.864	2.038
Relevant multimedia CDs-DVDs	mean	6.70	5.98	6.35	6.15	6.07	6.82	6.38
	s.d.	2.344	2.369	2.078	2.512	2.195	1.616	2.197
Books on the topic	mean	6.54	6.50	6.31	6.24	6.39	6.63	6.45
	s.d.	2.271	2.435	2.433	2.282	1.973	1.961	2.219
Information from the Internet	mean	7.13	6.96	6.88	6.54	7.10	6.81	6.90
	s.d.	2.210	2.303	2.256	2.401	2.300	2.248	2.272
Contact with ecological organizations	mean	7.54	7.28	7.58	6.87	7.32	7.14	7.29
	s.d.	2.478	2.399	1.736	2.247	2.150	2.207	2.218
Visits to environmental education centres	mean	7.94	7.64	8.08	7.35	8.15	7.98	7.86
	s.d.	1.994	2.884	1.866	2.203	2.044	2.013	2.191

where n = no of persons mean = average s.d. = standard deviation

For the reliability analysis, the above-mentioned descriptive statistics were checked for any great variances and negative correlation coefficients between the variables. That is why, a careful choice of questions for a reverse grading is required (Frangos 2004).

From the correlation coefficient matrix (Table 2), it can be seen that the weakest correlations exist between the variables “family upbringing” and “relevant multimedia” ($r = 0.0246$), while the strongest exists between the variables “family upbringing” and “teaching through education” ($r = 0.6355$).

Table 2. Correlation matrix of the polythematic variable.

	A1	A2	A3	A4	A5	A6	A7	A8
A1 = Family upbringing	1.0000							
A2 = Teaching through education	0.6355	1.0000						
A3 = Special programmes on TV and radio	0.2894	0.4870	1.0000					
A4 = Articles in newspapers and magazines	0.2166	0.3614	0.6262	1.0000				
A5 = Relevant multimedia CDs-DVDs	0.0246	0.1987	0.5192	0.5866	1.0000			
A6 = Books on the topic	0.0413	0.1431	0.3289	0.5584	0.6144	1.0000		
A7 = Information from the Internet	0.0416	0.1308	0.3260	0.3922	0.5513	0.4890	1.0000	
A8 = Contact with ecological organizations	0.1914	0.1406	0.1396	0.1730	0.2269	0.2481	0.2460	1.0000
A9 = Visits to environmental education centres	0.0529	0.0746	0.2214	0.2496	0.2658	0.2629	0.2902	0.4966

As regards the scale (for all the themes), the total mean is 66.02 and the standard deviation is 11.77, while the mean value per theme is 7.34 with a range of 2.19. The mean variance is 4.56 with a minimum value of 3.76 and a maximum one of 5.16. The mean correlation coefficient is 0.30, while the values of the correlation coefficients between the themes range from 0.02 to 0.64, with a relation of maximum to minimum of 25.80.

In Table 3, we observe that the correlation of the variable “family upbringing” with the sum of the grading for the other themes is relatively low ($r = 0.2746$). On the contrary, the variables “articles in newspapers and magazines” ($r = 0.6502$) and “relevant multimedia” ($r = 0.6140$) have the highest relation with the total group of variables, which indicates the high relation between these two variables and the rest.

Similarly, from the multiple determination coefficients R^2 of the regression models of each theme with the rest, it is found that the variables “relevant multimedia” and “articles in newspapers and magazines” are explained by the others by 57% ($R^2 = 0.5666$) and 56% ($R^2 = 0.5560$), while the variable “visit to environmental education centres” is relatively insufficient (30%).

Table 3. Means, variances, α -coefficients, correlation coefficients with the other themes and multiple determination coefficients, on a scale level.

Variable	Mean scale if the element is deleted	Variance scale if the element is deleted	Correlation coefficient with the other theme	Multiple determination coefficient	α -coefficient if the element is deleted
Family upbringing	57,7288	120,3140	0,2746	0,4353	0,7998
Teaching through education	57,4610	116,8276	0,4257	0,5078	0,7788
Special programmes on TV and radio	58,6610	110,5378	0,5943	0,5215	0,7578
Articles in newspapers and magazines	59,1186	107,3770	0,6502	0,5560	0,7495
Relevant multimedia CDs-DVDs	59,6508	105,9219	0,6140	0,5666	0,7526
Books on the topic	59,5593	108,4242	0,5489	0,4824	0,7620
Information from the Internet	59,1186	109,5743	0,5003	0,3592	0,7690
Contact with ecological organizations	58,7153	115,9799	0,3720	0,2992	0,7868
Visits to environmental education centres	58,1492	115,8076	0,3823	0,2998	0,7852

The value of the α -reliability coefficient is significantly high (0.7920). This is a strong indication that the scale degrees are logically consistent, i.e. the data have the tendency to measure the same thing. This can also be supported by the significantly high individual α -reliability coefficients after the deletion of a theme, and particularly with the deletion of any problem, that does not help to increase the reliability coefficient.

Similarly, in the factor analysis, if we initially study the correlation table (Table 2), there are indications that the correlations between the variables are satisfactory. We see in all cases, with a few exceptions only, that the values of the simple correlation coefficients are high.

The Keiser-Meyer-Olkin index has a value of 0.768. It is proposed that the KMO index must be over 0.80, however, values over 0.60 are considered tolerable (Sharma 1996). Furthermore, as was expected, the Bartlett test of sphericity rejects the null hypothesis that the correlation table is unitary (value of the function-test 960.96, degrees of freedom $p(p-1)/2=36$, $p=9$). Similarly, the partial correlation coefficients of the two variables (non-diagonal data of the Anti-Image table) as evaluators of the correlations of the characteristic factors are relatively low. The above results show that our data are suitable for factor analysis.

Nevertheless, before we apply the latter, we must first explore if all the variables are suitable for use in the model. The suitability measures of the sample (MSA) for the variables used, which appear as elements of the matrix (diagonal) of the Anti-Image table, have values ranging from high to very high, that support the view that the factor analysis model is acceptable. Finally, the multiple determination coefficients R^2 of each variable with the rest have relatively high values, ranging from 0.545 to 0.8031. Although the variable concerning “information from the Internet” seems to have the smallest connection with the rest, it was not considered necessary to remove it from the group of variables.

The percentage of variance explained by the three selected variables is 70.9% (Table 4). In fact, in the second column, we see the percentage of variance related to each factor, while the third column shows the percentage of variance related to each factor following rotation.

Table 5 indicates the loadings, which constitute the partial correlation coefficients of the nine variables with each of the three factors that have emerged from the analysis. The higher the loading of a variable to a factor, the more accountable that factor is for the total variance of the grading in the examined variable.

Table 4. Information on the emerging factors.

Components	Initial statistical measures			Analysis with the application of three principal coefficients					
	Characteristic root	Percentage of variance	Summative amounts	prior to rotation			post rotation		
				Characteristic root	Percentage of variance	Summative amounts	Characteristic root	Percentage of variance	Summative amounts
1	3.5462	39.4023	39.4023	3.5462	39.4023	39.4023	2.9125	32.3611	32.3611
2	1.6078	17.8644	57.2667	1.6078	17.8644	57.2667	1.9326	21.4735	53.8346
3	1.2273	13.6372	70.9039	1.2273	13.6372	70.9039	1.5362	17.0692	70.9039
4	0.6595	7.3279	78.2318						
5	0.5525	6.1387	84.3705						
6	0.4563	5.0699	89.4403						
7	0.3549	3.9433	93.3836						
8	0.3168	3.5202	96.9038						
9	0.2787	3.0962	100.0000						

Table 5. Table of factor loadings prior to and post rotation.

Variable	Component loadings					
	prior to rotation			post rotation		
	1	2	3	1	2	3
Family upbringing	0.354	0.781	0.213	-0.060	0.871	0.132
Teaching through education	0.516	0.733	0.014	0.176	0.879	0.020
Special programmes on TV and radio	0.737	0.256	-0.226	0.626	0.517	-0.006
Articles in newspapers and magazines	0.799	0.029	-0.264	0.772	0.334	0.035
Relevant multimedia CDs-DVDs	0.781	-0.289	-0.247	0.859	0.039	0.120
Books on the topic	0.712	-0.336	-0.163	0.783	-0.025	0.183
Information from the Internet	0.653	-0.339	-0.057	0.690	-0.044	0.259
Contact with ecological organizations	0.446	-0.117	0.752	0.101	0.136	0.865
Visits to environmental education centres	0.481	-0.265	0.636	0.231	0.007	0.808

The variables that “belong” to each factor are those for which the loading (columns 1, 2, 3) is higher (than the value 0.5) on that factor. The first factor comprises the variables “special programmes on TV and radio”, “articles in newspapers and magazines”, “relevant multimedia”, “books on the topic” and “information from the Internet” and can be entitled “shaping environmental awareness through the mass media”. The second factor entitled “shaping environmental awareness through formal and non-formal education” includes the variables “family upbringing” and “teaching through education”. The variable “special programmes on TV and radio” can also be included in the second with a smaller loading. The fact that it is linked to the teaching of youth also reveals the great significance and attention we need to pay when exposing our children to this variable. The third factor includes the variables “contact with ecological organizations” and “visits to environmental education centres” and can be entitled “building environmental awareness through informal education”.

Therefore, according to the students, education is the most important means through which to shape environmentally-aware persons. The view of the students from the Department of Forestry and Management of the Environment and Natural Resources, regarding the environmental training provided, is depicted in Table 6. The majority of students believe that environmental education is insufficient in primary, lower secondary and upper secondary school (60.6%, 65.7% and 49.8% respectively). The situation is somewhat improved in higher education, since 42.4% of students find that it is adequate. Regarding their own Department, they consider the environmental training provided to be complete (47.8%) and adequate (37.7%). It is also important to note that 1.3% consider it is non-existent, but this view is only limited to the first two years of study.

Table 6. Evaluation of environmental education at all levels of education.

Educational Levels	Non-existent		Insufficient		Adequate		Complete		DK / NA	
	n	%	n	%	n	%	n	%	n	%
Primary	39	13.1	180	60.6	65	21.9	5	1.7	8	2.7
Lower Secondary	40	13.5	195	65.7	53	17.8	4	1.3	5	1.7
Upper secondary	85	28.6	148	49.8	52	17.5	6	2.0	6	2.0
Higher education	30	10.1	89	30.0	126	42.4	21	7.1	31	10.4
Dpt of Forestry	4	1.3	19	6.4	112	37.7	142	47.8	20	6.7

Discussion

The students’ views concerning public participation in environmental protection issues, and the availability of information on environmental matters, are similar to the views of the people of Orestiada. More specifically, 66% state that there are few citizens who show interest in environmental issues, 16.1% note that many people are interested, 9.4% answer that almost no one is, 6.8% that almost all people have environmental concerns, while 1.8% of the citizens did not answer the question (Tampakis et al, 2004). If the peoples’ perception, knowledge, awareness and attitude toward environmental issues are high, this means that the peoples’ environmental literacy rate is also high. Increasing environmental literacy will lead to a change in behaviour or action. Determining what people know about the environment, how they feel about it, and what actions they take that may help or harm the environment is critical to establishing the sustainability of a community. This will create a strong national environmental movement that will conserve the environment by solving environmental problems (Sigit Sudarmadi, et. al., 2001). The most effective tool for achieving sustainable development is considered to be environmental education, since the aim of the latter is to make citizens environmentally-aware. Filho (1997) describes environmental education as a process of understanding and clarification of the value of the environment and the

relevance of environmental resources, with a view to encouraging people to use such resources in a more sustainable way. This awareness must be linked to the co-existence of all living creatures and to a feeling of responsibility towards the environment. In order for this to be achieved, citizens need to actively participate in a lifelong learning process, as basic, occasional training is not sufficient (Chapman and Sharma, 2001). Many social scientists have concluded that people's attitude has a considerable influence on their behaviour (Heberlein and Black, 1976; Weigel and Newman, 1976; Kallgren and Wood, 1989; Ramsey and Hungerford, 1989).

As regards the possible ways of creating environmentally-aware citizens, the views of the students converge with the basic principles of communication. Thus, mass communication methods are mainly used simply to make matters known, i.e. as an initial source of environmental information (Nagel, 2004; Aini *et al* 2003; Nurizan *et al*, 2004), while inter-personal communication methods are used when an in-depth analysis of an issue is required.

The environmental education provided at early childhood is considered particularly effective. This is supported by the fact that the first years of learning are a fundamentally-important period for moulding people's behaviour towards the environment (Bryant & Hungerford, 1977; Stapp, 1978; Tilbury, 1994; Wilson, 1994). These years are considered to be of vital importance and their results or impact can be irreversible in many cases. Therefore, when children are taught to respect the environment, this lesson will follow them later in life, while children that develop a negative attitude, will be deeply affected by it as they grow older (Tilbury, 1994; Cohen, 1984).

Environmental education in Greece is taking its first steps, as regards its practical application in the framework of educational systems; this is a logical development, since the former clashes with people's mentality and culture (Flogaiti, 1999). The preconditions for promoting environmental education in our country were created after the resolution of the EU Ministers of Education in 1988 (Tamoutseli, 2003), while Law 1982/90 in 1990 officially instituted its position in the school curricula (Georgopoulos, 1998). However, although we must accept that efforts are being made to upgrade environmental education, it will take time for their results to have an impact on society. In a relevant research among the citizens of Orestiada, 59% consider that environmental education is insufficient, and a similar percentage (17.9%) believes that it is either non-existent or adequate. Only 1.3% consider that it is complete and 3.9% ($s_p=0.0099$) of the citizens chose not to answer (Tampakis *et al*, 2004).

Conclusions

The views of the students from the Department of Forestry and Management of the Environment and Natural Resources, one of the two existing University-level Departments in Greece, are considered to be of great importance, since graduates of this Department will be employed by the Environmental and Forestry Services and Agencies of the country.

The students' opinion is considered disheartening, both regarding public participation in the protection of the environment and also in relation to the existing information on environmental issues.

With regard to possible ways in which environmentally-aware citizens can be created, the students believe that three factors emerged from the grouping that followed the principal components analysis; these are related to formal and non-formal education, mass communication and informal learning. They also consider that the most suitable methods for the main objective to be achieved, in hierarchical order, is through formal education, through the family and by visiting environmental education centres. They consider as least effective the following means of communication: TV, radio, newspapers, magazines and multimedia, i.e. mass communication methods.

In addition, the teaching provided on environmental protection at various levels of formal education is considered inadequate, with a slight differentiation concerning the training provided by Technological and University Institutes. Therefore, the educational system must capitalize on the

participation of students in activities with an environmental content either through or beyond the teaching syllabus.

References

Aini, M. S., Fakhru'l-Razi, A., Paim, L. & Masud, J. (2003) Environmental concerns, knowledge and practices gap among Malaysian teachers, *International Journal of Sustainability in Higher Education*, 4(4), 305–313.

Bartkus, K. R., Hartman, C. L. & Howell, R. D. (1999) The measurement of consumer environmental knowledge: revisions and extensions, *Journal of Social Behavior & Personality*, 14(1), 129–147.

Bradley, J. C., Waliczek, T. M. & Zajicek, J. M. (1999) Relationship between environmental knowledge and environmental attitude of high school students, *Journal of Environmental Education*, 30(3), 17–22.

Bryant, C. K. & Hungerford, H. R. (1977) An analysis of strategies for teaching environmental concepts and values clarification in kindergarten, *Journal of Environmental Education*, 9(1), 44–49.

Chapman D. and K. Sharma, (2001) Environmental attitudes and behaviour of primary and secondary students in Asian cities: An overview strategy for implementing an eco-schools programme, *The Environmentalist* 21 (2001), pp. 265–272.

Cohen, M.J. (1984) *Prejudice Against Nature*. Freeport, ME: Cobble-smith.

Daoutopoulos, G. A. (1994) *Methodology of social research in rural areas*. 2nd edition. Thessaloniki.

Dzoufras, I. & Karlis, D. (2001) *Elements of Multivariate Data Analysis*. Notes on course “Data Analysis I”. Dpt of Business Administration. University of the Aegean.

Filiass, V., Pappas, P., Antonopoulou, M., Zarnari O., Magganara I., Meimaris M., Nikolakopoulos, I., Papachristou, E., Perantzaki, I., Sampson, E. & Psychogios, E. (2000) *Introduction to the Methodology and Techniques of Social Research*, Gutenberg Publications, Athens.

Filho, W. L. (1997) Integrating environmental education and environmental management, *Environmental Management and Health*, 8(4), 80–82.

Finger, M. (1994), "From knowledge to action? Exploring the relationship between environmental experiences, learning and behavior", *Journal of Social Issues*, Vol. 50 No.3, pp.141-60.

Flogaiti, E. (1999) *Nature in environmental education. Nature in ecology*. Stochastis publications / INIER, pp. 111-122.

Frangos Ch. K. (2004) *Methodology of Market Research and Data Analysis with the use of the Statistical Package SPSS for Windows*. “Interbooks” publications.

Franzen, A. (2003). Environmental attitudes in international comparison: an analysis of the ISSP surveys 1993 and 2000, *Social Science Quarterly*, 84(2), 297–309.

- Gambro, J. S & Switzky, H. N. (1996) A national survey of high school students' environmental knowledge, *Journal of Environmental Education*, 27(3), 28–34.
- Georgopoulos, A. (1998) The debate on environmental education. *Ecology and Environmental Science*. Stochastis publications, pp. 217–232.
- Harman, H. H. (1976) *Modern Factor Analysis*. Chicago: The University of Chicago Press.
- Herberlein, T.A. and Black, J. S. (1976) Attitudinal specificity and the prediction of behaviour in a field setting. *Journal of Personality and Social Psychology* 33, 474–79.
- Howe, R. & Disinger, J. F. (1988) Teaching Environmental Education Using Out-of-School Settings and Mass Media, ERIC/SMEAC Environmental Education Digest No.1. Available at: <http://www.ericdigests.org/pre-19215/mass.htm> (accessed 26 May 2005).
- Howitt, D. & Gramer, D. (2003) *Statistics with the SPSS 11 for Windows*. Kleidarithmos publications. Athens.
- Hungerford, H.R., & Volk, T.L. (1990). Changing learner behaviour through environmental education. *Journal of Environmental Education*, 21(3), 8-21.
- Joseph, L. A., Victoria, E. A., Campbell, A. B. & Louie, R. (2004) Teaching students to make better decisions about the environment: lessons from the decision sciences, *Journal of Environmental Education*, 36(1), 33–44.
- Kallgren, C.A. and Wood, W. (1989) Access to attitude-relevant information in memory as determinant of attitude-behavior consistency. *Journal of Experimental Social Psychology* 22, 238–58.
- Karlis, D. (2005) *Multivariate Statistical Analysis*. Athens. Ath. Stamouli publications.
- Nagel, M. C. (2004) Lend them an ear: the significance of listening to children's experiences of environmental education, *International Research in Geographical and Environmental Education*, 13(2), 115–127.
- Nitz, M. (2000) 'The media as a tool for communication on the environment and sustainability', in Leal Filho (ed.), *Communicating Sustainability, Environmental Education, Communication and Sustainability*, Vol 8, pp. 45–68 (Frankfurt: Peter Lang).
- Nurizan, Y., Laily, P., Sharifah Azizah, H., Norhasmah, S., Aini, M. S., Othman, M. N. & Naimah, S. (2004) Sustainable consumption: understanding of main concept and knowledge of environment. *Malaysian Journal of Consumer and Family Economics*, 7, 1–15.
- Oppenheim, A.N. (1973) *Questionnaire Design and Attitude Measurement*. London: Heinemann.
- Piperopoulos, G.P. & G.E. Tsantopoulos, (2006). "The characteristics of environmental organisation in Greece in relation to employment of a public relations officer", *Environmental Politics*, v.15 no.3, pp. 454-461.
- Ramsey, J.M. and Hugerford, H.R. (1989) The effects of issue investigation and action training on environmental behaviours in seventh grade students. *Journal of Environmental Education* 20(4), 29–34.

- Sharma, S. (1996) *Applied Multivariate Techniques*. John Wiley & Sons, Inc. Canada.
- Siardos, G. K. (1999) *Multivariate Statistical Analysis Methods. Part I: "Exploring the relations between variables"* Zitis publications. Thessaloniki.
- Simmons, M. R. (1998) *A study of high school students' attitudes toward the environment and completion of an environmental science course*. Research Reports. Educational Resources Information Center (ERIC) (Washington, DC, US Department of Education).
- Stapp, W. (1978) An instructional model for environmental education. *Prospects* 8(4), 495–507.
- Strong, C. (1998) The impact of environmental education on children's knowledge and awareness of environmental concerns, *Marketing Intelligence & Planning*, 16(6), 349–355.
- Sudarmadi, S., Suzuki, S., Kawada, T., Netti, H., Soemantri, S., Tugawati, A. (2001) "A Survey of perception, knowledge, awareness, and attitude in regard to environmental problems in a sample of two different social groups in Jakarta, Indonesia" *Environment, Development and Sustainability* 3: 169-183
- Tamoutseli, K. (2003) "Environmental Education Programmes. Brief Guide to the implementation of environmental education programmes", Published by the Environmental Education Bureau of the Directorate of S.E., West Thessaloniki.
- Tampakis, S., Karanikola, P. & Koutroumanidis, Th. (2004) An initial approach of the views of the citizens of Orestiada on ecological issues (Recycling, Reforestation and Organic Products). *Proceedings of 1st Environmental Conference*, Pref. Orestiada 7 - 9 May 2004, pp. 376 – 382.
- Tikka, P. M., Kuitunen, M. T. & Tynys, S. M. (2000) Effects of educational background on students' attitudes, activity levels and knowledge concerning the environment, *Journal of Environmental Education*, 31(3), 12–20.
- Tilbury, D. (1994) The critical learning years for environmental education. In *Environmental Education at the Early Childhood Level* (R.A. Wilson, ed.). Washington, DC: North American Association for Environmental Education.
- Tsantopoulos, G. (2003) 'The application of categorical regression for the identification of factors that contribute to the growth of planned public relations', *Special Themes Institute of Technological Education Ministry of Education and Religion* 4: 59–73.
- Volk, T. L. (1984). Project synthesis and environmental education. *Science Education*, 68(1), 23-33.
- Weigel, R. H. and Newman, L.S. (1976) Increasing attitude behaviour correspondence by broadening the scope of the behavioural measure. *Journal of Personality and Social Psychology* 33, 793–802.
- Wilson, R. A. (ed.) (1994) *Environmental Education at the Early Childhood Level*. Washington, DC: North American Association for Environmental Education.

**Education for Sustainability : is rhetoric more welcome than the reality?
Some thoughts from Primary Initial Teacher Education in Middle England.**

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Abstract

This paper outlines work undertaken by the author, a science tutor in Primary Initial Teacher Education (ITE) in a university in Middle England. It is presented as a two fold case study, which serves to illustrate how a particular commitment to sustainability issues was realised in the practise of being a university tutor. The paper is a very personal perspective. The experiences presented will, it is suggested, resonate with those of the reader so that the ‘thoughts’ given here may act as spur to action for others. Through presentation of how both the author and her students (the next generation of English primary school teachers) came to incorporate ESD into their lives (both personal and professional), we aim to provide a vignette of hope.

First, we shall demonstrate how a simple response to a national call for action enabled the author to embark on deepening her commitment to raising awareness of ESD through course design and development. We suggest that the time is ripe to examine ESD provision on ITE courses because this will do something much more profound than enhance subject knowledge, it will build character and this will impact on the future of all our lives.

Secondly, we focus on the experiences of teaching about sustainability, of a small cohort of science specialists and non science student teachers on an undergraduate degree programme in the above university. The experiences of these students are related in their own voices and expose personal attitudes, commitments and understandings of sustainability. What was revealed was a highly unexpected challenge for these budding teachers.

Keywords:

Education for Sustainable Development (ESD), Attitudes, Perceptions, Frame of mind, Sustainability.

The Earth is green and beautiful and God has appointed you his stewards over it

The Prophet Mohammad (PBUH): The Quran

Introduction: From Science to Sustainability

In 2003, the Teacher Training Agency (TTA) of the United Kingdom, (now known as the Teacher Development Agency, TDA), undertook research to assess the range of Web based professional development materials available for a range of science related strands that were considered desirable in an holistic science education for teachers. The research revealed that there was a dearth of materials available for certain areas including sustainability and citizenship. A national call was made by the TTA to address the situation since both sustainability and citizenship were considered to be closely linked to science education and highly topical.

Engaging in sustainability had many adherents, a new rhetoric about the importance of ESD could be heard at all levels of society and was beginning to impact on education too. The word rhetoric, is used here in the sense that the discourses of sustainability were being used to persuade, influence

and in some quarters to please us enough to inculcate a desire for change. There were calls for action from a number of laudable perspectives including from the Secretary General of the United Nations, Kofi Annan, who espoused that,

Our biggest challenge in this new century is to take an idea that sounds abstract – sustainable development – and turn it into reality for all the world's people. (2001)

UNESCO shed further light on the nature of ESD,

Education for sustainable development has come to be seen as a process of learning how to make decisions that consider the long-term future of the economy, ecology and equity of all communities. This represents a new vision of education, a vision that helps people of all ages better understand the world in which they live, addressing the complexity and interconnectedness of problems such as poverty, wasteful consumption, environmental degradation, urban decay, population growth, health, conflict and the violation of human rights that threaten our future. This vision of education emphasises a holistic, interdisciplinary approach to developing the knowledge and skills needed for a sustainable future as well as changes in values, behaviour, and lifestyles. (2003, p.4)

And Professor David Hicks, invited us all to act because,

The current state of the planet requires that exploration of just and sustainable futures becomes a major priority at all levels of society' (Hicks, 2002, p.5).

The arguments presented were both compelling and convincing enough to spur universities across the United Kingdom to begin to examine how an education for sustainable development made good common sense. Indeed, it was suggested that if we provided an education for sustainable development in all sectors of education from schools to universities, we might really be able to, as the Brundtland Commission Report, *Our Common Future* (WCED, 1987) said, meet

the needs of the present without compromising the ability of future generations to meet their own needs.

In response to this call by the TTA (2003), the Association for Tutors in Science Education, ATSE (a subsidiary organisation of (The Association for Science Education, ASE) was commissioned to produce materials on Science, Sustainability and Citizenship for the professional development of new tutors in science education. These materials were to be put on the new ATSE website (called the Sci –Tutors website) to be launched by the ASE in January 2004 at its annual conference in Reading, UK. The development of these Web based materials led the author to initiate the integration of ESD into Primary Initial Teacher Education courses.

National Agenda, Personal Response

When the TTA, set its remit to support the development of web based materials to help the professional development of tutors and hence their trainees in ITE, the opportunity arose for me to become involved in an idea which would have national impact and which I felt, would help me develop as a professional and potentially as a researcher.

At the time, I was both a member of the ATSE and worked in the field of Primary ITE. Serendipity meant that I was chosen to be commissioned to produce these materials on, Science, Sustainable Development and Citizenship (Zaman, 2004).

Before embarking on a career in the University sector I was a primary school deputy headteacher who also led the science curriculum within the schools I worked in. During this time my ideas about the centrality of notions of ESD and citizenship were consolidated and in facilitating the setting up and running of schools councils, environmental clubs, school gardening clubs, I came to realise the

important contribution children, even at the primary level of schooling can make. I believed that primary school children can, given the right circumstances and guidance, make decisions about their lives and were capable of exercising their rights and responsibilities. I believed, that the role of all teachers, especially those of science, should be to facilitate for embedding notions of ESD and citizenship from the primary school onwards. I was convinced that if children are to have an impact on a local, national or global level then it was not just a scientific or educational goal but a moral imperative for us as their teachers to give them practice in making decisions and participating on all manner of issues which affect all our lives albeit in the microcosm of the primary school.

For as long as I have been teaching science, both in schools and subsequently in the university sector, a pedagogical mantra has been that students at whatever level (whether at school or in ITE), need to be provided with moral imperatives which might arise from a combination of scientific and educational principles that will lead to some action, whatever this maybe. Furthermore, I believed that the *raison d'être* for science education was to help learners understand that in learning science one has to accrue certain procedural and conceptual understanding and develop certain attitudes which will then enable them to actively and productively engage in the world around them. Developing certain attitudes, I believe lie at the heart of making progress as scientists and as responsible scientifically literate citizens. In short, I hoped that education would become a revolutionary activity. By giving my student teachers in ITE an opportunity to accrue personal skills, knowledge and develop certain attitudes through an education in science that emphasises the value of ESD in all our lives, I hoped no less than for a cultural revolution. If handled with sensitivity, I hoped that a situation could arise where people; the student teachers themselves, the children they teach and the families that such teaching might impact upon, might even make changes in their lifestyle. If this were to happen then ESD as part of a science education could be said to be directly related to changing the local contexts we all inhabit. But changes are not welcome by all and changes in lifestyle certainly can be dramatic and are unlikely to be achieved at no personal cost as we shall see in the excerpts from our student teachers given later in this piece. Additionally, if we are to promote learning for life in the 21st Century as Claxton (2002) argues, schools should be aiming to prepare learners for an unpredictable future in which their greatest asset would be their ability to adapt, to be flexible and to be able to cope with ambiguity and uncertainty.

I would argue further that this should not only be the remit of schools but of society it self and as part of society at a micro cosmic level, of all educational establishments including universities such as the one I currently work in. Thus, in a democratic society education and in this case the rhetoric of ESD becomes part of the political process. And as we all know, the field of politics is prone to contestation, full of alternative views, vested interests, prejudices, power asymmetry and control. We cannot afford to treat these lightly.

Working in any university, I feel that tutors of science (or for that matter any subject in a school of education), consistently tread on the edge of a knife. On one side of the blade, it seems to me, that we wish to impart all that we value as important for a proficient education in science. For example, I might feel that it is vital, that the curriculum for science education in ITE which I develop and subsequently teach my student teachers has to help them develop a range of conceptual understandings and let's say, proficient research skills. The rationale for such curriculum development might be both personal, arising out of the values I and the University hold and political, the values we might collectively hold as part of the wider society. If we then superimpose on this our notion that education is indeed to be revolutionary, it should equip these student teachers and the children they will teach to deal with the fast changing environments in which we find ourselves. Turning our attention to the other side of the knife blade, there is the more personal agenda of research activity itself. If I am to teach about research skills effectively, then, I might argue that I can only do this if I am an active researcher. As a former and current researcher, therefore, the question of how I could make connections between research and practice is inevitably at the forefront of my thinking. As any university tutor will understand, the answer to this question is often convoluted and research activity is itself blighted by the vagaries of a system that has no one framework that is followed by all on a like for like basis (I'm diverging slightly here, so I'll get

back to the point). When I joined my current place of work in Middle England, I was still working towards finding ways to research and it occurred to me that if I was to incorporate raising awareness of ESD, research and the use of Web based resources then I could solve a number of dilemmas both personal and political.

The impetus for providing an ESD for student teachers in ITE came from guidance laid down by the Sustainable Development Education Panel (SDEP) commissioned by the DfES (and thus part of the political process of raising societal awareness of the importance of ESD) .The SDEP produced amongst several documents a draft national strategy for ESD called Learning to Last which suggested that:

We need to ensure that teachers have access to skills, expertise and a body of knowledge in ESD. It is important to ensure that newly qualified teachers are competent and confident in this area and that they continue to develop these skills throughout their professional life. (2003, p. 4)

In the following year, 2004, the DfES commissioned the Geographical Association to carry out research on ESD and teachers' needs. Their findings suggested that ESD was a low priority in an overfull curriculum, with teachers lacking knowledge, time, co-ordination and communication. The research highlighted seven areas that might be developed and called for the need for CPD related curriculum development within subject communities (Elshof, 2005)

I came to this ESD/ Sci –Tutors project through being interested in the teaching of ideas about ESD and citizenship and particularly the use of the World Wide Web as a learning tool. Additionally, my work at as a university tutor meant that I had responsibility not only for science teaching but also for the professional development of trainee and practicing teachers. Taking part in the development of not only the publication mentioned above (Zaman, 2004), but also of the ATSE Sci- Tutors website itself was an opportunity that was too good to miss.

Course redesign and implementation

As a new arrival at the university in September 2005, I was charged with leading particular modules including as part of the BA Primary Education programme a module on Science Leadership, a final year module for science specialists. A brief audit of experiences provided by this whole programme and the Science Leadership module in particular, revealed that there were important gaps in provision, namely that ESD was not covered at all. This highlighted a discrepancy between the rhetoric as espoused by the Government and media and the reality of our lives. Student teachers (and the rest of us) were being bombarded by political agencies and the media to get to grips with tackling issues that were impacting on our lives. Concerns such as resource management, conservation of fragile environments, social equity and quality of life were part of the zeitgeist. I felt, therefore that the time was ripe for the students following the science leadership modules to be given opportunities to experience the vision of science as posed by Irwin, (1995). His 'citizen science', conceptualised how 'official' or 'normal' science was being increasingly challenged by the times we live in and as new forms of knowledge emerged in response to legitimation crises. Citizen science saw

Values as central (explicit) and Knowledge that empowers critical and active citizens as agents of sustainable development (p.35) After Eden,(1998) and Sardar, (2000)

An audit of the assignment for the leadership module undertaken in the previous year revealed that of the development projects undertaken by the cohort (2004-2005), none had focused on ESD. Thus, I wondered how ESD might be incorporated into some aspect of the course for Science Leadership and whether this module might be used as a vehicle to encourage student teachers to develop important generic skills required of the science subject leaders of tomorrow as espoused in the National Standards for Subject Leadership (TTA 1998). These standards had been instigated by

a political movement which sought to provide a specialist teaching workforce (in the form of subject leaders), who met certain benchmarks set by the Government.

Other important publications which guided my thinking and that of educators working to develop ESD within ITE were as follows. With the increased emphasis in schools since 1998 of the Citizenship agenda and a personal commitment to believing in and accepting Agenda 21, a 'Blueprint for action in the 21st Century' (Quarrie 1992). I felt that, as a tutor of budding science teachers and potential subject leaders in school it was vital to harness our efforts into raising student teachers awareness of its four strands:

- To decrease the use of raw materials and energy
- To reduce pollution and waste
- To protect fragile environments
- To share wealth and responsibilities more fairly in consideration of everyone's needs

However, awareness raising could not be solely relied upon but pragmatic solutions needed to be sought. After all, it would be pointless to have accrued a bank of knowledge about how to act to meet the above four strands if that knowledge stayed within the confines of the university to be used by our student teachers merely for course assessments. But other publications indicated how we might avoid such a situation and that the knowledge accrued of the four strands above could be usefully transferred in practice for all our student teachers and their children through means which already existed. These means were revealed when undertaking a review of the Curriculum Guidance for the Foundation (DfEE/QCA 2000) and the Science National Curriculum at Key Stages 1-4 (1999). Both suggested that children should acquire certain skills, concepts and implicitly attitudes (particularly at KS1-4) when learning science. The DfEE/ QCA identified seven key concepts of ESD in 2004, (the same year that I wrote the materials on Science, ESD and Citizenship), these are:

- Interdependence
- Citizenship and stewardship
- Needs and rights of future generations
- Diversity
- Quality of life
- Sustainable change(within limits)
- Uncertainty and precaution(adoption of a cautious approach)

Clearly then, it seemed that these concepts and the values that must be adopted if these are to be effectively understood and incorporated into the daily lives of those learning science complement each other. Science education, I felt had to help to explore all of these concepts in a range of science content areas and so could be considered an ideal vehicle for the promotion of these concepts.

I felt that if the science leadership course we offered could raise awareness of the four strands of Agenda 21 and integrate these with an understanding of the Key concepts for ESD, then I could excite, entice and empower my student teachers to see themselves as potential and real agents of change. It was a rather grand vision of education which sought through local action (through an ITE module) to begin to enact global change. I hoped that the Leadership module would be a vehicle for ESD so that the student teachers I taught would in turn educate the children in their charge about sustainable development. I hoped that the cascade effect would work and that a mini revolution, at a local level at least, might take place.

Case Study 1

The Web materials I'd produced (Zaman, 2004), had a section looking at resource materials such as children's books (both fiction and non fiction), CD-ROMs, relevant Internet sites and a range of books to supplement subject knowledge about ESD. I designed a directed time task, initiated during sessions at the university and supplemented by the students when working in schools on teaching practice and in their own time. Significantly, unlike previous years the task was mark bearing and contributed to the final mark to be awarded for the whole assessment of the module. Marking of this first cohort of assignments suggested that student teachers clearly engaged well with this task and several of these students through module evaluations noted that personal benefit, through being awarded marks, proved to be a great incentive. The task was facilitated by the tutor working in collaboration with the Science Subject Leader of a local primary school. The subject leader was briefed about task requirements before student teachers were taken into the school. The full task as it was presented to student teachers is reproduced below.

Aims of Task:

- Raising awareness of Science and its links to ESD
- Raising awareness of the roles and responsibilities for leading the science curriculum in a Primary School.

Overarching requirements:

- Plan for the development of the school grounds for ESD through Science
- Develop suitable activities for use by children from Foundation Stage (ages 3-5) to Lower Key Stage 3 (up to the age of 12).
- Use a range of resources to help you in this task including Web based materials developed by the ASE

Specific requirements were to:

- Show how science can help to enhance children's understanding of ESD and Citizenship.
- Present your ideas in the form of a poster and accompanying booklets which details your development plan. Ensure that your poster shows the following:

Before and after plans for areas to be developed around the school—clearly annotated

How you might consider financing such development

Activities for each Key Stage

Resources including reference materials such as the ASE web based materials for Sci-Tutors as well as books and equipment.

What the tutor and students did

- We visited a local school, children from the school's council acted as tour guides, information providers and reference agents
- We spent some time examining and exploring the school grounds (we took photographs and asked questions)
- We spoke with the Science Subject Leader who provided contextual information about what the school community wanted and what they needed
- Student teachers researched and completed the task producing both posters and booklets as required.
- Student teachers agreed to look at stories from the Web resources

How the task was assessed

- Each poster was presented by individuals to the whole group. Ideas were evaluated using pre specified criteria. Verbal and written feedback was given.
- The posters and booklets were taken into school and left for a week so that all staff and children could evaluate them and award a mark out of ten (using the above criteria) and deciding which they felt best met their needs
- The Tutor evaluated the posters and booklets and allocated final marks after collating those given by the other students, the school community, by herself and a second tutor who taught part time on the module.

Outcomes

As a way of introducing ESD into the curriculum for subject leadership in science this task proved to be very useful, although student teachers reported that it was time consuming the depth of consideration applied to its completion was laudable. It seemed that student teachers had taken on board some items outlined by Agenda 21 better than others. A detailed analysis of work produced, however, is not within the remit of this paper although the benefits accrued were summarised by the students and the science subject leader in the following way.

This task helped me see what is possible to do if you understand what ESD is about and you work towards getting your children to understand it too

Sarah, BA Student 2006-2007

I talked about this task in my interview and coz I could tell them (the interview panel) about ESD and my feeling about it and how I think it links to science, they told me afterwards that it was this that convinced them to give me the job

Emma, BA Student 2005-2006

It seemed to be a really worthwhile task..... I never had anything like this module on the course that I did, I wish I had as it seems to prepare you to tackle the job whereas people like me have had to learn as we go along..... The head and other staff suggested that I ask if we can copy some ideas from Louise's and Sarah's booklets because they were so good. A lot of us (staff), felt that we could use the ideas suggested to really get us thinking about ESD in the school. It is something new for us and we're still working on it and as a new subject leader I was particularly interested to get all these good ideas. Will you come back next year?

Mel, Primary Science Subject Leader, 2006.

Some initial thoughts about Case Study 1

Given the relatively short time it took to set up this task, the benefits conferred on the student teachers seemed to suggest that it proved to be valuable in helping them to understand important aspects of ESD and pedagogy. There was an added, if unexpected bonus as 6 out of the 10 students from the 2005-2006 cohort reported they were able to talk about their experiences of learning about ESD at interview and felt it had an impact on being offered a job. In this case, it appeared that buying into the rhetoric of ESD, had a positive impact on the reality of the lives of these students. The comment by the subject leader of the school we worked with (see above), reveals that there maybe a wider impact. Indeed from this year's cohort (2007), one particular response to the same task was awarded a first class mark by the school and the tutor but more importantly the head-teacher reported that 'this piece was remarkably astute, could we copy aspects of it and use it within our documentation?'

He also suggested that the school staff wished to adopt the ideas suggested by the student teacher when developing the school grounds in the coming year. This therefore demonstrates the very real

impact that a university module undertaken by student teachers in ITE could have on the lives of the local community through the schools we liaise with. In taking us as a group around the school, the student teachers spoke with the children from the school council about the children's desires for developing the school grounds and as these were incorporated into the response produced by my students, we demonstrated that children's voices (expressed by their representatives elected through a democratic process which models itself on the wider political process) can be heard and acted upon by us at the university and it seems their requests will be realised by their school. This was, luckily for us, the ideal conclusion to our joint endeavours, but it would be foolish to think that in every university and every school across the land, similar possibilities exist. It is, of course entirely context and content dependent. But if this case study could indicate anything to the reader it is that a little effort can go a long way and hope springs eternal. However, whilst this may come across as cheerfully optimistic and a little naïve, I choose to adhere to it as Hicks (2006) suggests, "Hope has a central role to play.....not in the shallow sense of hoping that things will improve but in the sense of accessing deep sources of inspiration". Thus, Paulo Freire writes: "I do not understand human existence and the struggle needed to improve it, apart from hope and dream. Hope is an ontological need. Hopelessness is but hope that has lost its bearings, and become a distortion of that ontological need.....Hence the need for a kind of education in hope." Freire (1994). Hicks further suggests that "Cynicism about hope is one element of the psychology of despair" and that it is this that can lead to inaction. If we engage our student teachers by teaching them about ESD in their ITE courses, we inevitably teach them about issues that might threaten our emotional and physical security. In the face of this, Bailey (1998) suggests, that there is always the ever present danger of succumbing to the pessimism of the times, of diving into despair because the problems that we face might seem overwhelming and unmanageable. In presenting this case study, my hope is that by making my experiences visible and explicit I might go somewhat towards sharing my experiences so that others may embark on fashioning their own stories about how they could begin to incorporate ESD in their own universities, for their own courses. In reading this case study I'd advise readers caution against assuming that I am attempting to present a blueprint for integrating ESD in primary science ITE and to imagine that my 'story' can be easily transferred to other contexts. The development of a specific module in a middle English University, presented here charts my particular journey, others journey's will rightly be quite different and each will be faced with tensions and successes specific to their own contexts.

Case Study 2

The experiences of science specialists undertaking the Subject Leadership module described above and one non science specialist undertaking an elective in Education for Sustainability EfS (a shorter module provided as an elective within the final year of the BA Primary Education degree), are described in this next case study below. These budding teachers awareness of the most important issues and their attempts to learn and teach about sustainability, is juxtaposed against the impact of such teaching on the lives of the children they teach and the children's families. The unexpected reality of teaching in a community that is, it seems, reticent about changing its attitudes and commitments revealed a new challenge for local action for some of the students undertaking these modules. As a leadership module tutor one of my tasks was to visit the student teachers in school, observe them teaching a science lesson and provide feedback. One such visit prompted the idea of gathering some research data about student teachers experiences of ESD. After an observation of a primary science lesson with Sophia (who inspired this research), I was asked for advice on how she might address a backlash from parents against her teaching about ESD through her science lessons. Sophia outlines the problems and tensions associated with her teaching in her own words below, but as she told me her story I wondered if other student teachers experiences were in any way similar. When I asked the students on this Science Leadership module to tell me of their experiences of ESD, they all had similar anecdotal stories. In addition they were all feeling challenged but resilient and determined to fight against this backlash because they felt passionate

about the imperative for ESD and refused to give in to what they said were the ‘whims’ of some parents and carers. Once both modules were finished, I contacted all twelve student teachers (five from the Science Leadership module and seven from the EfS elective) and invited them to provide their thoughts about their experiences of ESD in their teaching so far. They were given the option to partake in an informal discussion with me and /or to provide some free writing about their experiences. Whilst several students, (nine out of the twelve) expressed an initial interest in taking part, the work of three student teachers is presented here as all these provided data both verbally through discussions with me (not presented here other than incidentally), and in written form. In addition, one of the three students whose work is presented below also provided a final course work assessment from which an excerpt has been taken. Through these means student teachers thinking about and teaching of ESD was explored. An initial review of such endeavours seemed to suggest that indeed, in many instances, for these students particularly, rhetoric was indeed more welcome than reality.

The rest of this section is presented in the voices of our representative sample of three of the twelve student teachers who were asked to relay their personal understanding, commitments and experiences of ESD both through the modules they undertook at the university and within their daily teaching in schools. These student teachers ‘stories’ were chosen for this case study because each represents the current concerns and passions of these budding teachers and they point to those vignettes of hope that I spoke of within the abstract for this paper.

Science Leadership Student 1

ESD- My experiences of teaching so far...

Being placed in an upper class area in Nottingham I found some stark differences in attitudes and actions from parents and carers to the way in which they supported and became involved in their child’s school experiences.

My experiences of dealing with ESD came about through following the children in my classes own interests in the world around them. As a science enthusiast I am always thrilled to maintain lively discussions and debates involving the world and our responsibilities to it. By nurturing my classes opinions, and by furthering their initial ideas I was quite worried by the ‘backlash’ of disapproval by the parents and carers of the future generation.

‘Miss. Dodd, why aren’t you sending us all Christmas cards? Everyone else is.’ Demi

I had no idea at the time that in answering such an innocent question that I would develop a new topic and be challenged so fiercely by adults!

I explained to Demi and to the class of Year 2 pupils that I wished them all a wonderful Christmas; however, I did not like to send cards, because I worried that not everyone would recycle their cards, and therefore I would be contributing to pollution. The children were clearly engaged with my ‘odd’ explanation, and began to ask questions about recycling, and the impacts of not recycling. From our discussions I decided to integrate more ESD into the class’ curriculum. We shared books and websites explaining to children the importance of cutting down our own waste and reducing the size of our ‘carbon footprint’, we began to make paper, and turn off all electrical equipment around the school, and took it in turns to be ‘eco monitors’. The children were engrossed in ESD and how they could make a very real difference to the future of the planet by starting to make a difference in their school. I was awestruck with the amount of enthusiasm and thirst the children had to become ‘global warriors!’

Together, the children and I started to believe that we were global citizens and ready to make a change for future generations as well as our own. Media issues at the time and programmes such as BBC's Planet Earth and other topical shows depicting the destruction of natural resources by man seemed almost to be taking over our lives. Everyday we would set aside 'philosophy time'. Where we would discuss topics from the tsunami in Sri Lanka to the hardship of Polar bears in the Antarctic. We felt as if we could find a way to help through taking care of our planet so that we might avoid such disasters in the future. We also discussed ideas that global warming may not even be 'real'.

Unfortunately, our 'global warrior' status did not enthuse all who it began to effect. At the school gates I was confronted by irate parents such as Janet and Paul who quite openly expressed dissatisfaction with aspects of my teaching.

'Tim won't let me use plastic sandwich bags for his lunch anymore, because he says that it is polluting the earth or somethin'. He won't let me put anything in the bin any more! What is it your filling his head with?' Janet

'Mandesa won't let me drive to school anymore, or to the shops. She's talking about a carbon boot print or something. Whatever your telling them is starting to effect our day to day activities...' Paul

Excellent. I thought. The 'global warriors' and I were actually beginning to start a revolution. People may yet change their lives because we were informing them about their own choices even though these choices were not popular!

After several days of anxious and frustrated parents coming to talk to me with stories of 'too much clutter for recycling', I began to reconsider the hardships of teaching ESD to children, and adults. The parents actions seemed contradictory as they were doing things such as buying 'bags for life' from Tesco as some children reported, so that they could help save the planet, yet they were complaining to me about not wanting to be told that they shouldn't be driving to school or the shops. Because I really wanted to allay the fears of these parents I sent a letter out to them and went with my diary to the school yard, offering to make appointments to talk with those who were complaining in more detail.

Through the letter to Parents I suggested that if there were any real concerns that I would love to meet with those parents and talk about their understanding on government agendas. And that I wished to use the opportunity to let parents know that I was simply talking to children about a topic which interested them and me. Further I suggested that the parents might wish to consider that there was a chance that the children were asking them to be a part of something which they actually cared about because they want to make a difference. The parents all wanted appointments with me to discuss what I was teaching and why the children were so 'frightened' of a carbon footprint!

No parents, however, actually turned up for appointments booked, which suggested to me that they knew inside that they should be listening to their children. I understood that some parents may find difficulties in ensuring that all waste could be recycled, but even though the children wanted to help to take things to be recycled, the parents couldn't be bothered to save 'clutter'.

Perhaps ESD and the changes that we all must make to ensure its progression is too difficult for everybody. However, I know that the attitude and drive that the children and I felt to be a global citizen, and make a difference can be induced in all, it just takes commitment and early education so that incorporating ESD into our lives becomes as second nature as driving a 5minute journey to school.

Sophia Dodd Science Leadership Student , BA Primary Education 2006-2007

EfS Student

Examining my own values, I realise I have strong personal views on the importance of the environment on our life. I also think that in our 'no risk' society today children have few chances of making links between the environment and their life.....

*With the increased awareness of our unsustainable lifestyle, I, as a teacher, need to give children the chance to make informed choices about **all** alternatives available to them.*

I also need to model the values I want the children to adopt, thus the importance of whole school approaches to EfS cannot be over-emphasised. As a community the school can show the larger picture of what happens when individuals combine and work together to achieve a given aim. The practice of children and adults working together to initiate ideas, settings targets that are achievable allows ownership of the learning, (Symons, 1998) which in turn will see benefits to the school and local community, for instance less vandalism, waste recycling and energy saving.

Teaching EfS raises issues of empowerment. The advent of the internet, twenty-four hour news, satellite television enables instant access to all manner of issues that many children find deeply upsetting and disturbing -

I personally think back to my class's response to the Boxing Day Tsunami, beamed into all homes at a time when children should be having fun. The children's responses were immediate, what could they do to help? What caused it? how to stop it happening again? By showing them what happened and being able to offer help, the children felt that events were not totally beyond their control, in some small way they were able to influence the outcome of this disaster for some people.

Carole Turner BA Primary Education 2006-2007

Science Leadership Student 1

My Experiences of ESD in Schools

Schools Attitudes

It is important to me to begin by explaining the differing attitudes of schools towards the incorporation of ESD into the schools curriculum. There seems to be a huge difference in this with some schools almost ignoring EDS, whilst others are taking an approach where little effort is made or at the other end of the spectrum schools seem to me to be fully embracing it as a whole part of their curriculum.

These differences are one of the most important things I have noticed when considering the teaching of ESD in schools and the gap between the two is pertinent to how ESD pans out in primary schools nowadays. A further problem can also be where one teacher has an interest in ESD but few others in the school do and little/ no effort is made to

share these views with other teachers, therefore when the interested teacher leaves their interest leaves with them, and whilst the children might still have gained a lot from this kind of education they are not given the opportunities to do so. For me this really shows the importance of schools working not just individually, but as part of the community (including other schools within that community) to ensure that children are given a good, full education in these areas.

The Trouble with Teaching ESD

As well as the problems outlined above another key problem when teaching ESD is that unfortunately little of what we teach the children about topics such as global warming is set in stone, in fact it is highly open for debate. This means a tentative approach needs to be taken, particularly when we consider that parents or even other teachers may not share our views with us and may not wish to share these views with their children. A key part of ESD is that children can accept the different lifestyles people may have, but work towards improving their own, and their school life for the better.

Global Perspective

One way I have discovered that may help overcome this is to take a global perspective: looking at how our actions affect other people's lives and what other cultures (as well as our own) are doing to help overcome these problems. This global perspective is key to children understanding their place as a citizen of the world.

Cross Curricular Work

ESD should not be something that is taught as a standalone subject, it should be integrated into the curriculum, as well as the wider life of the school so that in turn it becomes an part of their every day lives. Children should be able to debate, and share their feelings.

Active Work

Another key factor of successful ESD work is that children must be actively involved in its implementation, growing and making things, recycling, contacting schools in other cultures etc. I have seen a severe lack of this in schools and this can lead to scare mongering, where children are told about the negative effects of changes in the world/ climate but are not giving the opportunity to feel they can make a difference to help solve the problem of these changes.

Mel Smith BA Primary Education Science Leadership 2006-2007

Some initial thoughts about Case Study 2

Each of the three student teachers in this representative sample demonstrate how a personal commitment is required to both understand and teach about ESD. Sophia's example was particularly interesting because it posed a new challenge that readers might be alerted to. The disparity between good intentions on the part of the teacher and the resistance to change experienced by her, may be part of the new discourse of ESD as we move, from an era of complacency to an era of action, from an attitude of can do, to a commitment to will do.

With Carole's story, we can see that her personal commitment has given her a very particular stance on EfS; it appears that she considers that if teachers are to be effective in combating the unsustainable lifestyles that many of us have rather successfully learned to live, this can only be done through examining with children how to learn to live sustainably. To this end, Carole suggests that her role as a teacher, is in modelling the values she grew up with and continues to hold about the importance of the environment in her life. Through discussion, she talked of how for her, a sense of love for the environment was born through first hand interaction with it during her childhood and how this sense of love had now in her adulthood, been transformed into a passion for protecting and sustaining this environment. It is this transformative effect that she and the other student teachers in this sample all argued for in their discussions and which Stephen Sterling of

London South Bank University and some other educators have pondered . Sterling argues that no less than a complete transformation of the current mechanistic and technocratic educational paradigm is required (Sterling 2006), if we are to have what he calls sustainable education. His version of sustainable education comprises the following four elements

“Sustaining: it helps to sustain people, communities and ecosystems

Tenable: it is ethically defensible, working with integrity, justice, respect and inclusiveness

Healthy: it is an adaptive, viable system, embodying and nurturing healthy relationships

Durable: it works well enough in practice to keep doing it” (Sterling 2004)

Lastly in this case study, Mels example begins to ponder the question of how can we as educators be part of this change? In her written submission for this small scale research she has, it seems to me, made a start in thinking about how we can change education from being part of the problem to being part of the solution. Her insightful observations from her teaching practice placements over the four years of the BA degree she undertook, show us what has been the reality of ESD in those schools she has worked in. That this reality is dependent on the interests and enthusiasm of individuals which are prone to waxing and waning as staff in schools change is clearly suggested. But what leaps out at us from her writing is a sense of hope that this situation maybe combated by having strong leadership and a whole school commitment and ethos that suggests that ESD is vital not only for the good of the pupils in school but for society in general. Mel outlines for us what she considers might be some solutions for effecting change; promote global education and through it give children a sense of being a responsible global citizen; that what we do will impact on not only our individual lives but of our lives collectively; that an integrated curriculum best serves ESD and that if children are to learn about ESD they must be provided with opportunities to interact directly with their environment taking part in activities which might help foster a love of the kind our other student experienced in her childhood.

Conclusions

This paper has sought to relay the reality of ESD in a university in Middle England. There are three main conclusions (highlighted), which might usefully be drawn and are as follows:

(1) ESD is a laudable ideal towards which we should all strive- the political rhetoric now strongly supports this. As with all such ideals, however, the practice at the grass roots level may be quite different as indicated by Mel (Student teacher, case study 2). One dilemma that is not easily reconcilable, however, is that the truths or pseudo truths that politics and science deal with is directly in opposition to the somewhat evangelistic nature of the cause of ESD which could be said to have greater parallels with the nature of faith. Carole and other students who took part in the research for case study 2, talked about beliefs and values more akin to religious experiences rather than scientific endeavours. Perhaps what we need to do is to encourage our student teachers to believe that there is always a political agenda which circumscribes all educational activity. Being successful in fostering such a belief might be a determinant in winning or loosing the battle for sustainability.

(2) Student Teachers can be empowered through ITE courses to find out more about ESD by being offered a choice of appropriate modules and be directed towards these from the outset of their ITE course. However, choice of university course is according to Inman (2006) dependent on the interests, expertise and experiences of staff working to develop modules and where there is a lack of such staff, courses may be impoverished and the value of ESD never realised by beginning teachers unless they are already committed to ESD through personal life experiences. There is a sense that those ITE institutions who have committed teaching staff and strong leadership will be further ahead in the battle for sustainability than those that do not. The stakes (the future of all society) are high so we must move towards finding ways of integrating ESD across of all ITE

provision such that it is not dependent on individuals, projects or initiatives but is what all institutions do as a way of preparing their students teachers for the future.

(3) If we agree that “ Often, education is described as the great hope for creating a sustainable future” and that “ teacher education institutions serve as key change agents in transforming education and society so such a future is possible”(UN, 2005), then we might be convinced that appropriate modules can be developed by anyone with enough commitment to sustainability education. The first case study presented here is illustrative of this idea as it demonstrates how a national agenda to raise awareness of ESD for tutors enabled the author to cross the boundary between personal interests and local requirements. It is hoped that this case study shows one way in which ESD was brought into a particular science course and is presented so that readers might seek opportunities to find ways to incorporate ESD in their own courses as it is without doubt, truly cross curricular in nature.

It is recognised, however, that whilst personal commitment may not be enough to change the world on its own and indeed as with any new initiative fear as suggested above is an important limiting factor. We must recognise that both history driven by personal champions versus history created out of opposing forces can be validated in the world in which we live; ESD comprises a vast, complex and ever changing area of knowledge and understanding. This may be daunting for some tutors hence the experiences of their students may as suggested above obviously be deprived in comparison to those tutors who have a genuine interest in the subject. Sally Inman (2006), suggests that “In our experience it is often fear of not knowing enough that can prevent tutors and teachers from engaging with ESD in ITT and in the school classroom”. She describes a project sponsored by the World Wildlife Fund in collaboration with a number of London based ITE institutions and their partners in schools called the “Partners in Change” initiative. The suggestion is that if fears can be overcome then effective ESD may ensue. One challenge for ITE thus is to elicit what staff in university might fear with regards to ESD. Auditing staff and student teachers understanding and experiences of ESD might go some way towards identifying what staff and student teachers understand, and indeed don’t understand about ESD so that an action plan can be drawn up to develop such understandings. This, however, can in itself become a huge task. Problems may arise in doing what might seem like a simple task such as auditing if there is a lack of leadership within the ITE institution. In the Middle English university, described here, staff experiences suggest that ESD has been left to the enthusiasm of a small corpus of interested staff who have rallied to push forward the case for ESD. If we believe, Inman’s idea that “ITT plays a crucial role”(2006) in developing the attributes that teachers must develop if there is to be effective ESD in any school then surely the leaders of such institutions must act upon this?

Recommendations /What next

There are several recommendations one could make and some of these are given below:

(1) Further auditing across all institutions is required if we are to be reliably informed of the nature of ESD in ITE. Some recent moves by the Teacher Development Agency to fund a large scale project (Sci- Tutors project 2006- 2008) may provide some scope for conducting a wide reaching audit as part of Science Education in ITE . Alternatively within Middle England, there is now a United Nations Regional Centre of Expertise for the East Midlands, one of ten such centres planned for the UK. This may provide sources of funding and expertise to keep ESD at the forefront of the minds of leaders and staff alike in universities.

(2) Staff development for university tutors should aim to raise awareness of the importance of ESD

(3) Time to develop curricula and opportunities to share good practice and ideas must be built into the work commitments of all staff so that ESD can be translated for use across all subjects and not just within those which may seem most closely linked to it such as Science and Geography.

(4) Strong leadership is required as personal commitments can only go so far, strategic plans need to be made and then progress periodically monitored, reviewed and new targets set.

Final thoughts

The key message for me in undertaking the integration of ESD into the ITE I am involved with and the resultant outcomes reported here is that we need to be vigilant. And only by being vigilant, will we recognise that the political has a tendency to surface locally. The second case study presented shows that in this instance, it was in some parents questioning what the school is teaching their children. There are echoes here of the disputes over the teaching of literacy with either phonics or real books; or the teaching of computational basic algorithms in mathematics versus teaching problem solving; or the teaching of science for citizenship versus the teaching of the canon of science; or the teaching of sports studies rather than the getting kids to run around, let off steam and eventually, one hopes, getting us to win Olympic gold medals. So it is not too surprising that in introducing any new topic into the curriculum there will be disputes as to the nature and legitimacy of such introductions. The curriculum is contested and in constant flux as the struggle for control over "what our kids should learn in school" is joined.

If we could foretell the outcomes of these struggles there would be no need for history. More positively social studies analyses such as the one attempted here does allow us to stand back and inspect the course of events so far and ask, "What is going on here?"

One answer to this question seems to be that if we are to embrace the rhetoric and turn it into reality then we must learn to understand that sustainability does indeed require what John Huckle (2006) calls a new 'frame of mind'. Within ITE in Middle England developing such a frame of mind seems to have already started to happen.

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References

- Annan, K. (2001), United Nations press Release: SC/SM/7739 "*Secretary General Calls for Break in Political Stalemate over Environmental Issues*", 15/03/01
- DfEE (1999) *The National Curriculum – Curriculum 2000* (Handbook for Teachers) QCA, London.
- DfEE(2000) *Curriculum Guidance for the Foundation Stage*, QCA, London
- DfES (2004) *Five Year Strategy for Children and Learners*
<http://www.dfes.gov.uk/publications/5yearstrategy/>
- DfES (2003) *Learning to Last The Governments Sustainable Development Education Strategy for England*
http://www.defra.gov.uk/environment/sustainable/educpanel/pdf/sdeduc_draftstrat.pdf

- Eden, S. (1998) '*Environmental Knowledge, Uncertainty and the Environment*', Progress in Human Geography, 22/3, pp. 425 – 32
- Elshof, L. (2005) '*Teachers' interpretations of sustainable development*', International Journal of Technology and Design Education, 15/2, pp. 173 – 186
- Freire, P. (2004) *Pedagogy of Hope* Continuum Impacts, Continuum
- Hicks, D. (2002) *Lessons for the future: The missing dimension for Education* London, Routledge
- Huckle, J. (2006) *Education for Sustainable Development: a briefing paper for the Teacher Training Resource Bank (TDA). Updated edition 10/06*
<http://john.huckle.org.uk/download/2708/Education%20for%20Sustainable%20Development,%20a%20briefing%20paper%20for%20the%20Teacher%20Training%20Agency.doc>
- Inman, S. & Rogers, M (Eds) (2006) *Building a Sustainable Future: Challenges for Initial Teacher Training* CCCI/WWF-UK
- Irwin, A. (1995) *Citizen Science*, London, Routledge
- Sardar, Z. (2000) '*A Science for Us All, Not Just for Business*', New Statesman, 7 February, pp. 30 - 31
- Sterling, S. (2004) "*An analysis of the development of sustainability education*" in Cullingford and Blewitt (Eds) "*The Sustainability Curriculum*", Earthscan
- Sterling, S. (2006) "*Education for Sustainable Change : Unit 7*" *Study Guide of the Education for Sustainability Programme*, LSBU
- TTA(1998) *National Standards for Subject Leaders* TTA, London, England.
- UNESCO (2003) The Brundtland Commission Report: *The Decade of Education for Sustainable Development: framework for a draft international implementation scheme*, Paris, Unesco
- Wells, G & Claxton, G (Eds)(2002) *Learning for Life in the 21st Century* Oxford, Blackwell Publishers
- Zaman, F. (2004) *Science , Sustainability and Citizenship* ASE Sci- Tutors Website
http://www.ase.org.uk/scitutors/professional_issues/professional_values/sustainable_development.php