Educational Paths towards Sustainability

Proceedings of 3rd World Environmental Education Congress (3rd WEEC)

Edited by **Mario Salomone**

2

"Sustainable" education
Une éducation "durable"
Un'educazione "sostenibile"

SCHOLÉ FUTURO

WEEC
International Environmental Education Network

Educational Paths towards Sustainability

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SESSION 2
Sustainable education
Une education durable
Un'educazione sostenibile

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L'INTRODUCTION DE L'EDUCATION A L'ENVIRONNEMENT POUR UN DEVELOPPEMENT DURABLE (EEDD) DANS LE SYSTEME SCOLAIRE FRANÇAIS. LE CAS DU LANGUEDOC-ROUSSILLON

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Depuis une trentaine d'années, les instances internationales ont régulièrement appelé l'École à réfléchir aux grands défis environnementaux.

En France, une action pédagogique, appelée dans un premier temps « pédagogie de l'environnement » (années 70), puis « éducation à l'environnement (EE) », a été mise en place. Elle repose sur des textes dont la production correspond peu ou prou au rythme des grandes conférences mondiales. Récemment, l'UNESCO a décidé que la décade 2005-2014 serait consacrée à l'éducation au développement durable.

Le Ministère français de l'Education, dans cet esprit et dans celui de la charte gouvernementale (Charte de l'environnement, 28 février 2005), a promulgué (Bulletin Officiel de l'Education Nationale, 2004) la généralisation d'une telle éducation qui peut être mise en œuvre dans un grand nombre de dispositifs (les classes transplantées, projets culturels, ateliers de culture scientifique ou artistique, projets innovants, itinéraires de découverte, travaux personnels encadrés, projets pluridisciplinaires à caractère professionnel).

Ce qui se fait depuis une trentaine d'années en Languedoc-Roussillon

L'Académie de Montpellier possède une solide expérience en matière d'EE. Une importante réflexion pédagogique a déjà été formalisée, les ressources abondent, de nombreux partenariats sont dès à présent engagés, de nombreuses sollicitations[1] arrivent aux enseignants. Les initiatives locales, souvent impulsées par les collectivités territoriales et les services de l'État[2] se sont multipliées. A ces partenaires institutionnels, on

1. Propositions d'action sur des thèmes porteurs et médiatisés (énergie, effet de serre, risques), actions à mener au quotidien (tri des déchets, transport et pollution, électricité, eau du robinet), modes de restitution alléchants (concours, journées de, semaine de, exposition, action ponctuelle pour.

2. Ministère de l'Ecologie « 1000 défis pour ma planète », « Printemps de l'environnement ». Ministère de l'Agriculture « A l'école de la forêt ». Conseil

peut ajouter les forts nombreux acteurs associatifs, les entreprises et les fondations dont l'aide n'est pas négligeable. Les enseignants qui ont assuré avec ténacité cette EE possèdent un net caractère « militant » et font souvent appel à des partenaires pour leur compétence technique, leurs ressources ou leur complicité intellectuelle.

On peut affirmer que dans la région Languedoc-Roussillon, il y a quelques brillantes réussites et un faisceau de conditions favorables. Une évaluation[3] des projets environnementaux durant l'année scolaire 1999-2000 a montré qu'un peu plus de 50.000 élèves, de l'école maternelle au lycée, ont participé à un projet environnemental. Ce chiffre peut paraître important mais ne représente que 12% de l'ensemble des élèves scolarisés dans la Région ; le recensement (Philippe Guizard, juin 2005) des actions menées en 2004-2005 dans quelques-unes unes des classes d'environ 400 établissements donne un résultat analogue (15%). Cela confirme un engagement très inégal des équipes si bien que les élèves ne connaissent malheureusement aucune continuité en cette éducation. En outre, le choix des thèmes indique une visée essentiellement comportementale, ancrée sur une action concrète et locale[4]. Force est de constater qu'il n'existe pas encore une EE construite et cohérente. La situation est plutôt globalement en stagnation, sinon en recul, par rapport à celle du milieu des années 90. Il est possible de déterminer quelques-unes unes des difficultés de l'intégration de l'EEDD dans l'enseignement, puis de signaler les choix d'amélioration faits au niveau ministériel.

Les conceptions des enseignants

Comme celle des autres membres de l'Education Nationale, elles sont marquées par une vision « naturaliste » et « morale » de l'EE (G. Berthou, 2000) : l'environnement est pensé comme une « nature » à préserver et non comme un ensemble de relations entretenues par les sociétés avec leur territoire qu'elles doivent apprendre à gérer en opérant des choix raisonnés et raisonnables.

Régional « Un aigle dans la garrigue », « Sortie nature du réseau des espaces protégés », « Réseau d'éducation à l'énergie », trophée CHENE.

3. Evaluation conduite conjointement par la Direction régionale de l'Environnement Languedoc-Roussillon (antenne régionale du Ministère de l'Ecologie), par L'Agence Méditerranéenne de l'Environnement (Conseil Régional) et par le Groupe Régional Animation Initiation Nature Environnement du Languedoc-Roussillon (Graine-LR).

4. Pour exemple, « cultivons notre jardin » dans une école du département de l'Aude, « gestion des déchets d'atelier » dans un lycée professionnel du département du Gard, « mieux vivre au collège » dans le département de l'Hérault, mais aussi, et heureusement pour le développement durable « la brebis lozérienne à l'heure de la mondialisation »ou « la canicule, explications scientifiques et implications sociales ».

L'absence d'explicitation claire de l'expression « Education à l'environnement vers un développement durable »

Implicitement, le concept à intégrer de « développement durable » est issu du Rapport Bruntland[5] (1987). Si l'on s'accorde globalement sur les volets économique, social, culturel et environnemental constitutifs du concept, les approches divergent en ce qui concerne la signification de « développement durable ».

Le développement est-il synonyme de croissance ? De décroissance ? De stabilité ? Que fait-on des différences Nord-Sud ? Ou Est-Ouest ? S'agit-il d'agir, d'aménager, de gérer ? Durable, pour qui ? Où ? Jusqu'à quand ? A quelle échelle ? Y-a-t-il réversibilité, irréversibilité ? Equilibre, déséquilibre ? Cela implique-t-il évolution, statu quo ? A partir de quel temps « zéro » ?

L'éducation aux valeurs

Elle a consisté pendant longtemps à transmettre certaines vertus morales, certains codes moraux (leçon de morale quotidienne à l'école primaire). Puis, elles furent ignorées, donc véhiculées implicitement. Depuis les années 80, on observe un retour aux valeurs traditionnelles telles que le sens des responsabilités ou le respect d'autrui.

Dans la mesure où l'EEDD est ajustée constamment aux valeurs sociales, elles-mêmes en constante mutation, un consensus international sur les valeurs est quasi impossible à obtenir.

Il est néanmoins crucial de connaître les attitudes et les valeurs aussi bien celles de notre propre société que celles des autres, puisque certaines décisions, certaines actions d'aujourd'hui auront une incidence mondiale dans le futur. Penser à long terme, penser pour ailleurs devient une nécessité.

Comment demander à des enseignants d'éduquer à l'EEDD s'ils n'ont pas conscience des valeurs profondes implicites qui les guident dans leur action éducative ? Font-ils la différence entre valeurs, attitudes, convictions, croyances? Ont-ils réfléchi à l'existence ou non de valeurs spécifiquement environnementales, de valeurs universelles? Ont-ils intégré les valeurs mises en avant dans la constitution européenne comme la justice sociale, l'égalité des droits, la participation, l'engagement, la responsabilité ? Ont-ils pensé à l'existence dans certains pays de valeurs normatives spécifiques non partagées par d'autres ? Ont-ils éclairci la nature des objets destinataires de ces valeurs : est-ce la biodiversité ? la biosphère ? les espèces vivantes ? la nature ? ou bien, les cultures humaines ? l'être humain ? la civilisation actuelle ?

5. "Un développement qui répond aux besoins du présent sans compromettre la capacité des générations futures de répondre aux leurs".

La manière d'enseigner

Elle laisse plus ou moins de liberté à l'élève, depuis l'écoute passive, la récitation mot pour mot jusqu'à l' apprentissage actif et l'éducation au choix. Une recherche européenne en cours (Biohead - Biology , Health and Environmental education for a better citizenship) insiste sur le rôle joué par les styles d'enseignement : ils influencent la façon dont l'élève perçoit sa liberté de choix et on peut penser que cela jouera sur sa vie d'adulte citoyen.

Dans le style Informatif, il n'y a que des données, des faits, pas de questionnement environnemental au sens actuel du terme. L'enseignement Injonctif ne laisse pratiquement aucun espace de liberté. Il y a des normes qu'il convient de respecter. Dans le style Incitatif, l'avis, s'il est donné, n'est en rien obligatoire … mais fortement conseillé et approuvé par les autorités. Dans l'enseignement Participatif, une décision concernant la vie de classe n'est prise qu'après discussion entre élèves, argumentation et vote. Dans le cas d'un débat, chaque opinion peut être librement acceptée après argumentation et dans le respect des valeurs admises par tous. mais quelles sont ces valeurs ? On se retrouve à l'interrogation précédente.

La politique éducative actuellement mise en place en France

A l'heure actuelle, elle introduit plus de cohérence dans des directives déjà existantes ; il ne s'agit toujours pas de créer une nouvelle discipline, ni même de nouveaux dispositifs, mais en restant à moyens constants, de définir un domaine « Environnement et développement durable » comme cela a été fait pour la citoyenneté. Durant sa scolarité, un élève a quatre possibilités de se trouver en « EEDD» :

- Tout d'abord les projets éducatifs qui concernent les enseignants les plus motivés et les plus militants.
- Puis, des projets sur tout un établissement. En Languedoc-Roussillon, les plus fréquents de ces projets concernent les Plans Particuliers de Mise en Sécurité (PPMS), obligatoires depuis peu pour chaque établissement de la Région et dont l'importance a été mise en évidence lors des dernières inondations début septembre.
- Les deux autres possibilités touchent l'enseignement disciplinaire et les dispositifs pluridisciplinaires. Les programmes ne sont pas changés, mais s'y ajoute une forte incitation clairement exprimée à les traiter, dès que possible, dans une optique de développement durable. Ainsi, la complexité d'une question environnementale a de meilleures chances d'être appréhendée.

Aux dispositifs évoqués jusqu'à présent qui concernent les disciplines, on peut ajouter pour la prochaine rentrée scolaire en collège, les thèmes de convergence : certaines parties du programme peuvent être introduites et développées de façon coordonnée par des professeurs de disciplines différentes. En particulier, tout ce qui touche aux importants sujets de société que sont

l'énergie, la météorologie et la climatologie, la santé, la sécurité et bien sûr l'environnement et le développement durable.

En conclusion

Il semble possible, en s'appuyant sur l'existant, de fonder une véritable EE, généralisée à tous les élèves, inscrite dans la perspective d'un développement durable. A priori, les dispositifs existants sont utilisables et peuvent permettre, avec une réelle économie de moyens, de servir de cadre à des projets sur l'environnement. Pour inciter les enseignants à introduire de manière plus fréquente cette éducation, on trouve des directives nationales publiées et commentées, une volonté affirmée à la fois par l'Etat et par les différentes instances de l'Education, un effort sans précédent de relecture des programmes, la mise en place de formation continue ainsi qu'une formation dès l'entrée dans le métier. S'il y a un effort important sur les stratégies à développer, on ne peut que déplorer l'absence intentionnelle d'explicitations sur les fondements de cette éducation et sur les principes qui fondent sa légitimité. Cet effort suffira-t-il ?

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TOWARDS AN EDUCATION FOR SUSTAINABLE DEVELOPMENT NATIONAL STRATEGY IN ROMANIA

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Environmental education in Romania can be improved and enhanced from two different fronts. First, people and NGO's currently doing environmental education in Romania need to work together to make their efforts and resources known and available to each other and to other teachers and individuals interested in environmental education. Not only should resources be shared and talked about, but efforts at teacher training need to increase.

Second, the government needs to make efforts from top to down. Thus far, almost no movement occurred from this end. On one hand, general laws affecting NGO's and donations need to change so that the local communities and companies are encouraged to support environmental education efforts. Outside support for these efforts is quickly drying up and if the void is not filled than the grass root momentum will be lost. On the other hand, the central and local authorities needs to get their act together and starts incorporating environmental education into its activities and protection efforts.

It wasn't ever a better opportunity to develop a strong framework for the sustainable development education in Romania. Education is the main approach for achieving sustainability. Everybody recognize now that the actual development trends should shift to a more sustainable future society.

Even if in Romania a lot of wonderful environmental education/education for sustainable development initiatives are taking place (especially at grassroots level), there is still a lack of clear/coordinate approach of this extremely wide filed of education. Sustainable development is difficult to explain in a simple/accessible way, but in any definition should be stressed the three main components: environment-society-economy.

The concepts of education for sustainable development and related mechanisms are not well understood in Romania, and are neglected by high-level decision makers. Many sectorial development policies have been proposed in the past few years, but these have not been integrated into a comprehensive document. This is due to the lack of a national forum in which these varied debates, discussions, and planning could take place. As a result, education for sustainable development as a concept is almost unknown. Most people still assume that economic growth must be the priority for the years to come, and only after economic development and stability is achieved will it

be possible to pay attention to environmental issues such as clean production and investment in environmental improvements.

At the same time, demonstrations are needed of how sustainable development principles, now enshrined in many national policy statements, can best be translated into concrete actions. This is true especially at the community level, where capacity building for sustainable development is needed. Effective models for sustainable development at the community level, together with an improved understanding of the concept of sustainable development and what it means for Romania at the national level, are essential prerequisites to the emergence of a national strategy on education for sustainable development.

In Romania the path: conservation education, environmental education, education for the sustainable development has been followed in a very short time. The huge information input that arrived in the last fifteen years, the very important changes supported by all the levels/compartments of the society, the recent need of acquiring new skills and accessing new structures, showed the necessity of a Education for Sustainable Development National Strategy in Romania. The initiative of starting a complex process belongs to the nongovernmental organization Mare Nostrum, from Constanta, Romania. Based on more than ten years of experience in the field of environmental education, the experts of this NGO presented the frame of the strategy to the decisions makers from the Education Ministry, Environmental Ministry, Health Ministry etc.

The first questions that the NGO Mare Nostrum experts had to answer was: why an Education for Sustainable Development National Strategy in Romania? Have been identified more reason to start such a complex initiative:

- The existence of a Sustainable Development Romanian National Strategy (with a chapter dedicated to the human resources).
- The Romanian Government adopted educational and environmental protection lows that stress the importance of a sustainable development of the Romanian society.
- The need of the harmonization of the national legislation with the European Union laws, from the perspective of the Romanian ascension in EU in 2007.
- The UN decade of Education for the Sustainable Development (2005 - 2014).
- And last but not least the commitment of many teachers, students, NGO workers in the field of education for the sustainable development.

The main priorities/goals of the Education for Sustainable Development National Strategy in Romania are:

- Reorienting the existing education system towards a more modern, sustainable approach;

- Insuring a effective collaboration among all the levels of the educational sector;
- Providing the local communities with skills that allowed them to understand and contribute to the sustainable development of the Romanian society;
- Expending the life long learning initiatives;
- Optimising the collaboration among the decision makers (individuals, local and national institutions and organizations);
- Developing quality curriculum support materials that respects the particularities of the Romanian society;
- Organizing a wide database with educational for the sustainable development good practice examples;
- Involving the general public in the sustainable development decision making process;
- Effective training of trainers with the effective involvement of the universities and training centres;
- Strengthening the relation between formal/non-formal/informal education;
- Widening the filed of the education for sustainable development through the opening of the system to the latest, most urgent environmental/social/economical local/national/international issues.

Currently, education for sustainable development in Romania is limited by some of the cultural beliefs and societal attitudes: a general apathy that things are not going to improve and that an individual cannot make a difference; an externalisation of responsibility, that is the idea that someone else is at fault; a rejection of things associated with a imposed behaviour (e.g. recycling and reusing) and a love for consumption.

The reform of education should lead to a new quality of human resources. It is a question, on the one hand, of a re-allocation of existing resources and on the other, of training human resources in another paradigm, where quality is an objective at least as important as equity.

From this perspective, the strategic objective human resources for the educational system presupposes the achievement of the following:

- Consolidate the new school curriculum and training of teachers for the development of the school based curriculum;
- Update psycho-pedagogical and methodology training of the teaching staff according to the requirements of sustainable development;
- Stimulate the intrinsic motivation of pupils and students, associating them to the organisation and administration of the learning system;
- Emphasising long-term results, not only performances that can be used exclusively in an academic environment;
- Shifting to a different system of controlling quality in education, through formative evaluation and examinations focused on

performance not on learning facts and figures by heart, and by using other relevant instruments;
- Encouraging alternative education.

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EDUCATION A L'ENVIRONNEMENT ET DISCIPLINE SCOLAIRE, ENTRE RUPTURE ET CONTINUITE. L'EXEMPLE FRANÇAIS

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La présence de l'éducation à l'environnement à l'école semble être une évidence. Une grande partie des travaux de recherche présentés au III World Environmental Education Congress porte sur le public scolaire. L'introduction de l'éducation à l'environnement soulève des problèmes théoriques et pratiques que l'on ne peut occulter.

En France, l'éducation à l'environnement a été introduite à l'école en 1977[6] par une circulaire la rendant obligatoire. Elle prévoit que tout élève doit aborder l'éducation à l'environnement au moins une fois au cours de sa scolarité. Cette éducation est alors définie comme devant « répondre » au besoin généralement rencontré chez l'enfant et l'adolescent de comprendre la nature et le monde qui les entourent. C'est une formation qui doit leur permettre de saisir les problèmes de l'environnement de façon intelligente et constructive Les ambitions premières des instructions officielles ont été révisées à la hausse en 2004 via une seconde circulaire[7] qui généralise l'Education à l'Environnement et au Développement Durable (EEDD). Désormais elle devient « une composante importante de la formation initiale des élèves, dès leur plus âge ». Elle n'est plus occasionnelle et ponctuelle mais systématique et récurrente dans la scolarité des élèves.

L'EEDD se décline théoriquement sous une forme disciplinaire et sous une forme interdisciplinaire. Le cadre interdisciplinaire est assez souple. Il s'agit de projets qui mobilisent les élèves autour de leur propre environnement ou sur des problématiques plus globales dans les classes supérieures. Ces projets ne répondent pas à un programme précis. Ils sont créés en fonction des motivations et des opportunités de l'enseignant et de sa classe.

L'inscription disciplinaire de l'éducation à l'environnement et au développement durable est plus problématique. Les disciplines scolaires s'organisent autour de programmes précis. Elles apportent les savoirs nécessaires à la compréhension de l'environnement et permettent une prise de conscience des problèmes environnementaux. Toutes les disciplines sont concernées mais la géographie et les sciences de la vie de la terre sont en première ligne. Les programmes de ces disciplines sont en cours de

6. Circulaire n°77-300 du 29 août 1977 publiée au *BO* n°31 du 8 septembre 1977
7. Circulaire n° 2004-10 du 8 août 2004 publiée au *BO* du 15 juillet 2004

rénovation dans la perspective d'une mise en cohérence des différentes disciplines sur les questions environnementales.

L'EEDD prend ici place dans un cadre préétabli que représente la discipline scolaire ; ce qui pose le problème de savoir comment se réalise cette inscription disciplinaire de l'EEDD. Est-ce que l'éducation à l'environnement et au développement durable adopte le cadre disciplinaire et les normes qui le régissent ? Ou bien, remet-elle en question ce cadre ?

Pour répondre à ce questionnement, nous nous appuierons sur l'exemple de la géographie. Ce qui est présenté ici est issu des réflexions théoriques qui ont fondé un travail de recherche entrepris en géographie : « L'éducation à l'environnement entre culture et patrimoine » sous la direction d'Isabelle Lefort à Lyon 2.

La difficile introduction de l'éducation à l 'environnement et au développement durable en géographie.

L'introduction de l'EEDD dans la géographie scolaire soulève la question de la faisabilité des programmes scolaires en place. Les programmes de géographie sont chargés. La circulaire qui généralise l'EEDD ne redéfinit pas des programmes scolaires. Elle attribue à l'enseignant un nouvel objectif. Comment donc introduire de nouvelles notions relatives à l'environnement ? Cette question est d'autant plus aiguë que « les programmes juxtaposent des études spatiales » (Desplanques, 1991) et non des notions. Le programme de la classe de seconde fait néanmoins figure d'exception. L'introduction de l'EEDD au sein de la géographie ne semble pas être cohérente avec la structure actuelle des programmes scolaires de géographie.

L'EEDD constitue, comme nous l'avons vu ci-dessus, une nouvelle priorité. Elle n'est pas la seule. Les enseignants du primaire et du secondaire doivent également assurer une éducation à la santé, une éducation aux risques majeurs… Ces priorités éducatives ne sont pas hiérarchisées. La diversité et la multiplicité des priorités définies par le ministère de l'éducation nationale tendent à nuire à une réelle prise en compte de l'éducation à l'environnement et au développement durable.

L'introduction de l'EEDD pose également un questionnement d'ordre théorique. La géographie est une discipline scolaire, c'est-à-dire « une institution qui, si modeste soit-elle, fait vivre des milliers d'enseignants de tous les niveaux, quelques chercheurs, des techniciens, des personnels d'édition » (Grataloup, 1988)**.** C'est un cadre contraignant dans lequel l'EEDD doit s'inscrire pour être mis en œuvre. Le savoir enseigné en géographie répond à des normes théorisées par François Audigier (1977), qui les a synthétisées en quatre R. Ce qui est enseigné constitue :

- Des Résultats, c'est-à-dire des savoirs admis par tous.
- Des faits Réalistes, qui sont présentés comme la réalité du monde ou l'explication de cette réalité.
- Des Référents consensuels, exempt de tout débat.

- Des faits exempts d'enjeux politiques. C'est le Refus du politique.

De là, on peut se demander dans quelle mesure ce qui est transmis dans le cadre de l'EEDD répond-il à ces normes.

Les ambiguïtés de l'approche disciplinaire

On ne peut qu'ébaucher ici des éléments de réponse à cette question qui mériterait une thèse à elle seule. On peut tout d'abord souligner la contradiction entre la démarche de la géographie scolaire et celle préconisée pour l'EEDD par les textes officiels. L'éducation à l'environnement et au développement durable part du local et de l'expérience pour aboutir ensuite au général.

La circulaire de 1977 indique que l'éducation à l'environnement « suppose une exploration dans le milieu environnant de l'élève ou de l'établissement (le quartier, la commune, le canton, une entreprise industrielle ou agricole), mais elle pourra être complétée efficacement par la découverte d'un milieu différent ». Cette disposition est reprise par la circulaire de juillet 2004.

La démarche de la géographie scolaire est inverse. Chaque cycle du secondaire, collège et lycée, débute par un cours de géographie générale où sont exposés des grands principes de la discipline. Le programme de sixième s'organise par exemple autour de la répartition de la population mondiale, l'étude des grands domaines climatiques et biogéographiques, les grands reliefs et la distinction des grands types de paysage. Les élèves étudient ensuite des espaces singuliers. La structuration des programmes du secondaire part du général au particulier.

Dans le cadre de l'EEDD, la démarche est inductive, ce qui signifie que le savoir enseigné est construit avec l'élève. Ce n'est pas un Résultat, ce qui est contraire au savoir enseigné dans le cadre de la géographie scolaire. De là même manière, l'éducation à l'environnement et au développement durable « implique une démarche critique et met en valeur l'importance de choix », donc des doutes alors que la géographie transmet des Référents Consensuels.

Le second problème que soulève l'inscription disciplinaire de l'EEDD est le morcellement des savoirs. C'est ce que met en évidence la lecture des programmes actuels met comme l'illustre le tableau ci-dessous.

Les sujets qui touchent l'environnement sont éparpillés et disloqués entre les différents thèmes au programme, sans qu'il y soit une réelle cohérence dans l'apprentissage.

De la même manière, il n'y a pas ou peu de concordances entre les programmes des différentes disciplines concernées par l'EEDD. L'introduction de l'EEDD en géographie ne présente néanmoins pas que des inconvénients. Elle participe à la réactualisation de la discipline.

Classe	Géographie
Primaire Cycle 2	Découvrir le monde : savoir lire en comprenant la description d'un paysage, d'un environnement et savoir retrouver le rôle de l'homme dans la transformation d'un milieu
Primaire Cycle 3	Education à l'environnement
6e	– Les grands domaines climatiques et biogéographiques : "on montre les relations des sociétés au climat." – Les grands reliefs: "on montre la relation des sociétés au relief," – Des paysages urbains: "Afin d'évoquer les problèmes d'environnement, un exemple peut être particulièrement développé pour chaque ensemble proposé,"
5e	Afrique: la diversité de l'Afrique "Le rappel du rôle du milieu s'appuie sur les acquis de la classe de 6ème"
4e	France: "Ces paysages constituent un environnement et un patrimoine à gérer et à préserver."
3e	
2nde générale	– L'eau entre abondance et rareté: maîtrise de l'eau et transformation des espaces, une ressource convoitée et parfois menacée – Les sociétés face aux risques: les zones à risques naturels majeurs – Nourrir les hommes : agrosystème et environnement Thèmes au choix : – Les littoraux, espaces attractifs: gestion et protection d'espaces convoités ou – Les montagnes, entre tradition et nouveaux usages : l'environnement en montagne
1e scientifique	
1e littéraire	La France et ses territoires : des milieux entre nature et société
1e Economique et sociale	La France et ses territoires : des milieux entre nature et société
Terminale scientifique	

Fig. 1. 'environnement dans les programmes de géographe

Le renouvellement apporté à la géographie par l'EEDD

L'EEDD a permis de renouveler les finalités de la géographie scolaire. A l'origine, en France, la géographie a été introduite à l'école après la défaite du pays face à la Prusse en 1870. Cette défaite a été imputée à l'ignorance des soldats français qui ne connaissaient ni les contrées de leur pays ni la lecture des cartes d'état-major alors que les soldats prussiens excellaient en la matière. La géographie vise alors à rectifier la situation. Elle doit former de bons citoyens. Pour ce faire, elle doit susciter l'amour de la France dans le cœur de chaque petit Français, en lui inculquant la grandeur de sa patrie. Les finalités civiques et patrimoniales originales se structurent autour de l'individu et de son rapport à la patrie.

L'EEDD contribue à décentrer les visées civiques et patrimoniales de la discipline. Elle permet le passage d'une discipline centrée sur la formation individuelle à une autre axée sur la socialisation. Le patrimoine à transmettre ne se limite plus à nos valeurs identitaires portées par la patrie. Il se comporte désormais un élément commun à l'ensemble de l'humanité : l'environnement. Le patrimoine n'est plus national mais mondial. Ce changement d'échelle engendre un décentrage des finalités patrimoniales. Ce décentrage est double.

Le cadre de référence du patrimoine, c'est-à-dire l'environnement, transcende l'humanité. Le terme est en effet défini en 1977 comme « l'ensemble, à un moment donné, des aspects physiques, chimiques, biologiques et des facteurs sociaux et économiques susceptibles d'avoir un effet direct ou indirect, immédiat ou à terme, sur les êtres vivants et les activités humaines» ce qui inclus tous les êtres vivants. Le patrimoine est deux fois hors de l'entre soi : il est hors de la patrie et hors de l'humanité.

Il crée un nouvel entre soi : celui des vivants. Ce double décentrage engendre une redéfinition des finalités civiques de la géographie. Il ne s'agit plus de former de bons soldats mais de faire adopter aux élèves un comportement respectueux de l'environnement. L'EEDD participe ainsi à une réactualisation de la géographie.

Conclusion

L'introduction de l'EEDD au sein de la géographie, bien que difficile, semble bénéfique à la discipline. Elle questionne les pratiques en place. Elle favorise le renouvellement de la géographie.

De nombreux aspects de la question n'ont pas été abordés ici : notamment celle de la formation des enseignants, du partenariat avec des associations, etc. L'introduction de l'EEDD à l'école, que ce soit sous une forme disciplinaire ou interdisciplinaire, reste un sujet complexe et un chantier encore en construction.

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PILOT CONTEMPORARY COURSES IN CENTRAL ASIA

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Abstract

There are several severe problems in Central Asia (CA): water deficit, contradiction between hydro-power needs and irrigation needs, strong-continental alpine and arid climate, permanent danger of earthquakes and landslides, "nature-consumer" mentality, high population growth, unemployment and poverty, tribes and religious contradictions. Kyrgyzstan and Tadjikistan are least development countries of CA and all former USSR territory.

Changing of élite mentality (by new university curricula) is great destiny for "civilization gap" overcome. Sustainable development and global ecology curricula implemented in our pilot non-traditional curricula last six years. The course is emphasizing Strategic Balances (Brundlandt principle) between Nature Conservation and Nature Use. The theoretical-cognitive part of the courses includes Rio ninety-two documents; Club of Rome Reports; Vernadsky biosphere-noosphere theory; ESPO, Stockholm and other Conventions. The experimental courses consisted of comprehensive: Recent Nature Concepts, Ecology, Nature Security, Economy (nature using part), Geography, were done in several universities. Regional natural-emergency problems were included too: The Kyrgyz Comprehensive Development Framework Strategy (CDF 2001-2010), Global Mountains Forum resolution (October 2002), Initiative Water Management for Central Asia (2004) and others.

We include in the curricula several Moslem principles and their ecological interpretation, for example, "Khima" delicious-touching territory (similar with natural reserve areas) and "Kharim" strictly non-touching territory (similar with wildlife/biosphere conservation); and several Islamic documents were used which support contemporary views on the environment. They comprise: Right of Thirst (Al-Wanscharisi); Al-Bukhari; Special "Fatwa" of the Council of Islamic Scholars (announced in 1978); Uz`Ad Din ibn Abu As`Salam, (published in Thirteenth century) and others.

The courses also deal with specific Central Asian mentality and ethnic-religious cultures (Turk-Kazakh, Kyrgyz, Uzbek; Farsy/Iranian-Tadjik). Emotions are important in the courses and therefore we are using poetry (and sometimes religious) verses of Usuf Balasaguni, Furkat,

Firdousy, Kaligul, Nizamy, Moldo Klich. We used parallel verses and texts of Leopold, Toro, Wordsworth and other western writers.

Keywords: Kyrgyzstan, Tajikistan, environment, Moslem, emotional learning.

Introduction

Kyrgyzstan and Tajikistan are countries in Central Asia that were part of the former Soviet Union. Communist mentality crashed and Moslem mentality renaissance have complicated on problems of the countries, and ecological education too. Education in these countries has very different implications then in Europe and other industrialized European countries.

We decided what needs modify education in three ways:

- To do close connect with contemporary communities needs (water and energy needs, safe dwelling).
- To do it close to national plans (CDF)
- To implement eco-mentality in packet of all conscious (includes tradition and Moslem dogmas).

Preservation of nature is important for tourism. Various technologies might help to provide comfort for local inhabitants and tourist and preserving the natural beauty of the country, like the introduction of new energy and building-technology in the mountainous region of Tien-Shan-Pamir.

There are several nature problems in Central Asia: A strong-continental climate, with windy, low temperature, and fast changeable weather conditions, permanent danger of earthquakes and landslides; long time of alpine valleys isolation due above mentioned reasons.

There are following habit and mentality problems:

- The traditional cattle-breeding "nature-consumer" mentality (resulting in non-entrepreneurial conduct);
- Non-sanitary habits (use "haus" traditional pit filled with water in home-yard for cooking, washing, and taking bath).

Nature problems have been analysed and ranked before [Hadjamberdiev, 1994, 1996).

Education objects

The countries situation leads to specific needs for special environmental education. The experimental courses (containing: Nature-thrifty technologies/Best Available Technique, Safety Dwelling, Sustainable Development, Recent nature concepts, Ecology) deals with the subject from two perspectives:

- Understanding problems and contemporary process over-coming them;

- Understanding the specific local background of Central Asia, both in respect to natural environment as in respect to the Moslem and ethnic cultural traditions.

The course has been taught since 1998 and has been offered in two different forms:

- For students of "ecological architectures/engineering" (eco-technology, ecological exploitation of natural resources) it is a one year course.
- For decision-makers it is a two months course.

Thus far 700 students and 134 administrators/local authorities passed through the courses.

Education for Specialists

One of the new education ways is the economy/technology specialists (Technical and Architecture universities) education on nature thrifty methods. Some international and some original technologies might help to provide comfort for local inhabitants and preserving the natural beauty of the country, like the introduction of new energy- and building-technology in the mountainous region of Tien-Shan-Pamir. Practical eco-technologies are treated in the courses:

- Bio-gas machines (to transform manure and residential waste to eco-fertilizer and fuel).
- Sun-collectors for water boiling and room heating.
- Sun-drying equipment for crops and vegetables.
- Small hydro-electric stations (1-22 KW).

Construction related problems that are treated in the course are:

- Coal-ash (health danger because of high radioactivity and cadmium content).
- Desert-stile clay for building (not safe, and not warm).
- Granite-stone buildings (high natural radioactivity).

It is especially important to improve the conditions of living in the mountainous rural areas. Some measures that could be taken are:

- The construction of special cow-sheds for the mountain cattle herds.
- The construction of self-strengthening water supplies systems to enable farmers to grow crops at mountain slopes in rural areas (Invention, registration number SU 1570677).

New construction methods are treated in the curriculum (Architecture university) that could help cattle breeding in the mountainous rural areas by building better stables for hibernation. These methods are includes: Old Turkish cattle-breeding style constructions (sheep-woollen

walls and ceiling); Old caravan-saray style (very thick, up to two meter walls of sedimentary-rock material); New ecological North-European style (thin, double walls).

Dwelling in the region must be equipped with mini-electricity stations (wind-power or sun-power) and waste/sewage utilization equipment (bio-gas) to provide comfort and to preserve the natural environment.

Water and energy deficits

Water deficit is result of: arid/semiarid climatic zone; the ambitious projects that have been carried out during the Soviet period; non-thrifty technology and population habit. The Soviet Union constructed a network of irrigation canals and reservoirs to stimulate cotton production. As a result of the tapping of rivers the Aral Sea dried out and its ecosystem was destroyed. Desertification and salinisation of agricultural land became serious problems and threatened food production. One of the reasons for this development is that the Soviets introduced non-paid relationships between water-donors and the water receiving rural areas. The led to non-economic use of water by the consumers as well as by the manufacturing sector (it is estimated that 70% of the water is wasted). The average water-consumption per person in Central Asia is two-three times higher than the water consumption in Canada. For example, water consumption for one hectare of irrigated land: 13355 m cubic in Turkmenistan, 15860 in Tadjikistan; the Coefficient of Washing-out Irrigation in Syr-Darja district (which has no underground water for irrigation) steadfast fall down from 0,64 till 1,0, that shown initialisation of soil secondary salting.

There are steadfast problems in the region: shortages of irrigating water and energy-water contradiction needs (Hadjamberdiev et al., 2005). These process lead to tensions between the states in the region, which escalated in the last five years. It is a danger for whole regional stability.

As a consequence of privatisation of water and soil, the arable land of the poor is degrading fast, and pollution of both surface- and groundwater poses a public risk especially to the poor. So, it leads to special curriculum's necessity for local authorities and new farmers.

The old traditions of community control over water consumption (similar to traditions in all South Asian Moslem areas) need to be restored. A network of micro-canals ("arik") and delicate distribution of water to the villages and families by high skilled "mirabs" might solve the water problems. In the past three years (2002-2005) there have been extensive campaigns (TV, papers) to promote economical use of water in our countries.

As it educated in our curriculum: the essence of a solution for the Central Asian water problem will be to reduce the irrigated area in all Central Asia (with rise of corn productivity, simultaneously moderate demographic growth), and changing the electricity source of the Tien-Shen-Pamir states from large scale hydroelectricity to other (non-traditional) forms of energy such as: solar energy (potentially the surface for solar

energy may be increased from 89 to 1350 thousands sq. km, and power output from 28 to 600 Gcal/hour in Tien-Shen), wind energy (potentially it may rise from 100 kwt to 25000 kwt).

Sun-collectors for water and house heating, and processes for drying crops and vegetables by sunlight are also included in the course. Small hydroelectric power stations (by Swiss example) might be used in the mountainous regions of the country.

Natural risks (landslides, earthquakes, avalanches)

This subject is included in the course because earthquakes and landslides are an important factor in the chemical contamination of soil, and degradation of agricultural land. There are forty-nine uranium-warehouses in the Tien-Shen-Pamir territory, nineteen poly-metallic storages, twenty-four large water-reservoirs and over two hundred small ones, and over 350 cemeteries for animals killed by anthrax. Without earthquakes and landslides (which is not likely), the harmful substances may be kept in place for about hundred years. If the necessary protection and maintenance measures are taken (repairs of concrete constructions, covering the surface of waste-storages with viscous materials or limestone, etc), the process may be prolonged. Moreover, landslides, snow-slides or earthquakes endanger 88% of the roads of both our countries.

Near mountain ranges there are a line of pleated foothills. The line of foothills is separated from the valley and the mountain range by a series of faults. The fault lines can cause earthquakes, which might lead to cracks in storage facilities and the development of landslides. Earthquakes in our region can occur with magnitude of eight-nine at the Richter scale. The external morphologic results of earthquakes that, already took place, can be noted in landslides, avalanches of different nature and volume, and by the presence of seismic-ditches and seismologic breakdowns. Moreover, the natural conditions of both Tien-Shen and Pamir are facilitating the formation of landslides.

The presence of underground ice cellars, combined with occasionally hot weather might also give rise to landslides. Cracks in the surface are often filled with clay and mud. These "kurums" can be found all over the region. They create a great danger to the mountain population.

These natural risks had been issues of separate geographical, common ecology curriculums, we joint hem in common curriculum. It is very useful for understanding and common image on motherland problem.

An absolute guarantee of security may be provided only if the storages and dumps are demolished and the harmful substances are transferred to areas with favourable natural conditions. However, practical measures to mitigate the risks has been included in the curriculums:

- Make an inventory of all old dump sites, and an assessment of their stability.

- Natural ultraviolet irradiation to break down chemicals (open liquid ponds).
- Limestone conservation use for deserted mines and water-pumps.
- Groundwater anaerobic remediation method.
- Introduce the diaphragm wall-cement insulation method.
- Barrier Containment Technology for groundwater.
- Global Information Systems for comparative prognosis of affected areas.
- Move people that are endangered to other places.

Traditional culture in the curriculums

Contemporary sustainable development principles are implemented in our course. The course is emphasizing Strategic Balances (Brundlandt principle) between Nature Conservation and Nature Use. The theoretical-cognitive part of the courses includes Rio 92 documents; Club of Rome Reports; Vernadsky biosphere-noosphere theory; ESPO, Stockholm and other Conventions; and Kyrgyzstan Comprehensive Development Framework 2001-2010 (KCF). Philosophy, Recent Nature Concept, Regional and Global Problems are also included in the courses. The Kyrgyz Comprehensive Development Framework Strategy (CDF 2001-2010) is also discussed in the course. Moreover, the year 2002 was the UN Year of Mountains the Kyrgyz Republic was a pivot of the international program and the host of the UN Mountain Forum in October 2002.

We include in the course several Moslem principles and their ecological interpretation. For example, “Khima”: delicious-touching territory (similar with natural reserve areas) and “Kharim” strictly non-touching territory (similar with wildlife/biosphere conservation).

Several Islamic documents were used which support contemporary views on the environment. They comprise:

- Right of Thirst (Al-Wanscharisi Le pierre de touche des Fetwas, v.2, Paris 1909; Al-Bukhari 2, 104 in Hadith Encyclopedia),
- Special “Fatwa” of the Council of Leading Islamic Scholars (Saudi Arabia, 1978),
- Animal Rights for Life and Sympathy (Uz`Ad Din ibn Abu As`Salam, first publication at 13 century),
- about eco-crisis (Suras of K`uran, 2:204-206, 30:41, and others).

The courses also deal with the specific Central Asian mentality and ethnic relations (Turkish-Kazakh, Kyrgyz, Uzbek; Iranian-Tadjik). Emotions are important in the course and therefore we are using poetry (and sometimes religious) verses of Usuf Balasaguni, Moldo Klich, Kaligul, and Furkat. We try to use parallel verses and texts of Toro, Leopold, Wordsworth and other Occidental writers.

It has been published on wrong mean about contradiction between Asian/Moslem and European-style cultures (Hadjamberdiev, 2000).

Conclusion.

Focal points of our curriculums are: to restore balances between Nature conservation and Nature utilization by thrifty technologies; to restore balance between contemporary technologies and traditional mentality.

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CORSI UNIVERSITARI PILOTA NELL'ASIA CENTRALE: TRADIZIONE E NUOVE VISIONI DELL'AMBIENTE.

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L'Asia centrale è oggi caratterizzata da gravi problemi ambientali dalla scarsità d'acqua alla contraddizione tra i bisogni idrici di base e le necessità dell'agricoltura, un clima continentale con venti forti e basse temperature, estrema variabilità delle condizioni del tempo, rischio permanente di terremoti e frane, prolungato isolamento delle valli montane - e altri di natura socio-culturale: mentalità "consumistica" nei confronti della natura, espressa dal tradizionale allevamento del bestiame; mancanza quasi totale di servizi igienici, crescita demografica incontrollata, disoccupazione e povertà, contrasti etnico-religiosi.

Il Kyrgyzstan e il Tadjikistan sono i paesi più arretrati tra quelli che componevano l'ex Unione Sovietica.

La caduta della mentalità comunista e il riaffermarsi di quella islamica ha determinato diverse conseguenze, anche nel campo dell'educazione ambientale. L'educazione in questi paesi ha implicazioni diverse da quelle che ha in Europa o negli altri paesi industrializzati.

La situazione peculiare dei due paesi determina la necessità di implementare un'educazione ambientale specifica e adatta al contesto locale, basata fondamentalmente su tre elementi: il bisogno di connettere il più possibile l'educazione con le necessità delle comunità locali (acqua, energia, abitazioni sicure); con i piani nazionali; con una maggiore sensibilità ecologica, facendo ricorso anche alla tradizione e ai dogmi islamici.

La conservazione della natura è importante anche per il turismo. L'implementazione di nuove tecnologie - come per esempio le energie alternative e la bio-architettura nella regione montuosa del Tien-Shan-Pamir potrebbe contribuire a offrire migliori condizioni di vita agli abitanti e ad incentivare il turismo, preservando però la bellezza naturale del paese.

Il cambiamento della mentalità delle élite, (attraverso la creazione di nuovi curricula universitari) rappresenta oggi lo strumento più significativo per superare il "divario economico tra civiltà".

Islam ed ecologia nei corsi universitari-pilota

I curricula improntati sui concetti di Sviluppo Sostenibile ed Ecologia Globale, implementati nei corsi universitari-pilota, hanno una durata media di sei anni. I corsi sperimentali sono interdisciplinari e riguardano temi come: concezioni recenti della natura, ecologia, sicurezza abitativa, economia (intesa

come uso delle risorse naturali), individuazione di tecnologie non invasive/ovvero delle migliori tecnologie disponibili, geografia e sono realizzati in diverse università del Kyrgyzstan e Tadjikistan.

I corsi enfatizzano l'equilibrio strategico (principio Brundlandt) tra la conservazione della natura e il suo utilizzo, mentre la parte teorico-cognitiva del corso include: i documenti di Rio 92; i rapporti del Club di Roma; la teoria di Vernadsky sul concetto di biosfera; ESPO, Convenzione di Stoccolma e altre. Infine, si fa riferimento anche ai problemi ambientali emergenti su scala regionale, attraverso l'esame di documenti quali il Quadro strategico Kyrgyzo di sviluppo integrato (CDF 2001-2010), la Risoluzione del Forum mondiale delle montagne (ottobre 2002), l'Iniziativa per la gestione dell'acqua nell'Asia Centrale (2004) e altri.

Nei curricula universitari vengono inclusi anche molti principi islamici e la loro interpretazione ecologica, come per esempio i concetti di Khima, "territorio appena toccato" (qualcosa di simile alle riserve naturali) e Kharim, letteralmente "territorio intatto" (qualcosa di simile al concetto di "natura selvaggia" / "conser- vazione della biosfera"); e molti documenti islamici sono utilizzati per supportare la moderna visione dell'ambiente. Tra questi: la shafa o il "Diritto dell'Assetato", cioè il concetto giuridico islamico in base al quale tutti gli esseri viventi che hanno sete hanno diritto all'acqua (in Al-Wanscharisi - Le pierre de touche des Fetwas, tr. E. Amar, vol. 2, Leroux, Paris, 1909 e in Al-Bukhari 2, 104 in Hadith Encyclopedia); la Fatwa Speciale del Concilio Supremo dei Dotti Islamici (proclamata nel 1978 in Arabia Saudita); "Diritti degli animali alla vita e alla compassione" (Uz`Ad Din ibn Abu As`Salam, pubblicato per la prima volta nel Tredicesimo secolo); "Sulla crisi planetaria" (Suras di K`uran, 2:204-206, 30:41) e altri.

I corsi si adattano alla mentalità dei popoli dell'Asia Centrale e alle sue culture etnico-religiose: Turco-Kazakha, Kyrgyza, Uzbeka, Iranica, Tadjika. Anche le emozioni sono importanti e per questo si usano spesso versi poetici, quando non direttamente di natura religiosa, come nel caso di Usuf Balasaguni, Furqat, Firdousy, Kaligul, Nizamy, Moldo Klich. Si utilizzano però anche versi e testi di Aldo Leopold, Henry David Thoreau, William Wordsworth e altri scrittori occidentali.

In definitiva, i curricula hanno come obiettivo quello di ripristinare l'equilibrio tra conservazione della natura e il suo uso, utilizzando tecnologie non invasive; e di stabilire un dialogo tra moderne tecnologie e mentalità tradizionale.

ADULT LEARNING AND THE ENVIRONMENT

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We cannot not learn. Learning is often defined as the process of taking in data, organizing the data, and making meaning of the information (Bloom, 1976; Carlson, 1988). Given this construct, then, it might be possible to attend to life without learning to occur; but even for the most stubborn of individuals, learning happens even if it is subconscious, incidental, or ignored. Learning is a life-long, natural process that happens consciously, subconsciously, and often coincidentally with the intentions of the individual. Many, if not most people, are neither aware of nor believe in the self-mentoring strategies that humans continually employ as valid learning: talking to people, reading, watching how people do things, taking a class, and simply figuring things out (Darling, 1986 in Cyr, 1999). Few individuals would argue with the above statements, yet, when we examine the construct of life span learning, it is often in the context of constructed situations for learning: schools, universities, training programs, even conferences such as this.

If we look at the percent of an individual's life spent in one of these formal learning settings, however, a different picture begins to emerge. In the United States, for example, by the time a young person reaches the age of eighteen (or a high school diploma) approximate 15% of their life has been spent in school. Even so, these years of their lives are considered to be dominated by school. Of course, homework and extended learning situations are not included, but the point is clear. If we extrapolate those hours into adulthood, add time spent in universities and colleges, training programs, and even professional development, over a person's life the amount of time in formal learning settings is averaged to be 3%. We could argue over the accuracy of the actual percent, but the point is to clearly illustrate that formal schooling is not the dominant part of an individual's life. Even more to the point of environmental education: within this small percent of a person's life spent in formal schooling, the amount of time spent learning about the environment is but a small percentage (unless career focus is within this area).

Most people have clear ideas about nature, their relationship to nature, their attitudes towards the environment, and even topics such as conservation, individual responsibility and environmental ethics. It is known that these attitudes, beliefs, and orientations can and do change throughout a person's life; so how an individual gains the information to make these changes is important.

The purpose of this paper is to explore how adults in our societies are learners, and to understand how we as educators can access and enhance the environmental learning that would lead to a more environmentally literate citizenry.

How adult education coaligns with EE

Though most of a person's life is spent outside of formal education and training settings, learning in non-school settings is trivialized. Fields of study such as museum education, interpretation, visitor studies, and to a much lesser degree environmental education have frequently focused on how people learn in non-school settings, but the vast majority of educational programs, and even interpretive events (such as in zoos, parks, nature centres, aquaria, science museums) in these non-school settings are focused on the "captured" audience of youth, and especially school groups. What is the role of life-long environmental learning, especially for adults?

There are at least five powerful arguments for focusing on adults in non-formal, informal, incidental free-choice environmental settings:

1. The vast majority of adults have left formal education systems.
2. If educational programs for children are to be effective, the most be role models and systems in place that support what children are being taught.
3. Adults are decision-makers and the earth cannot wait for another generation and hope lessons of childhood "stuck".
4. It is vital we reach the most people possible if we hope to effect change in the environment, especially given the level of degradation.
5. Critical-thinking demands ongoing (lifelong) learning and environmental literacy.

The purpose of this paper is to explore the many access points for education about the environment, and to examine how principles of adult learning could be used to help environmental educators better meet their missions. As noted in a policy discussion paper in the U.K., the vast majority of citizens, consumers, workers, employers, and parents have already left full-time education and training (NIACE, 1993), yet the need for them to remain informed is tremendously important related to the environment.

Perhaps the question that can start this inquiry is the question that should initiate any discussion on adult learning of the environment: what is environmental education to adults and the potential adult learner? This question leads to many others: Is environmental education a strategy for helping people become environmentally literate and making good decisions related to their environment and their lives, or is environmental education about holding certain beliefs, attitudes, behaviours, and positions on environmental, conservation, and natural resource issues? Is environmental education limited to laws and principles, or are there affective variables that influence learning outcomes, career choices, and use of leisure time

(Koballa, 1988)? Are the goals "the intellectual goals of thinking and reasoning, the personal goals of appreciation and understanding, the practical goals that will help us in our life's work and in our role as intelligent citizens, and the futuristic goals of innovation and creativity" (DeBoer, 1991) or are the goals recall, identification, classification, and evaluation?

In many cases, there is a disconnect between what we claim environmental education to be and what many adults understand as 1) "education" and 2) environmental education versus nature study or environmentalism. What creates perceptual dilemma for some was the dominant approach to "learning" as defined by the educational systems using cognitive testing of recall throughout the schooling of those who are now adults (Sears and Kessen, 1964). On the other side of the teaching/learning exchange, Mathews (2002) suggests that much of the incidental and even informal learning is not of interest to many educational professionals who are more interested in examining the instruction-learning process including the selection, arrangement, and delivery of information in an appropriate setting and the way the learner interacts with the environment.

My contention is that the vast majority of adult publics perceive environmental education as a body of knowledge and absolutes based on their prior experiences as pre-adults. Thus, environmental education is perceived not as a way of learning to think about ones relationship and responsibility to nature, but rather as a stable set of data that are either learned or not learned, a specific catalogue of behaviours that are environmentally appropriate absolutes, a series of facts of science, and a way of feeling toward nature. Karruppaiyan (2002) argues that each person throughout life must adjust to environmental changes requiring active participation in learning. In a statement related to science education which applies equally well to environmental education, Bybee (1985) reminds us that "citizens have a genuine need to understand the impact of science and technology on our society and the social issues they must evaluate" and "educators have a responsibility to meet this need". This responsibility extends also to the larger society as "to date insufficient policy attention has been given to education for sustainability for adults. Much needs to be done to ensure that adults as citizens, consumers, workers, employers, and parents are able to develop the social and political skills, and acquire the knowledge and awareness, that they and our society need" (NIACE, 1993). So what is it about the adult learner that can guide us toward addressing environmental literacy in our larger population?

Defining adult learning

In most societies, adult education is concerned with the increase of quality of life for people. One important component of quality of life is environmental quality: Yerroju (2002) suggests the deficiency in addressing environmental issues throughout the world demonstrates the lack of environmental awareness among adults. Adult education and life-long learning relate to all activities throughout the lifespan that serve the individual's needs for improving knowledge, skills, and competence within a personal, civic, social, or employment venue and perspective (Louis, 2002).

What are the characteristics that drive adults to want to know answers; where do they get information; and how intentional is science learning in adults? Further, why should we care about adults' learning about the environment? Among many others, Hariharan (1997) reminds us that public misunderstandings and attitudes can work their way through the political process and emerge in detrimental policies. Prewitt (1983) notes these detriments as wide fluctuations in funding, unrealistic demands for quick results, political rather than scientific criteria for setting research/funding priorities, and misguided regulations and/or accounting procedures. People need to be aware of environment-related social problems and realize their personal decisions are part of the larger social decisions that can either further or alleviate social ills (Bybee, Harms, Ward, and Yager, 1980).

There is a large body of research on how adults learn. Knowles' (1973, 1980) assumptions of adult learning still stand as foundational in the field and include that: adults seek information and knowledge that has immediate application (distinguishing andragogy from pedagogy in the term of application of learning outcomes); adults seek information that supports their perception of their life and social roles; adults bring increasingly larger reservoirs of knowledge with them; adults are increasingly self-directed; and adults are increasingly intrinsically motivated. Merriam and Clark (1993) suggest that although "andragogy does not define the uniqueness of adults learning, it does provide a set of guidelines for designing instruction with learners who are more self-directed than teacher directed".

These assumptions, however, are based on thirty years of research using "primarily white, middle class, employed, younger and better educated" adults in the United States and to some degree in Canada (Merriam and Caffarella, 1999).

Much of the criticism of the North American models of adult learning are grounded in the use of andragogy as a learning theory based on internal learning structures which ignores the social and cultural context of learning (Caffarella and Merriam, 2000). Social and cultural contexts include but go beyond the class, gender, and racial social constructs based on some shared physical characteristics (Cain, 2002).

By focusing on characteristics of adult learners, the contextual factors (including disorienting dilemmas as suggested by Mezirow, 1991),

situated cognition, interpretation of context and adult development are often overlooked. In 1977, Knox noted factors of content relevance, pacing, socio-economic status, social change and personal role in society as factors that influence and modify learning outcomes in adults in formal and no formal/informal settings (in Cyr, 1999).

A strong dependence on human agency for learning can bias what we understand about adults learning in the context of their lives (Pratt, 1993). The criticism of universality related to adult locus of control and the ability of all adults to become self-motivated (Lee, 2003) reveals challenges to adult learning in marginalized, trans-cultural, cross-cultural, and other situations where individuals may be discouraged from assuming these attributes (Alfred, 2003).

The lesson for adult educators is, and remains to avoid seeing adults as a unified, generalizable group of learners, but rather to see adults in the complex social constructions in which we operate. This position is both complicated and complimented by the environmental settings and contexts in which environmental educators work.

How adult learning differs from pedagogical learning has been expressed in various ways by different authors: Frith and Reed (1982), for example, suggest the differentiation is based on the adult's life experience creating distinctive needs, attitudes, problems, life-styles and expectations, while Beder and Darkenwald (1982) explain that the psycho-social dimensions of learning and the teacher-learner relationships are different for the two groups. Kidd (1973) characterized adult learners by four broad understandings for the educator: 1) there are no correct answers for adult questions; 2) appropriateness of the instruction is associated with traditions or religion; 3) solutions offered have effects on the individual; and 4) the expectations of adults differ and include finding answers to specific needs (self directed).

One major difference between adults and pre-adults as identified by Maslow, is that self-actualisation does not occur in young people (Darkenwald and Merriam, 1982); further, Maslow's hierarchy does not imply any order in which people are motivated to undertake activities, as the needs in question depend on the individual's circumstances (Kalat, 1993). For adults, learning is considered to be correlated more with what the learner does rather than what the teacher does (Milton and Associates, 1978) which positions the educator as a change agent who plans and directs the process for each individual, facilitates the learning and assists in evaluation (Boone, 1985). For the adult learner, the success of the learning transaction depends in part on the appropriateness of the teacher helping the learner at whatever point the learner is in the learning process (Robinson, 1979).

Merriam and Clarke (1993) operationalize the development of the learning situation for adults by distinguishing learning experiences as those, which are meaningful, and those, which are meaningless. In doing this, it is important to note that adult education does not take place in isolation from the rest of the world (Jarvis, 1987) and how adults make meaning is a key part of their education and learning (Merriam and Caffarella, 1991). The

construct of "meaning making" is also espoused by Mezirow (1991) in writing about the differences between adult and pre-adult learning where he states that adult learning is "becoming critically aware of how and why our presuppositions have come to constrain the way we perceive, understand, and feel about our world". This provides an important link as to why we care about adult environmental learning and its role in policy generation.

As with young learners, each adult learner is different, each being a product of a highly personal and unique set of experiences comprising their life (Lovell, 1987). Yet, Gagne (1970) offers that "learning is a change in human disposition or capability which can be retained...not simply ascribable to the process of growth" (p 3). Authors such as Schon (1987), Brookfield (1995) and Mezirow (1991) expand on the concept of change as it relates to learning in describing learning as a reflective process leading to change; each individual's path will vary, but change is inevitable (Imel, 2000). So how do adults change? And how does environmental information enter into their lives?

It is well understood that most adults seek information to answer immediate needs. Yet, the field of adult education has tended to focus on the purposes of adult education being 1) personal growth and development; 2) career-related education; and 3) adult education as a force of challenging or changing the social order (Merriam and Brockett, 1997).

In a seminar study, Tough (1972) revealed that adults tend to select no more than five to seven "learning projects" or intentional learning activities during a year. These may include hobbies, work-related learning, and recreational learning. The vast majority of information acquired by adults in daily activity is used for answering immediate questions, but not for the purpose of long-term recall, or what we call cognition.

This leads us, then, into an exploration of the channels for environmental information and education by adults.

Creating access to enhance adult learning beyond formal learning structures

In one taxonomy of adult education and training, there are eleven dominant sources of adult education and training (NIACE, 1993). Of these, five are formal education: vocational training in the workplace, adult learning in college-based courses, management training and consultancy, vocational courses through college, and trade union education and training. The other six, then, relate to the focus of this paper: non-vocational adult classes, leisure courses for adults, learning in voluntary groups, voluntary sector (NGOs) public information and campaigns, broadcasting and media, and government sponsored information campaigns.

If we can accept two broad assumptions: 1) that adults are a primary learner for environmental education and 2) that adult learning outside of formal education and training situations follows a different set of learning assumptions, then we can begin to examine the paths by which adults assume environmental knowledge. If we understand these pathways, the

logical though progresses that we can then better intervene for the purpose of enhanced learning and engagement in our adult audiences.

Media and environmental learning

One of the dominant sources for environmental information is the mass media. Television, radio, newspapers, magazines, and even the Internet are major providers of information for adults (see, for example, Filho, 1992; Fortner and Teates, 1980; Fortner and Mayer, 1983; Ostman and Parker, 1987). The media define for many people what it is important to know and when it is of importance, the agenda-setting model of mass communications (Kline and Tichenor, 1972). How and what is reported by the media can shape specific groups' opinions of issues (Badri, 1991). Nvirenda (1995) noted that radio broadcasts have tremendous potential in informing, teaching and persuading adults about issues, but that it is not an effective educational tool without active and guided group listening; as many others have observed that ecological issues appear as a peripheral topic in the media.

Research (see, for example, Borman 1978; Chien, 1996; Cole, 1988; Fishman, 1982; Friedman, Dunwoody & Rogers, 1999; Fortner, 1988) suggests that the dominant sources of what are traditionally viewed as trustworthy sources of science information are highly controlled and selective. Environmental information gleaned from television shows (the infotainment aspect) and the various news media tend to be incidental at best.

There are, however, many occasions in which environmental information is sought to answer immediate needs such as "is this the right for this location" or "how do I deal with cleaning this particular spill." The desired responses, however, are often superficial in terms of the learner wanting to know what to do rather than understanding why or how the solution is derived. Further, the sources of the information are often questionable or intentionally biased; for example, studies have found that the primary source of information for most people is from family and friends (Fortner, 1988). Increasingly, individuals are turning to the computer and the Internet to find answers to questions of immediacy. Some of the most attractive features of the Internet such as speed, lack of restriction, and ease of data retrieval are also the same features that can lead to issues of privacy, fraud, and the proliferation of misinformation (Kerka, 1999). Morrison, Kim, and Kydd (1998) found that users of the web generally assumed that whatever was found on-line was indeed fact; Kirk (1999) notes that on the web, excellent resources reside alongside those that are dubious. Heimlich (2004) found that among environmental educators, more frequent users of the web found the amount and the trustworthiness of the information to be their greatest barriers while those who use the technology less for professional information see trustworthiness and information overload as far less important and thus are far less critical consumers of the information they view on-line.

Even so, not all the information about environmental learning is bad; there are many occasions in which adults seek out places that teach science information either for purposive or incidental use. Sometimes these excursions are happenstance, and sometimes they are destinations.

Where learning occurs

Most of the environmental learning for adults outside of work-related training occurs in informal and no formal educational settings. Learning in such settings is often defined by activities outside the formal learning setting and is characterized as voluntary as opposed to mandatory participation (Crane, et al., 1994) and often defined as informal, no formal or incidental (e.g. Heimlich, 1993; Maarschalk, 1988; Mocker & Spear, 1982). As a contrast, there is an emerging body of literature looking at the teaching-learning event in these settings from the perspective of the learner. Falk and Dierking (1992; 2002), Falk (2005), and others use the phrase 'free-choice learning' to encompass the perspective of the learner. This does not diminish the philosophical differences in creating signage versus designing a multiple-contact program or doing an interpretive hike versus creating an interactive display; but for the visitor, the experience does not distinguish between informal, no formal, and incidental learning. Marsick and Watkins (1997) suggest that this type of learning is a process that occurs in everyday experience, often at subconscious levels and the control of learning (or not) resides primarily within the learner. Diem (1994) suggests that education is viewed as something organized, systematic, and planned while learning suggests something, which is "natural" or "accidental".

Adults visit those places where they feel comfortable, places that are no intimidating, user friendly, and speak in the language of the uninitiated public (Resnicow, 1994). Attractions (such as museums, science centres, exhibits) are often a draw to the adult visitor, and visitors to these attractions consciously or subconsciously seek to learn about themselves and their cultural heritage (Kramer, 1994). Given these considerations, for the purposes of learning about the environment, the construct of the science-phobic public is an inherent barrier. If a visitor does not feel grounded in the science (of the aerospace museum; of the nature centre; of the natural history/science program; of the zoo) underlying the attraction, the likelihood of that attraction being viewed as educational is reduced (Falk and Dierking, 1992; 2001).

Why do adults visit?

Beer (1987) found that slightly over half the visitors to a museum attended with learning as a purpose; other researchers, however (e.g. Hood, 1983; Miles, 1986; Hood and Roberts, 1994) found much lower numbers. The dominant reason for visits found by these researchers was social; and in one study (Hood and Roberts, 1994), less than a third of these social events were

family based. This suggests that the opportunities in adult visitors to institutions and potential learning is based in the social interactions of adult with family or of adult with other adults and the learning is, at best, a secondary factor in attracting the adult.

Some of the emerging literature around the motivations for visiting suggest that adult decision-makers have multiple roles, and these roles vary from time and place (Falk and Storksdieck, in press). Heimlich et al (2004) confirmed early taxonomies of roles of visitors in zoos and aquariums: social; personal; community; spiritual; and professional/hobby are dominant roles adult visitors play in making decisions to attend and also in how they engage in the visit.

Jarvis (1987) suggests that as adults, we all have lots of experiences, but any one experience may be meaningful or meaningless. As a learner, an experience can be either attended to and reflected on, or not attended to (non-learning); if the experience is attended to, the learning can be non-significant or not subjectively valued and hence be short term at best, or it can be significant in which personal value is highly supported by the experience and thus increase the cognitive impact of the information (Hilton, 1999).

It is therefore possible to understand that adults may learn about the environment by happenstance. This suggests that addressing the needs of the adult learner, through using language carefully, creating a climate of comfort and safety, and building the educational experience in such a way that the likelihood of a meaningful experience is increased are keys to reaching this oftentimes "nebulous" audience. Knowing that the learning may arise from a chance encounter, it is imperative that the institution creates a perceived need for the information in the adult visitor. Also of importance to the environmental educator is recognizing that most adults are not attending with the primary focus of learning but of socialization; building our programs around this need may enhance the opportunities for our educational efforts to be meaningful.

Where adults learn about the environment is answered simply and complexly as "everywhere" and equally as honestly, nowhere. Adults learn not the disciplines of science, but rather have the opportunity to apply science to their everyday lives, if the connections are allowed to be made. It is not sufficient to expect adults to choose to learn "science," but it can be expected that adults may be led to desire to understand how things work; why things happen; what can be predicated; what relates to "me." Every adult needs to be able to answer the question: "why should I know this?"

Applications of adult learning theory to environmental education

Engagement in the visit, however, can do more than create interest or inspire curiosity (Watkins, 1994). They can allow the adult learner to become engaged with ideas, even when the visit is for social purposes (Lucas, 1991). In the early 1960's, Houle (1961) constructed three categories

of learners based on relationship of how and why the learner participates: 1) goal-oriented learner; 2) activity oriented learner; and 3) learning-oriented learner. For many adults, the "goal" in participating in any environmental education program or attending an attraction or program is the social exchange, the entertainment opportunity, or the proximity to the information. If, then, an adult has the opportunity to "learn" science as a part of a destination excursion, the goal may not be the learning as defined by the educator, but be, indeed, the social interaction and activity.

In her study of adult learning in museums, Sachatello-Sawyer (1996) found that museums do offer programs for adults, although by far, most program offerings are oriented toward children. Applying the principles of adult education, she found that child-oriented museums are most closely aligned with schools and the formal curriculum while adult-oriented museums tend to offer primarily lectures and guided tours, although some museums are implementing more innovative teaching strategies such as gallery demonstrations, dramatic presentations, and discussion groups. A need exists, she argues, for museums to focus on adult learning principles in the development of their programs.

Adult participation in most environmental learning settings is voluntary and therefore cannot be prescribed in the same traditions with the education of children and youth (Rudd and Hall, 1974) and the content of adult environmental education must be consistent with the interest and needs expressed by the target adult audience(s) to provide motivating forces for the adults to desire to learn (Boone, 1985). Turner-Milenovic (1994) believes it is important that adults understand their stake in the outcomes of their learning, and how the increased knowledge or information base upon which they draw in making decisions can affect their lives. More than thirty years ago, London (1970) stated "adult education has a particularly critical role to play in a rapidly changing society by providing information and knowledge that people need in order to cope with changing conditions" (p. 3). The rapid decline in the half-life of knowledge, and especially within the many sciences and technology, demands that adults must be continually learning science, and understand science as the process of knowing rather than a set of facts, in order to meet the needs of the dynamic society (see, for example, Bybee and DeBoer, 1994).

Adult environmental education internationally must continue the focus on improving quality of life, whether through use of environment for literacy, empowerment, transformative learning, or application to daily life and sustainable living (Daudi, 2000; Hautecoceur, 2002). Joyce and Weil (1980) suggest the process of learning should be structured to aid individuals in achieving a fully functioning state where the ideal and the real selves meet the learner's capacity to deal constructively with life is respected and developed. Adult education can address both the natural and the human-caused issues of the environment as a learning priority with the "complexity of environment becoming the text to be continually reread and

interpreted, constantly helping people to build and rebuild themselves" (Orefice, 2002).

Environmental educators can choose to take the advice of both adult educators and interpreters (such as Tilden, 1977; Beck and Cable, 1998; Ham, 1992) who admonish educators to develop programs and messages that are different for adults than for children and not to treat one as the other.

At its most basic level, the advice offered by these many researchers, practitioners, and theorists is that we respect the learners for who they are, where they are. Four major constructs emerge from reflecting on these ideas:

1. In the literature on adult education outside of General Equivalency Degrees (GEDs), training, and formal programs, it is stressed that adults seek information and understanding that will help each individual deal with the unique factors of their daily lives. Often our attempts to teach adults, whether via media or direct programming, fail to take the learner beyond the answer to the question. We hear the question and provide the answer and in doing so, maintain learning as a body of facts and not as the process of inquiry. To create an environmentally literate population requires adapting the educational outcome to the needs of the individual and guiding the adult learner beyond the answer into the questioning process.
2. If we can help adult learners, visitors, participants, and viewers realize that learning about the environment is a process, we can help adults discover the power in not always having the right answer. In many societies, adults fear not knowing answers to the questions children ask; being environmentally literate can help an adult work through the question, seek the information, and know the point at which more information is needed and how to access it.
3. An important goal of environmental education is to foster more positive attitudes toward the environment and individual's behaviours for sustainable societies. Teaching EE with the orientation of testing of knowledge (even in evaluation) reinforces the construct of learning as a body of facts. Is it possible to change the approach to interpretation and explanation of the environment to focus on a greater use of excitement and awe leading to understanding? This approach, long advocated by those in interpretation, museum education, and no formal education, needs to go beyond traditional practice, and truly build environmental knowledge on affect; using the hook of the emotional reaction to an event, an idea, an object as the basis for leading the viewer/participant to want to understand the cognitive information that supports the affect. The goal is to not tell the adults what they need to or should know, but rather to enhance the experience and then reveal and provoke the visitor to create a more solidly experiential learning event. This also then

co aligns with the goals of community-based environmental education, helping people help themselves by using issues of importance to the individual.

4. One major focus of adult education in general is that of nation building and creating sustainable societies. Tanner and Tanner (1980), for example, write about the importance of education in promoting democratic citizenship. Merriam and Brockett (1997) discuss the idea that adult education can be used for development: "the infusion of personnel, programs, and other resources, to aid in a nation's development" (p. 185). Mayo (1997) writes in terms of adult education for transformation and relates this to the implications of adult education for sustainable development in both developing and industrial regions.

Although speaking pedagogically, the concepts McCormack (1992) offered stand true for adult environmental learners as well: education should encourage learners to become investigators of the social, economic, political, legal, and environmental ramifications of issues and to become active decision makers regarding the applications of discoveries and technologies in their lives.

The goals of critical thinking and decision-making skills are not limited to pre-adult learners. Indeed, the very nature of the "need to know" whether it regards health and medical issues, environmental decisions, voting practices, or any of life's demands, adults need and seek information to help them make decisions. One goal of adult environmental education must be to continue critical thinking and decision making skill development into lifespan development and growth.

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ENGAGING AMBIVALENCE: ENVIRONMENT IN SOUTH AFRICA'S NEW NATIONAL CURRICULUM STATEMENT

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Abstract

South Africa has, for the past ten years, been engaged in a significant curriculum transformation process. A key outcome of this process has been the foregrounding of the relationship between human rights, social justice, inclusivity and a healthy environment as a principle statement. This principle permeates all Learning Areas, with the result that each learning area has a rights-based environmental discourse embedded within the Learning Outcomes and Assessment Standards. This introduces a progressive normative discourse, which accords to a large extent with the "global consensus" on key sustainable development challenges facing humanity at the start of the 21st Century. This paper examines critically the opportunities that are created for participation and action through the new curriculum statements. The paper examines both: the generative power of the curriculum statements for social change, as well as a newly emerging governmentality, thus foregrounding the ambivalence inherent in centrally derived agenda's for social transformation. The paper draws on historical and case-based evidence generated in the context of a five-year National Research Foundation (NRF) research programme.

A note on the research programme

The NRF research programme entitled "environmental learning and curriculum" involved:

- Historical an conceptual research into the establishment of an environmental learning focus South Africa's national curriculum statement.
- Development of twenty case studies (undertaken mostly at Masters degree level) into re-contextualising processes at policy-in-practice level (i.e. in classrooms). The NRF research project data is complemented by research undertaken in a four year formative monitoring and evaluation programme of the National Environmental Education Project for General Education and Training (NEEP-GET, 2005). These studies form the data used in this analysis.

Genesis of the rights based discourse in the SA curriculum

South Africa has a history of unjust conservation laws, and a record of extreme human rights abuses and social injustice. Exclusionary policies governed peoples relationship with the environment, and the majority of South Africans were forcibly removed from the land, denied access to national parks, were disenfranchised by a lack of access to basic rights such as the right to water, education, freedom of speech and in the worst years of the apartheid regime, people were denied freedom of movement and choice. Development approaches adopted by the colonial and apartheid masters were extractive and drew heavily on the natural resource base of the country. Environmental injustices were rife, and numerous communities and workers were exposed to abnormal environmental and health risks in the mining, petroleum and other industries (Hallowes, 1993). Mainly black communities living in apartheid created townships were not provided with adequate water, sanitation and waste management services, or housing. When Nelson Mandela was released in 1990, the ANC had already formed an environment desk, which began to explore relationships between human rights, social justice and environmental health and management.

This work influenced the Bill of Rights in the Constitution, where the right to an environment that was not detrimental to the health or well-being of SA citizens was enshrined (RSA, 1996), influencing all further environmental policy making. This development also shaped and influenced educational policy making and in 1998 environment was included in the new curriculum. In 2000 when this curriculum was revised, the relationship between human rights, social justice, inclusivity and a healthy environment was explicitly fore-grounded as a curriculum principle, to permeate all learning and teaching in schools. The revised National Curriculum Statement (DoE, 2002:8) explicitly states that it seeks to "develop the full potential of each learner as a citizen of a democratic South Africa …with a respect for the environment and the ability to participate in society as a critical and active citizen".

This discourse was introduced to the curriculum by a ten year long state-civil society partnership involving environmental management groups and educators working together to develop a new focus in the national curriculum. This process effectively introduced a 'new regime of practice" (environmental management) into existing, but changing regimes of practice (curriculum development and pedagogy) in South African schools. The genesis of this discourse provides an important antecedent to teachers' and learners' responses to the curriculum statements. It provides a 'backdrop' for interpreting a) the generative power of this new focus in the curriculum and b) an emerging governmentality associated with this new focus in the curriculum, and thus sheds light on an apparent ambivalence associated with the genesis of a rights-based environmental education discourse in the National Curriculum Statement.

Exploring the generative power of the NCS

In discussing the generative power of this discourse, I draw on Archer's (1995) theory of morphogenesis. She proposes that it is possible to distinguish cycles of Structural Conditioning (e.g. the existing curriculum policy), Social Interaction (e.g. teacher education programmes and teachers interpreting the policy), Structural Elaboration (e.g. revised or transformed policy / classroom practice). Central to this process is an analytical separation of human action and social structure, which according to Archer (1995) allows us to analyse the processes by which structure and agency shape and re-shape one another over time, and to explain variable outcomes at different times, and also to identify contextual constraints on our freedoms for social transformation.

A case example explains how contextual constraints upon a teachers' freedom to undertake environmental education activities in the context of the NCS influences the outcomes and possibilities for action. It also provides insight into the generative potential of the NCS, and the role of teacher agency.

Case: A teacher in a peri-urban township developed a lesson on sanitation, in response to the fact that learners in the community were still using a "bucket system" for sanitation (where the municipality collects household sewerage regularly). To teach the lesson she introduced some interactive activities (children interviewed parents about sanitation problems), and she used some materials provided by a local group, which emphasized the strengths and weaknesses of different sanitation approaches. Her lesson was aligned with one of the Learning Outcomes of the curriculum. Learners were able to learn about different sanitation options, but at the end of the day they were not able to "do" anything about the problem affecting them.

In this case, the teaching was influenced by the structural conditions of the community (sanitation practices) and by the Learning Outcomes of the curriculum, and the available teaching materials. The Social Interactions that took place included active approaches to learning (which the teacher had encountered in her professional development programme). Structural elaborations that resulted were changes in pedagogy, but not in the sanitation conditions. Archer (1995) argues that analyses like this can help to generate practical social theories. In the case of this teacher, a practical social theory could be closer interaction with the municipality on issues of sanitation, so that the learners have more power to contribute to changes (as anticipated by the lesson originally).

Other case examples in a similar context of generative interaction with the National Curriculum Statements have shown that most teachers' who engage the issues in the context of the curriculum in lessons, achieve structural elaborations at the level of pedagogical change. Lesson plan sequences undertaken with NGO, parental or community support (e.g. food gardening projects) show evidence of structural elaborations (changes) in

the realm of pedagogical practice (if the school food gardens are used for pedagogical purposes), and in the realm of environmental and health management practice (where changes take place in environmental management and health practice). Teachers' freedoms therefore seem to be most prominent in their direct sphere of interest (pedagogical practice). Teachers' freedoms to bring about structural elaborations in the regime of environmental management practice, seem to require additional social / collective engagements and support.

Governmentality and freedom

Is this "freedom" what it seems? Archer (1995) argues that it is necessary to consider the contextual constraints of freedom, to articulate strategies to use our freedoms effectively. A deeper probing of "freedoms" provided by the generative power of the NCS may be necessary to develop a more critical vantage point on interpretations of the NCS. Dean (2003, after Foucault, 1985, 1986) argues that governmentality provides a somewhat 'hidden' constraint upon freedom, and that governmentality needs to be examined to reveal hidden subjugations. Governmentality involves instituting techniques and concerns for self-government (e.g. instituting techniques for governing own environmental behaviour), so that the art of government will be more effective. Governmentality is therefore the study of the way in which practices of government have 'come to rely on the agency of the governed themselves' (Dean, 2003:64).

In the context of the NCS a governmentality is evident in attempts to shape teachers' and learners' participation, actions and responses to environmental issues in particular ways. For example, the curriculum requires learners to:

- Examine environmental issues through a rights-based discourse
- Apply issue-based methodologies that are outcomes-based
- Deploy scientific, geographical, technological and indigenous knowledge in analysing their own and other peoples' environmental behaviours
- Contribute to school environmental policies and action projects such as recycling, waste and water management (amongst other requirements).

Here we see governmentality to improve environmental management in society, being implemented through outcomes-based assessment technologies, which are criterion referenced. Criterion referenced assessment in the NCS focuses on knowledge, skills and values, and in some cases is relatively prescriptive of expected behaviours (e.g. all Grade Three learners should participate in a recycling project, while all Grade Nine learners are to constructively deal with waste material and improve water management).

Conclusion

In considering Archer's point about freedoms, we might well ask "How might we deal with the agency of the governed?". In this case, we are considering the agency of teachers and learners. As shown in the analysis above, elements of governmentality are situated within / underly the generative nature of the rights-based environmental education discourse in South Africa's curriculum. As indicated by Dean (2003) governmentality appears to be necessary for contemporary management of societies, but care should be taken to examine possible subjugations if we are to continue seeking democracy in society. Cruikshank (in Dean, 2003) proposes that governmentality is a technology of citizenship, which presents an ambivalence to consider within contextually constrained framing of freedoms / realms of choice. Harraway (1997) and Bauman (1991) alert us to the perennial influence of ambivalence in modernity and they argue that we become more explicitly conscious of ambivalence. This paper suggests that it is through careful analysis of, and explicit recognition of the ambivalence in the NCS that further possibilities for teachers' freedoms (to undertake environmental education work which may be less constrained by hidden subjugations) may become possible. Cruikshank (in Dean, 2003) refers to the need to remain open to the possibility of unintended outcomes, and the formation of unexpected agencies (which may not necessarily be inscribed by the instruments of government).

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LES CHANGEMENTS DE PARADIGMES AU CŒUR DE L'ÉDUCATION AU DÉVELOPPEMENT DURABLE

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Résumé.

L'application des préceptes du développement durable passe par de nombreux changements de paradigmes. Cela implique une manière d'être, de vivre et de penser nos actions fondamentalement différente de celle que nous vivons actuellement. Or, si nous désirons que ces changements radicaux aient une chance d'entrer dans le champ de l'éducation, non pas seulement sous forme de discours, mais d'une réelle implication dont les conséquences seraient en accords avec les besoins d'un véritable développement durable, nos agissements quotidiens en tant que citoyens doivent eux-mêmes pouvoir servir d'exemple.

En nous appuyant sur l'organisation de ce III Congrès International, nous tenterons de montrer comment ces changements de paradigmes interviennent et sont, ou non, intégrés. Cet exemple nous permettra de mettre au jour une série de principes sur lesquels le développement durable s'appuie et qui peuvent être autant d'obstacles à la mise en œuvre de ce concept[8]

Un colloque qui se veut « durable »…

Il n'est pas courant que les organisateurs d'un Congrès International prennent le temps et l'argent de présenter à leurs participants un bilan relatif à l'émission de CO_2 qu'engendre leur participation à ce même colloque (transport, chauffage, consommations diverses). Ce geste doit être souligné et encouragé, au même titre que l'investissement d'une partie des fonds perçus en faveur d'un appui à la reforestation. Néanmoins, nous ne pouvons en rester à un simple constat de bonne volonté. Notre travail, en tant que colloquant et, plus encore, en tant que membre organisateur, consiste à mettre en évidence de manière tangible ce que représente réellement notre impact (en termes d'empreinte écologique), afin d'en tirer les leçons

8. Les données présentées ici sont issues d'une recherche commencée en 2000, dont les résultats sont à la base d'un projet qui met en collaboration le *Laboratoire de Didactique et Epistémologie des Sciences* (Université de Genève, Suisse), le *Laboratoire de Génétique Moléculaire Evolutive et Médicale* (INSERM et Université René Descartes, Paris, France), l'*Université Pédagogique de Cracovie* (Pologne), le *Centre de Recherche en Education Paulo Freire* (Université d'Evora, Portugal).

nécessaires devant nous servir à modifier nos comportements de la manière la plus optimale pour la planète et ses habitants, dans des buts qualitatifs et non plus quantitatifs.

Pour ce faire, nous nous sommes basés sur les données fournies par le *Regional Agency for Environmental Protection*, Piemonte, Italy, Torino 2-6 october 2005, organe responsable de l'étude d'impact susmentionnée. Nous pouvons lire dans ces documents que 1392 participants ont été enregistrés, que la quantité de CO_2 émise en quatre jours pour l'ensemble du 3rd WEEC est estimée à 1'100 tonnes et donc, que l'émission par participant est de 790 kg de CO_2.

Que représentent réellement ces chiffres ? Afin de mieux nous en rendre compte, il nous a paru nécessaire de transformer ces données pour qu'elles entrent dans un cadre de référence que tous puissent comprendre[9]. Pour commencer, 790 kg de CO_2 équivalent à une émission d'environ $430m^3$ de ce même gaz. Une autre manière d'exprimer cette pollution est de dire que, pour une seconde de travail effectif, en supposant qu'il travaille dix heures par jour, chaque participant double la concentration de CO_2 dans… 10 m^3 d'air !

Pour tenter d'être encore plus parlants, à quelle consommation de pétrole ces chiffres peuvent-ils être ramenés ? La production moyenne par participant de 790 kg de CO_2 correspond à la combustion de 340 litres d'essence. Or, cette grandeur qui est donc la quantité d'essence qu'aurait consommé chaque participant moyen s'il était resté chez lui à conduire sa voiture plutôt que d'assister au 3rd WEEC, est comparable à celle que consomme un gros 4x4 roulant à 50 km/h en ville durant 4 jours à raison de 10 heures par jour… c'est-à-dire l'équivalent du temps de travail individuel durant l'ensemble du Congrès.

Notons encore que pour simplement neutraliser l'impact négatif produit par le colloque, les organisateurs devraient à présent reboiser la forêt à hauteur d'environ 1400 tonnes, c'est-à-dire replanter un arbre par participant et attendre qu'il grandisse et qu'il ait absorbé… 790 kg de CO_2.

Changer de paradigmes.

Tous fondamentalement sensibles à notre empreinte écologique, puisque nous nous réunissons à Turin pour défendre une certaine vision de l'environnement et du développement durable, que devons-nous conclure face à de tels résultats ? Que nous ne sommes pas encore prêts pour agir au quotidien de manière durable… Mais quelles en sont les raisons profondes ?

Bien que nous puissions analyser cet exemple sous différents angles, il nous a paru intéressant de l'aborder par l'utilisation d'un paradigme

9. Les calculs qui ont permis ces transformations ont été effectués par R-E.Eastes, Département de Chimie, Ecole normale supérieure, Paris. Ils seront présentés de manière plus approfondie dans un article ultérieur. Consulter http://www.ldes.unige.ch/membres/pellaud.

particulier, celui du « pollueur payeur ». Mais tout d'abord, qu'est-ce qu'un paradigme ? Les paradigmes, tels que nous les définissons, sont les fondements sociaux de la pensée qui caractérisent un groupe humain. En tant que tels, ils constituent les soubassements de nos manières de penser, de raisonner. Culturellement acquis, nous n'en sommes pas (toujours) conscients[10]. Ils n'apparaissent souvent que dans la confrontation avec la différence et interviennent de manière forte dans nos jugements de valeur et l'établissement de nos vérités.

Ainsi, le paradigme du « pollueur-payeur » est issu d'une bonne volonté évidente, visant à pénaliser économiquement les plus grands pollueurs. Il n'en demeure pas moins que cette manière de raisonner est directement issue du néo-libéralisme économique. Si ce paradigme peut, dans certains cas précis, favoriser le passage d'un développement libéral à un développement durable, dans le cas qui nous intéresse, il nous montre essentiellement ses limites. En effet, dans notre exemple, réduire notre impact est largement insuffisant. Il faut avant tout penser à l'éviter. Mieux encore, nous devrions viser à réduire les impacts passés… et à éviter les futurs ! Il ne s'agit donc plus d'envoyer des fonds pour replanter des arbres, mais de se demander comment il est possible d'échanger des idées, des expériences, de tisser des liens, de créer des synergies et des réseaux (ce qui est le propre d'un colloque), sans pour autant participer à la détérioration de notre planète et aller ainsi à l'encontre des idéaux que nous défendons[11].

Cinq principes pour intégrer les changements de paradigmes dans l'enseignement.

L'organisation d'un colloque n'est qu'un exemple parmi d'autres pour illustrer le « changement de lunettes » que nécessite le développement durable. Le schéma qui suit regroupe les principes qui nous semblent au cœur des changements de paradigmes et qui peuvent faire obstacle à la compréhension et à l'application de ce concept dans la vie quotidienne.

Le principe de relativité fait appel à l'importance de la contextualisation, qui définit une compréhension ou des objectifs non pas dans l'absolu, mais relatifs à un contexte particulier. Penser le développement durable, en définir les priorités et les moyens d'y parvenir, prend par exemple des formes différentes en Suisse, au Brésil ou au Mali. Ce principe est facilement repérable à travers les notions de temps et d'espace. La notion de « long terme », par exemple, prend des significations extrêmement variables selon le champ disciplinaire considéré ; de cinq ans en économie à plusieurs millions d'années en écologie. Quant à

10. Pensez simplement à l'utilisation de la base dix dans toutes nos manières de calculer, à la division du temps en soixante minutes ou secondes, aux sept couleurs de l'arc-en-ciel, à la division de la gamme musicale en 12 demi-tons… Autant d'exemples évidents… qui ne le sont pourtant pas !

11. La mise en place d'une visio-conférence internationale permettrait de diviser par 10 la production de CO2 pour le même nombre de participants…Un article ultérieur proposera un projet plus complet.

l'espace, les pollutions ont grandement remis en question les notions de frontières, de territoires, d'appartenance et de propriétés.

Le principe de non-permanence se rattache à l'idée de processus dynamique, dans le sens où le développement durable nécessite de penser en termes de régulation et d'optimum. A l'inverse de ces notions, notre culture nous a habitués à prendre des décisions en vue de trouver des solutions définitives. Ce paradigme est renforcé par l'image d'une modernité salvatrice, dont les seules limites sont d'ordres financiers et techniques. Si cette image de la modernité commence à être remise en question par les intellectuels occidentaux et les minorités alter-mondialistes, il reste que l'école continue à ne proposer que des modes de raisonnement allant dans ce sens. Tous les problèmes proposés aux élèves possèdent encore et toujours une, et une seule solution, permanente et menant à une réponse « juste ».

Le principe d'ambivalence et celui de non-certitude nécessitent de prendre en compte, d'une part le paradoxal et d'autre part, l'incertain et l'aléatoire. Cela implique de savoir gérer l'inattendu, mais également le flou et le contradictoire. C'est ainsi que des notions telles que « le moins mauvais » ou, de manière plus optimiste, le « au mieux » apparaissent. Or, la confiance quasi aveugle dans le développement des techno-sciences nous a construit un paradigme nous faisant croire que l'on est - ou sera - capable de tout gérer, de tout maîtriser dans une logique cohérente. Il n'y a que peu de temps que des notions telles que le « principe de précaution » sont évoquées, en vue d'une meilleure gestion des prises de décision dans des situations dont la complexité et l'incertitude ne permettent pas d'en appréhender toutes les conséquences.

Enfin, si la psychologie nous montre que derrière toute peur il y a un désir, nos propres actions, notre propre engagement souffre de cette ambivalence. Bien des citoyens, attentifs aux problèmes écologiques et sociaux et cherchant à respecter une certaine éthique, estiment que leurs actions ne sont qu'une « goutte d'eau dans l'océan ». Cette attitude est due à un désenchantement envers les systèmes économiques et politiques, mais également à une non-intégration du principe d'interdépendance qui articule d'une part les actions locales et le développement global et, d'autre part, les différents acteurs du développement durable (de l'individu aux instances internationales). Ce n'est qu'en comprenant l'influence qu'exercent ces différentes instances les unes sur les autres et en percevant les réactions qu'une action localisée peut avoir sur un ensemble plus grand qu'il sera possible de dépasser ce syndrome, révélateur d'un mode de pensée soumis à un découpage trop cartésien.

Incluses dans ce principe d'interdépendances, les interactions sont le fondement proprement dit du développement durable, puisque ce sont elles qui sont au cœur du concept, reliant les développements économique, écologique et social. Avec elles commence toute l'approche des systèmes complexes, si bien décrits par Morin (1977, 1990, 1999), dont la densité exigerait un développement qui ne nous est pas permis dans cet article.

Conclusion.

Au-delà des changements de paradigmes, le développement durable nécessite une réflexion profonde sur les valeurs sous-jacentes à nos actions et à nos décisions. L'exemple que nous avons pris en introduction illustre parfaitement ces choix auxquels nous devons faire face. A l'heure actuelle, l'intérêt personnel, individuel prime souvent sur le collectif, alors même que nous sommes conscients des enjeux qui se cachent derrière nos décisions. Comment gérer ces paradoxes ?

Face à ces problèmes, l'école a plusieurs rôles à jouer. Le premier, lié aux changements de paradigmes, touche avant tout les connaissances et la manière de les aborder. Il devient primordial que l'approche systémique, inter ou transdisciplinaire permette la compréhension de ces nouveaux paradigmes dans lesquels nous plongent notre vision, notre compréhension du monde et nos décisions. Le second, plus lié à la réflexion individuelle sur nos propres savoirs, doit favoriser une prise de distance permettant cette vision globale sans laquelle nos choix ne résistent pas à l'égo ou au « culturocentrisme ». Le troisième, plus prosaïquement, concerne les habitudes de vie, ces gestes quotidiens qui conduisent, dans un premier temps, à intégrer des réflexes tels qu'éteindre la lumière, recycler les matériaux, économiser l'eau, etc. Acquis souvent à travers l'exemple que donne l'adulte, ils ne doivent pas être une fin en soi, mais le début d'une réflexion sur le « pourquoi » de leur existence. D'autre part, acquis très tôt, ils permettent de relativiser la notion d'effort liée à leur réalisation.

Les questions ainsi soulevées, pour autant qu'elles soient mises en perspectives par l'enseignant, permettent aux élèves de clarifier leurs valeurs, sans pour autant que l'école n'ait « à faire la morale ». Ceci est d'autant plus important que le développement durable est avant tout un état d'esprit, une façon d'être qui s'appuie sur une éthique, tant individuelle que collective, qui respecte la manière de voir et de penser de « l'autre ». Enfin, et contrairement à ce qu'imaginent trop souvent les enseignants, aborder les paradigmes, travailler sur nos modes de raisonnement, voire sur nos valeurs et nos choix n'exige, dans un premier temps, ni moyens supplémentaires, ni réforme ministérielle[12]. Il s'agit avant tout d'une décision personnelle, d'une volonté individuelle de prendre du recul par rapport à l'objet enseigné et de proposer à ses élèves ce même travail en leur offrant la possibilité de mettre le savoir abordé en perspective.

12. A terme une volonté politique est indispensable, ne serait-ce que pour instaurer ce type de démarche dans la formation initiale et continue des enseignants. De plus, pour que cet enseignement puisse réellement révéler ses potentiels, il est nécessaire de ne pas en rester à l'expérience isolée, proposé par quelques trop rares enseignants motivés.

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INSTITUTIONAL CURRICULUM GREENING FOR HIGHER EDUCATION: TOWARDS UNIVERSITY AGENDAS 21
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Introduction: sustainable development

We start with the idea that sustainable development is a dynamic concept that requires a series of change processes in the relations between social, economic and natural systems and processes, which may give rise to a balanced and integrated confluence among economic growth, social progress and respect for biological and cultural diversity (Goodland, 1997).

From this viewpoint, the university institution cannot remain on the sidelines of the road towards sustainability; this involves having to change:

- Resource and waste management.
- The interactions between university community members and their participation in daily academic life.
- Qualifying students towards awareness and education with criteria that are coherent with sustainability.

Furthermore, the idea that "making Higher Education a sustainable area" is already included in the Bologna Declaration within the present-day context of the convergent European university process.

The purpose of institutional curriculum greening would be the forming of an Agenda 21 for the university in correspondence with the development of local Agendas 21, which would have to consider the following:

- Actions related to management and research.
- Education-related actions through the creation of teaching resources, which link the various study matters with the sustainability criteria.
- Actions that involve the university community in the local sustainability processes, and actions by which the university

community participates in the local/global community that the university is included in.

Spanish university curriculum greening

In recent years, significant changes have taken place in Spanish universities with regards to their curriculum greening.

In September 2002, the Rector's Conference Assembly of Spanish Universities (CRUE) unanimously approved the creation of the "CRUE Work Group on Environmental Quality and Sustainable Development in Spanish Universities".

Twenty-four universities have been assigned to this group, and it has been backed by some universities, which had dedicated more time and effort to such themes.

The first universities to talk about applying an Agenda 21 were the two autonomous universities of Barcelona and Madrid (UAB and UAM). Both universities are located away from the urban centres and they are similar to local organisations insofar as they have extensive campuses and have to manage practically everything themselves. Although other universities have different characteristics, they have also started their own curriculum greening, such as the Polytechnic University of Catalonia (UPC) with its Environmental Plans (1996-2001 and 2002-2005), and the changes of its Interdisciplinary Centre Planning Office in Technology, Innovation and Education for Sustainability (CITIES), which have just been passed.

Additionally, the University of Girona has put environmental plans into practice. Others have opted to draw up Environmental Management Systems by following the ISO-14000 or EMAS standards, such as the University of Barcelona, the Polytechnic University of Valencia or the University Jaume I of Castellón. Generally speaking, a management organisation has been set up in them all (Green Offices, Rector Delegates for the Environment, or the Delegations themselves, or Occupational Risk Prevention Services).

University of Valencia

The Universitat de Valencia- Estudi General (UVEG) was created in 1499, and is the third Spanish university as far as the number of students is concerned.

It has more than 53.000 degree students, approximately 3.370 teaching staff members and 1.680 office workers. It is made up of fourteen Faculties, a High Technical School of Engineering, three University Schools and fourteen Research Institutes, which are located in three Campuses. The Campuses of Humanities and Social Sciences are located in the city of Valencia, while the scientific-technical Campus is situated in the area of Burjassot/Paterna, at a few kilometres distance from the city of Valencia. The University of Valencia is made up of ninety-two Departments and it

covers fifty-nines Degree courses, 109 Doctorate Programmes, and 253 Master's Degrees and Postgraduate Courses.

Institutional curriculum greening at the university of Valencia

The sustainability-related actions are divided into three main sections:

1. Management (people, means, resources…)
2. Teaching and research: curricular curriculum greening (our specific research scope).
3. University life (involvement and participation; interactions and ways of acting, as a propaedeutic to "professional life").

Curricular curriculum greening

This is a strategy that tends to facilitate the achievement of education objectives with regards to developing basic environmental competences of university graduates, by reorientating the various study plan subject contents upon the basis of sustainability criteria. The "environmental competences" concept has been defined as the complex and integrated group of knowledge, skills, abilities, attitudes and values that people place at risk in different contexts (social, educational, occupational, family) to not only solve situations related to environmental problems, but also to operate and transform reality with sustainability criteria (Erice & Geli de Ciurana, 2005); that is knowing, knowing how to manage, and knowing how to assess what working on environmental-related contents requires (natural, socio-economic and cultural) in order to be trained to provide viable answers to professional situations or problems. Educating and developing professional competences may offer various teaching-learning approaches and methodologies.

The constructivist approach has been taken in the study carried out; it has to be taken into account that the professor acts as a mediator among the information, resources and materials that he or she provides the subjects who learn; however, it is the subjects who construct meanings about the reality they study through their cognitive-affective activity (Aznar Minguet, 1994; 1999).

We inscribe the education addressed to learning competences in the university pedagogical renewal process framework promoted by the European convergence guidelines[13]; building a European space for higher education represents an appropriate situation to understand the teaching-learning activity in the university as a space for education from which sustainability challenges are dealt with. University education, as such

13. The Tunning Educational Structures in Europe Project: Gonzalez, J and Wagenar, R. 2003 has extensively occupied the theme of "competences".

requires a change in the teaching staff's teaching culture, as well as in the higher education institutions themselves; as for learning the competences that address sustainable development, the existence of an institutional commitment, and the teaching staff's involvement and perception as acting parties to include environmental criteria and approaches in their teaching programmes, is relevant.

A university education proposal for sustainability must include the promotion of learning three types of basic competences: cognitive, methodological and attitudinal.

In our research, we started with an initial proposal of competences, which was determined by the different work groups of target study degrees in the various areas of knowledge; to that effect, we begin with the premise that university degree holders who study an environmental studies plan will have to develop the following basic competence *nuclei*:

- Nucleus 1 (KNOWING). Cognitive competences: critical understanding of the global, national, local environmental problems.
- Nucleus II (KNOWING HOW TO MANAGE). Metholodological competences: acquiring abilities, strategies, techniques and procedures regarding decision-making and performing environmental-related actions.
- Nucleus III (KNOWING HOW TO BE AND HOW TO ASSESS). Attitudinal competences: developing environmental attitudes and values.

With curricular curriculum greening, sustainability is introduced in university teaching and research by undertaking actions at different planes:

- Vertical: curricular curriculum greening plans in Centres (curriculum greening levels in degrees).
- Horizontal: curricular curriculum greening plans in Departments (curriculum greening levels in subjects).
- Transversal: the curricular curriculum greening learning process plans (defining the environmental content profile – conceptual, procedural and attitudinal –) which a student needs to know when finishing a career; the Profile is obtained from the results of internal surveys addressed to professors and students to establish minimum environmental contents based on a previous definition of the educational environmental objectives.
- Research: Curriculum greening plans in Research Projects (Guide to environmental contents for End-of-Career Projects, Doctorate Research Works). This is not only the motive of Curricular curriculum greening, but also the distinction in teaching.

Curricular curriculum greening at the transversal plane

Our research focuses at the transversal plane at the learning processes level, which may be environmentalised in different ways, just as Capdevila points out (1999):

- The curriculum greening of the *syllabus* of existing subjects means reconsidering subjects to introduce those formative contents, which are related to sustainability, particular for the specific subject.
- Introducing different problems and examples in subjects, which are coherent with the principles of environmental human and socially sustainable development.
- Environmentalising laboratory practices, class works, practices in companies, and so one.

From this viewpoint, the methodology applied in our research includes quantitative and qualitative perspectives; the former to perform a first descriptive-explanatory and evaluative analysis on the initial situation in relation to curriculum greening, as well as to assess the changes produced after applying the curricular curriculum greening plans in three pilot degrees at the University of Valencia; the latter, which are more noticeable in the context, were applied to identify interactive disciplinary dialogue processes, and to understand their dynamics more fully.

We have followed an intervention sequence in various phases by applying the curricular curriculum greening plans:

- Preparation/motivation seminars to put such plans into practice with the three target study degree teaching staff members.
- Organisation and work in Nominal Groups of a disciplinary discussion type. The previous workshop sessions on alternatives for curricular curriculum greening are performed in eight two-hour weekly sessions, where the discussion will centre on the following aspects a) "negotiated" conceptualisation on curricular curriculum greening; b) defining the profile of the university degree students' competences to promote sustainability; c) environmental aspects of the university degree students' occupational contexts; d) concepts, procedures and attitudes to be reinforced in the environmentalised studies plan; e) professional practices that affect environmental problems.
- Drawing up teaching curriculum greening guidelines, which include: a) aspect descriptors, practices, examples or questions to be included in the various subject programmes; b) relevant pedagogical resources and materials; c) bibliography and references to web sites.

Furthermore, our research provides a system of indicators to assess the generated curriculum greening process.

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ENVIRONMENTAL SCIENCE AND EDUCATIONAL PROJECTS TOWARDS SUSTAINABILITY AT THE TEMPORARY HELLENIC SCHOOL PRACTICES

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Twenty first century found the planet in a frame where both the environment and the developmental strategies are linked together in terms of an inter-dependable and self-evolving crisis.

The definition of the environment as a holistic frame consists of complex procedures at the level of social and ethnic identities, environmental and educational strategies.

The idea that the environment embodies cultural value remains a recent perception for educational authorities. The environment representation at school practices, via textual conversion through the curricula, is now elaborated and re-processed; it is to our concern that the presentation of environmental aspects transports and reveals important messages, actually linked with the future of the planet, as they deal with the production of self-conscious citizens and the promotion of good practices. The environmental messages have to be educationally articulated at a national frame of formal and non-formal education.

Culture and cultural value consists of 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, 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 ends” but “The social basis of the ends themselves”, a factor of development but also the “fountain of our progress and creativity”.

Concerning school practices, all alternative methodology such as resource learning, implementing of new technologies, interdisciplinary projects, art activities and on, may not as such transform the current youth and adult's attitudes concerning the development - environment relation. Moreover, it may not alter the mono-dimensional perception of the environment itself, when seen as an addition of water, fauna, flora and energy.

It is concerned of major educational importance for traditional Science to affiliate with the Social-Humanistic cognitive fields, in order to produce a new discourse, that of Environmental Science, 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 values, totally different from the consumption pattern upon which the current socio-economic model is constructed.

Sustainable development calls for comprehensive change in the way society and thus education operates. An ecologically responsible manner on 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.

Concerning formal schooling, the organisation of knowledge is the crucial point, having a symbolic power to diminish the value of the method or even the value of the cognitive content. The democratisation of classroom life and learning did not help the school to become less selective or reproductive.

Active learning, handling educational material, encouraging dialogue offered a great lot of new broadly cognitive opportunities, but did not always questioned the symbolic authority relations and the traditional attitudes towards complex cultural/environmental issues built or supported in the classroom. A friendly classroom environment becomes sometimes a more convenient environment for a fortified stimuli - response knowledge building. Either authoritative or liberal, facilitator or communicator, the teacher in many contemporary classrooms, in the position of transmitter, is organising evaluation on pre-decided matters and goals and when this procedure is central, it merely invalids all efforts to alternative learning.

For Greece, the epistemological and educational discussion was imported. The curricula and taxonomy discussion was brought into academic environments, still it did not seem to be translated into educational policies. A mixed model is actually applied, of traditional syllabus and closed curricula. Nowadays an effort is made towards inter-disciplinary schemes concerning the first nine years of obligatory education. In this frame, project method, active learning, group-cantered learning, text or object- cantered learning are discussed and promoted as the new effective answer, the radical solution to the well-established educational problems.

A new cognitive paradigm of the affiliation of Environmental and Social sciences in terms of formal and non-formal education is expressed through trans disciplinarity.

Transdisciplinarity involves going between, across, and beyond different disciplines. While interdisciplinary refers to the links between knowledge and models available in different disciplines, transdisciplinarity moves beyond this to develop both a new vision and a new experience of learning. The move towards trans disciplinarity is closely today linked with changes in ways of thinking and teaching about the environmental and cultural challenges.

The concept of sustainable development emerged in the 1980s in response to a growing realisation of the above needs of balance and since then there has been a growing understanding of the complexity and interrelationships of problems such as poverty, wasteful consumption, environmental degradation, urban decay, population growth, gender inequality, health, conflict, and the violation of human rights. Trans-disciplinary 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 will to make future-oriented choices; to support the commitment to a world of socially just and peaceful development.

Education is referred 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.

A holistic approach to environmental learning implies the need of reorienting education towards sustainability, 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, themselves, contribute to the values and attitudes that are the foundation of sustainable development.

Education may not only concern with disciplines that improve the understanding of nature - despite their undoubted value - but with the study of the political economy, social sciences, and the humanities. State education should nowadays emphasize on aspects of learning that enhance the transition to sustainability including future education; citizenship education; education for a culture of peace; gender equality and respect for human rights; health education, population education; education for protecting and managing natural resources; and education for sustainable consumption.

Education through school activities and programmes towards the environmental awareness develops 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 practises emphasise on 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 not only be as broad as life itself but aims to empower everyone, young and old, to make decisions and act in culturally appropriate and locally relevant ways to redress the major contemporary problems.

The Decade on Education for Sustainable Development (2005-2014) offers an opportunity for educational institutions to advance progress made in education and training to ensure results in meeting current and future needs.

The World Commission on Environment and Development defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". 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.

Interpretation is the key word for formal and non-formal learning.

Interpretation is described as an educational activity which aims to reveal meanings and relationships through the use of original objects, by first hand experience and by illustrative media rather than simply to communicate factual information (Tilden). The process of interpretation focuses on the mental activity of the receiver. Interpretation in classroom mainly means doing interpretation for others. The interpretative agent may be the teacher, the cultural or environmental educator, or else.

The reflections of past environmental actions and attitudes in the present shall not be made in this frame in order for the present to recognise itself and be justified. Educational institutions organize social coherence through the messages implied, as the school learning procedure trains young receivers to that coherence.

The reduction of the examination of human culture to the level of method is vain. What is crucial is to admit that different ideas on truth, value and cognition exist and that formal and non-formal education should reveal this diversity.

Training to the construction of historical sense means that we overcome the natural naïf perspective, which judge the environmental decisions according to the variable factors of current life. Having historical consciousness means that we are thinking inter - and intra -, via and across the historic horizon which co-extends with the life we are living and had lived, both on nature's and society's matters.

Reflective behaviour towards inherited cultural / environmental capital consists interpretation: interpretation is not an optional choice- there is no way we can escape interpretation. But this is an ontological and not a methodological point.

In this frame the school interpretation policies are not seen as only cognitive reception policies, as vivid broadcasting of fragmented but attractive data, but are seen from the state that environmental educational practice may explain meanings by ex-closing social relations and

conditions, by de-closing ideology patterns. So the environmental education departments and institutions are not only sectors which appoint the technical, methodological elements of projects and activities but organised spaces in the service of social awareness, critical of itself and critical of the past, acting involving the communities for the future. An open school is needed, able to distinct between being empirical and being empiricist.

In this frame, current Hellenic educational environmental strategies, such as the Environmental Parliament Week for schools, Environmental Classes, Centres of Environmental Education, national programmes, teacher-training are presented, both as a means of dialogue as well as a case-study.

The Hellenic Ministry of Education in the frame of the 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 α module 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

The broad outline of the National Action plan is:

All academic years of the Decade 2005-2014 are nominated
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

In this frame all school projects are encouraged to evolve as interdisciplinary actions and through problem solving, workshops and relevant activities to conclude to suggestions, commitments and action of the student community at a local, regional or national level.

At the end of each academic year a Week of School Activities is engaged. A special event at a national level through which all educational material produced together with major projects implemented shall be vividly presented at a national level.

Support and enhancement of the Centres of Environmental Education

Fifty-six Centres for Environmental Education are established by the ministry of Education and function at a nation-wide level. The objectives of

the Centres are to stimulate young people's thought to environmental issues so as positive attitudes and co-operational behaviour to be developed towards the protection of the ecological balance and sustainable development. This is accomplished by the implementation of one-six days environmental education programmes for each primary and secondary school that visit the Centres and by informal, extra-curricular programmes for other youth groups. Through these programs students get involved in a collective procedure of learning and become aware of the environmental issues and willing to take up action towards the protection of the natural habitat. Moreover the Centres

- Organise training meetings for teachers.
- Support environmental education programs implied within the curriculum or via cross- curriculum projects in schools.
- Participate in or organize cultural activities concerning the environment.
- Create information archives and have an active publication plan of educational material.
- Organise cooperation actions with the local communities.

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 hall, laboratories, computer hall, work halls and library.

In this frame, the challenge for the teacher involved in environmental education projects becomes one not of transmitting knowledge but of creating a meaningful context within which learning can occur.

Critical teachers tend to see themselves as part of a community of learners among whom they are on call to teach as needed. In these instances, teachers see themselves as participants and co-learners.

What we all seek to discover still is better ways to create a setting or environment that is conducive to the pursuit of social useful, correct environmental, holistic knowledge and experience.

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ISLANDS OF DISCOURSE: CASE STUDIES OF AN ECOLOGICAL FRAMEWORK FOR ENVIRONMENTAL EDUCATION

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Abstract

This paper describes an ecological framework for environmental education, enacted through a recent summer institute for teachers conducted on Haida Gwaii. Our model is grounded in an ecology, which emphasizes the "imbedded ness" of human societies and cultures (and their technologies) within physical communities. The model describes a range of ecological, socio-cultural and technical influences that influence educators' interpretations of curriculum and explores the model within the context of "island" communities where we are apply the framework in specific ways: contributing to the professional development of teachers with/in these islands of discourse. This paper describes one instance of this framework: the case of Haida Gwaii.

Haida Gwaii

A recent teacher institute in environmental education was held in "the place of the Haida" on the northern extremity of the West Coast of Canada: an archipelago which embodies our "island metaphor" for ecological and environmental education. The Haida have an archaeological case for occupying these islands that dates back 10.000 years and as such the southern portion of the island group has been recognized as a UNESCO World Heritage Site. Sadly, the UNESCO designation effectively limits access for the Haida to their historical (read abandoned) village sites despite the joint management plan put in place. Before continuing the story, a geographic orientation may be in order: Haida Gwaii is shown on maps as the westernmost extremity in Canada, about 1200 kilometres north of Vancouver and separated from the British Columbia mainland by the turbulent Hecate Strait. The archipelago was originally named for a monarch who never saw them: Sophie Charlotte von Mecklenburg-Strelitz, the wife of the Mad King of England, George III. The British called her Queen Charlotte; hence the more common moniker, the Queen Charlotte Islands (Reid and Bringhurst, 1984). There is deep irony (and deep offence taken) in the knowledge that this remains the official name on government

maps of the area, despite the Haida community's deep connection to these magnificent and ecologically significant islands.

Throughout Haida Gwaii, the Hemlock-Sitka spruce zone dominates (say ecologists), though on the eastern fringe of the islands mountain hemlock and alpine tundra vegetation zones appear at higher elevations. Elsewhere, cedar, pine and western hemlock are seen in a variety of island's microclimates. The diversity of environments on Haida Gwaii has caused some naturalists to dub these the "Canadian Galapagos". The Gwaii Haanas park website relates the following about the natural history of the area:

> The distinct island flora and fauna have evolved over thousands of years. The species here often differ from those found on the mainland. Many common continental species are not found on the islands at all, or have evolved into unique subspecies such as the black bear and the pine martin (both larger than mainland cousins)…
>
> An estimated 1.5 million seabirds nest along some 4.700 km of shoreline on the Islands from May through August… Many are burrow-nesters, such as the rhinoceros auklet, ancient murrelet, tufted puffin, horned puffin… Because the islands are situated along the Pacific flyway, dozens of species of migrating birds stop here in spring and fall.
>
> The seas around Gwaii Haanas teem with life. These waters are home to salmon, herring, halibut, rockfish, mussels, crab, starfish, sea urchin and octopus, along with numerous other species. Haida Gwaii is also on the spring migration route of the grey whales, which spend their summers in feeding grounds in the Bering Sea…
>
> (Excerpted from the Canadian National Parks web site. Online document available at: http://www.pc.gc.ca/pnnp/bc/gwaiihaanas/natcul/natcul2_E.asp).

For the non-islander (indeed, most of us), our "migration" to Haida Gwaii translates into a six-hour road trip from Vancouver, through the northern part of Vancouver Island, then on to a sixteen-hour voyage by car ferry to the northern port city of Prince Rupert. The journey culminates with a lengthy (and frequently delayed) daytrip by car ferry to the final island destination. While the entire trip can be made easily in one hour by plane it is prohibitively expensive to do so. Despite this obvious economic disincentive for our students to fly, we also make a point of encouraging students to travel by other means as we believe the process of "slow travel" assists in students determining the "lay of the land" and a deeper sense of the community they

will eventually participate in. To this end, many students accompanied us on our voyage to Haida Gwaii as part of a pre-course road trip and ferry adventure. Indeed, since most islanders travel to and from the islands by the ferry system, our cultural immersion in island life began to occur on the ferry immediately as it left Prince Rupert.

Early on in our time on the islands we further attempted to develop in our students a spiritual and ecological sense of place by organizing our first excursion: travelling on foot for two days through Naikun (or Rose Spit in Naikoon Provincial Park). At Naikun, an island can be seen to grow out of the sea as new land is formed literally out of the shifting currents and sands of Hecate Strait. Here, ecological succession is handily referenced near the shore (in human scale) as the sand, grasses and herbs give way to the majestic cedar used for the massive canoes and poles that the Haida people still traditionally carve. Naikun is most importantly the site of the Haida's well-known creation story whereby men were said to be released by Raven from their watery prison "within a cockle shell" washed ashore on these shifting sands. Later, raven caused the meaty "red chitons" to merge with the men, creating the female form. As we read these stories, here in this place, we contemplated the Haida's deep social and cultural connections to their island home. This connection embodies our ecological framework. We imagine the Haida paddling around these islands, founding villages, raising families: the very social make-up of community imbedded in the physicality of the place.

An integral part of the experience for students in our course is backpacking (notable as another form of slow travel). This practice takes a lot of organization and planning long before a pack is hoisted onto the shoulders and the hike to Naikun commenced after a great deal of planning and logistics. Still, after a short van trip we arrived on a stunning twelve-kilometre stretch of sandy beach. Six hours later, and with tired feet we began to set up camp where there were still some trees for shelter from the wind. After setting up our tents, we walked the final five kilometres through grassy fields then along a beach to arrive at the northernmost tip of Haida Gwaii. Naikun alludes to the rich spiritual mythology of the Haida. Similar to many cultures, mythic stories of the creation, its creatures and their adventures instructed, informed and entertained the members of the Haida society. One of those creatures is Raven: central to many stories as both a trickster and a troublemaker. The story at Naikun then, was a natural reading in order to help capture the essence of this sense of place. Now, with the help of the (imaginary) sound of waves lapping in the background, here are some excerpts from The Raven and the First Men, the story we read aloud in that place:

> The great flood which had covered the earth for so long had at last receded, and even the thin strip of sand now called Rose Spit, stretching north from Naikun village lay dry. The raven had flown

> there to gorge himself on the delicacies left by the receding water, so for once he wasn't hungry. But his other appetites – lust, curiosity and the unquenchable itch to meddle and provoke things, to play tricks on the world and its creatures – these remained unsatisfied… He gave a great sigh, crossed his wings behind his back and walked along the sand, his shiny head cocked, his sharp eyes and ears alert for any unusual sight or sound… he found at his feet, half buried in the sand, a gigantic clamshell. When he looked more closely still, he saw that the shell was full of little creatures cowering in terror of his enormous shadow… Their skin was pale, and they were naked except for the long black hair on their round, flat- featured heads. They were the original Haidas, the first humans…

The story progresses by relating how the first Haida were male and how with the help of the Red Chiton, Raven turned some into women. The story ends with this quote:

> They were no timid shell dwellers, but children of the wild coast, born between the sea and the land, challenging the strength of the stormy North Pacific and wresting from it a rich livelihood… For many generations they grew and flourished, built and created, fought and destroyed, living according to the changing seasons and the unchanging rituals of their rich and complex lives. It's nearly over now. Most of the villages are abandoned, and those, which are not entirely vanished, lie in ruins. The people who remain are changed. The sea has lost much of its richness, and great areas of the land lie in waste. Perhaps it's time the Raven started looking for another clamshell (Reid & Bringhurst, 1984).

In retrospect, twenty years had passed since this retelling of Raven's story and our recent environmental experiences on Haida Gwai. Throughout the intervening time, there has been a progressive re-birth of the Haida Nation and a strong sense of place has re-emerged both culturally and politically among its people. The Haida here have an ancient saying: "when the tide is out, the table is set." This literal interpretation bears true today as it is possible to subsist here on the incredible intertidal marine life and it would not be too difficult to consider the Haida "literally" constituted from this easily gathered (and calorie rich) food source. Even the local black bear has demonstrated this cultural adaptation here growing fat and large on a steady diet of crabs and other invertebrates. Later on, after our own rich meal of hand caught Dungeness crabs (scooped from the receding tides) we contemplated this in the fully embodied state. With such little effort needed to collect their food, it is easy to conceive of a member from the Bear (or other) clan, developing the characteristic deep and broad carving strokes of a master Haida carver. So

here at Naikun, watching the shifting sands, telling stories and feasting on Dungeness crab, we thought just maybe the tide on Haida Gwaii had turned.

An ecological framework

The preceding story of our educational experiences on Haida Gwaii belies the consideration of an alternative framework for environmental education. Our ecological approach offers a critique of the mainstream organization of curricula while at the same time makes a case for alternative place-based pedagogies, which allow teachers to interpret curriculum in a way that focuses learning within the context of community. Our story gives just one example of what this approach can look like in teaching practice. Teaching with/in an ecological framework focuses teaching on attempts to improve the quality of life within communities while at the same time assists students and teachers to develop a sense of "their place" within them. While others make arguments for place based or community based models of learning, our practice attempts to take this further by describing the need for critical/embodied approaches in their implementation. Central to this is the idea that an ecological framework for education identifies many taken for granted assumptions about teaching. These are best enacted when our actions are deeply embedded with/in the complexity of real environments and communities.

The notion of a place-based education has been well described by Soble (1993; 1996) and related ideas have been expanded on by others (Grunewald, 2003; Hutchinson, 2004; Orr, 1992, 1994; Thomashow, 1996; Woodhouse & Knapp, 2000). The difficulty in describing exactly what would constitute a place-based education becomes clouded partly due to the multiple and interdisciplinary nature of the literature where this notion seems to reside. Grunewald (2003) writes that the idea of place-based learning connects theories of experiential learning, contextual learning, problem-based learning, constructivism, outdoor education, indigenous education and environmental education. To the more academic critic, this might indicate that the idea of a place-based pedagogy lacks a theoretical framework. However, to the pragmatic and community-minded practitioner, the idea of place-based education might gain greater currency as it has arisen independently in a variety of different academic discourses.

Grunewald (2003), in arguing for what he describes as a critical pedagogy of place, writes that our educational concern for local space (community in the broad sense) is sometimes overshadowed by both the discourse of accountability and by the discourse of economic competitiveness to which it is linked. In my opinion, place becomes a critical construct to it opponents, not because it is in opposition to economic well being but because it challenges assumptions about the dominant "progress" metaphor and its imbedded neo-conservative values. This point is particularly true in the case of the Haida people where progress initially came at the expense of their local community and cultural values. An ecological framework would seek to discard this one-sided view of progress

by taking as its first assumption education "about" and "for" defined communities. Ecological education denotes an emphasis on the inescapable "embeddedness" of humans and their technologies in natural systems. Rather than seeing nature as "other", ecological education involves the practice of viewing humans as one part of the natural world and human societies and cultures as an outgrowth of interactions between our species and particular places (Smith and Williams, 1999).

Environmental change and society

Realistic interpretations of the kind of environmental and organizational change experienced by the Haida and other communities can be attributed to a balance of influences. Goumain (1989) states that due to the pace of change we are often forced to cope reactively, adapting to changing environmental conditions only when they become intolerable. Gardiner (1989) describes a framework for thinking about these pressures consisting of three spheres of influence, which he described as, respectively, the ecosphere, sociosphere and technosphere. Gardiner's ecosphere relates simply to a person's (or group's) physical environment and surroundings, whereas sociosphere relates to an individual's net interactions with other people within that environment. Lastly, technosphere is described as the total of all person-made things (present and future) in the world. Gardiner notes that for many organizations, the influence of the technosphere often drives the dominant changes in our society at the expense of other mediating influences including local geographies (ecosphere) and the influence of local cultural and social norms (sociosphere). Hutchinson writes:

> The technological shifts that are occurring just now are already altering our notions of place community and selfhood. Contemporary notions of place, which for centuries have been, grounded in the physical experience of neighbourhoods and local communities now face serious challenges (Hutchinson, 2004).

While the adoption of technical tools and technological perspectives can blur the lines and identities of communities, we maintain that it can also obscure our desired community focus for environmental education. This is evidenced by the increasingly close association of environmental education with the sciences. Bowers (1999) states:

> The effect of this categorization is that the other areas of teacher education and graduate education continue to ignore the connections between the values and ideas they promote and the cultural behaviours now overwhelming the viability of natural systems.

The concept of an ecological model lies at the nexus between a "science education", which emphasizes particular forms of knowledge construction conceived of and implemented outside of "authentic" communities, and an "environmental education", which juxtaposes this knowledge with other socio-cultural and values based constructs which could be described as an environmental ethic. Our developing framework promotes an understanding of scientific and environmental issues in the wider context and in particular provides a model for the interpretation of curriculum in a broad range of communities. To facilitate this, we must look outside the routine of curriculum and continue to adopt socially relevant strategies that will make scientific issues readily accessible to the public. McBean and Hengeveld (2000) write:

> Society in general, accumulates and processes knowledge through experience, perception and intuition. Thus new information and facts are best understood and assimilated if these are placed within the context of the existing knowledge and past experience of the individual or community." (…). In this effort, we must make a concerted effort to include the notion of community (even islands) within this discourse. Figure one introduces our ecological model for environmental education.

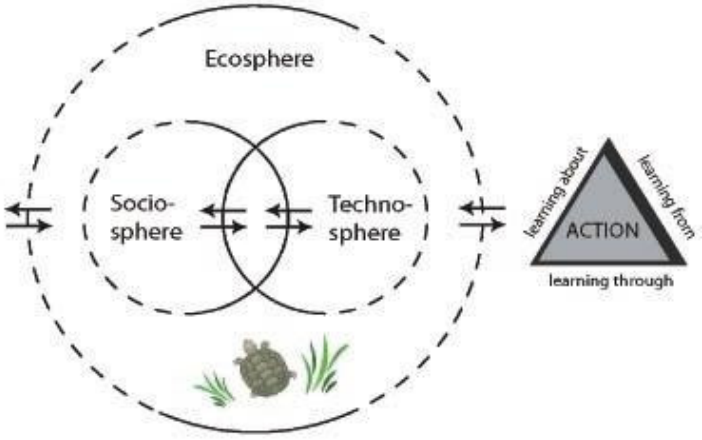

Fig. 1. Island Metaphor for Community and Place

Conclusion

Through the development and presentation of this ecological framework for environmental education, our assertion is that grounding

learning in a sense of our physical and cultural environments is an essential component to a balanced view of environmental education. We contend that the dilemma posed between scientific and environmental models for education is resolved as follows: in the first instance, the (hegemonic) scientific perspective is centrally included in a more holistic model where its "cultural" meaning is not allowed to dominate and is set beside other forms of knowledge common to critical pedagogy or environmental education approaches (eg. ethical, cultural, legal, political, aesthetic). Further, those perspectives inherent in a critical environmental education framework resist becoming marginilised as our framework takes the form of an epistemology rather than a curriculum implementation strategy.

Through the development and testing of this model, we have had considerable success in the implementation of teacher professional development activities in a number of Canadian contexts including Haida Gwaii, the Yukon, and the Okanagan. We are beginning with distinct "island" communities where the boundaries of the community (physical and social) are quite distinct, and where we apply the framework in specific ways. These cases will contribute to the professional development of teachers in what we term "islands of discourse", ultimately informing the development of ecological models in a variety of communities (indigenous and other) for the purposeful interpretation of curriculum. Our intent is to continue to develop the framework through a number of case studies and in this way give greater detail to the model so that others may provide further discussion and critique.

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Sub-session 2.2

CURRICULA AND INTERDISCIPLINARY EDUCATIONAL ENVIRONMENTAL PROGRAMMES : THE CASE OF CONSTRUCTING AWARENESS AT A REMOTE ISLAND COMMUNITY.

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Following the results of scientific research, a series of new ideas are evolving concerning the cognitive procedure in terms of formal and non-formal education. Traditional curricula and teaching practices are today criticized; recent attempts are made towards student-oriented teaching, creative thinking, problem solving, construction of critical thought, holistic perception of knowledge instead of information hunting and education instead of simple pupils' training.

Learning environments in current Hellenic schooling are weak in terms of active participation, social interactivity, constructive knowledge and re-procession of old knowledge, reflective thinking, interpretative teaching, motivated learning, spare time offering, concern on social or cultural differences.

Environmental Educational Programmes (EEP) in the frame of the national education scheme stand as an optimistic umbrella and provide classroom and extra-mural space for implying experimental teaching and classroom research, for the appliance of various learning strategies, for the use, design and production of educational material, the exchange of experience, the cognitive function of field trips as well as a means for supporting pupils' self-appraisal, emotional and mental awareness.

As environment is seen not from a physicalist point of view but as a social historic entity including natural and social acts, facts, procedures, aims and perceptions, the EEP becomes more than an educational programme on natural sciences: it stands as a way of implementing questions and extract answers, as a tool for investigation of established attitudes, as a field able to support the effort of a cognitive synthesis.

At the Gymnasium – Lyceum of Volissos, a remote agricultural community at the north of the island of Chios, near the east Hellenic borderline, an interdisciplinary EEP was realised under the title TOPOS, the Greek word for the socially transformed natural space. TOPOS implies the

places, the fields, the grounds and landscapes which are not considered as neutral nature but merely as community - identified places through the historic sense of use, belonging and neighbouring.

The outlines of the above EEP effort at a school of social enclosure are to be presented, as a case study for the aims and goals, limits and orientation of an EEP when implemented alongside the national curricula.

The TOPOS programme was organized seeking answers on results of alternative didactic and pedagogical approaches, concerning the teaching of modern and ancient Greek language as well as the history curriculum modules via the use of trans-disciplinary educational material, inter-disciplinary projects and creative activities workshops. On the other hand, the programme was implemented within the potential of production of final educational material designed by the classroom community, based on the environmental group activities throughout the year, having a multiplying effect for other school groups regionally and at nationwide level.

The thematic frame TOPOS was chosen with criteria the broadness of cognitive fields involved, the inter and trans-disciplinarity, the combination of environmental, cultural and social dimension, the local dimension and scope arising via the activities. Within this concept natural and historical place and ground - in Greek τόπος/topos - is perceived as the transformed by human collective activity space. Abstract nature in general is not an object of the EEP study. The EEP focuses on the social organization of natural space and its connection with human activity, the transport and reflex ion of social ideas and symbols to natural places, the nature's representation on collective consciousness through history.

The EEP provides a perfect field for work at the interface of disciplines in order to address the complex problems of today's world. In this effort of reorienting educational process, environmental education is an important component.

A highly active pedagogy based on environmental values and ethics for over fifteen years in the Hellenic national educational system has been flourished, where emphasis was driven upon learning the local environment through field studies and classroom experiment or where students were encouraged to examine environmental issues from a variety of angles and perspectives.

The influence of environmental education in promoting interdisciplinary inquiries and inclusive education can be seen at all levels of history education, where the cultural perception was seen together with aspects of environment functions in order to prevent the over-use and exhaustion of natural resources. Environmental education has also found original ways of looking at and measuring human impact on the environment and these efforts may be reused at the humanities and history study fields in order to support the building of historical sense, as a key element of environmental awareness.

Natural space was important to the TOPOS EEP programme, mainly concerning its route through time. The adventure from ancient city to the agricultural habitations of eighteenth and nineteenth century via the medieval

era forms the EEP'S thematic red line: natural and human-made environment in the historic dimension.

The EEP started from modules concerned with the social organization of space at the center of the ancient classical city - Greek άστυ/asty - in comparison with the perceptions of fifth and fourth century BC for the semi-wild space at the borders of the ancient town - Greek πόλις/polis -, named εσχατιαί /eshatie, and meaning the last end, the ground between the civil organization and the wilderness of the absence of the social element, mild and wild place in one, belonging both to the city and the forests.

At the EEP TOPOS material such as the Hellenic myths of creation, the mythical onomatology of plants and trees, the mythical motives for grounds and water, the construction and representation of the idea of landscape as presented through historic and oral narrations are exploited.

Other EEP modules were concerned with the spatial organization of the medieval era, where an altered frame of habitat and social needs lead to a different perception of nature: town/castle - territorium/agricultural settlements - fortified roads, observatories, links and routes to the sea.

From there, EEP study extended to the use of space from traditional communities of eighteenth and nineteenth century and their perceptions of nature as may be seen at land use, economic relations, folklore, beliefs and values.

The concept of natural and historical space and place offered the opportunity of combination of a variety of pedagogical and methodology approaches. The EEP, providing a series of smaller thematic modules and thus the potential of multiple case- studies at a local and regional level, became a flexible cognitive chain oriented at the current interests and educational needs of the school group.

A previous experience of an environmental education programme called Knowing my History, implemented during the academic year 2001-2002, was the initial for the school group to familiarize with environmental and history issues. Evaluated as a successful cognitive experience, the school group was very eager for new opportunities of collaborative study and learning, of experimental workshops, field studies and the use of extra - curriculum educational material.

The schools at the municipality of Amani cover a rather difficult to reach area in northern Chios, were cognitive and cultural disprivilege is profound, still all pupils are characterized by distinctively high emotional intelligence, strong will for participation and learning, collaboration and high moral values.

It is recognized that current strategies and programmes have largely been insufficient or inappropriate with regard to needs of children and youth who are vulnerable to marginalisation and exclusion. Where programmes targeting various marginalized and excluded groups do exist in other parts of the country, they have functioned outside the mainstream programmes.

Differentiation in regional communities may sometimes become a form of discrimination, leaving children with various needs outside the

mainstream of school life and later, as adults, outside social and cultural life in general: Regular schools with inclusive orientation are the most effective means of combating discrimination, creating welcoming communities, building an inclusive society and achieving education for all (Salamanca Statement, Art. 5).

Environmental education efforts try to meet the challenges of pluralism and enable every child to find its place in the community to which primarily belongs and at the same time to be given the means to open up to other communities.

If inclusive education is concerned with providing appropriate responses to the broad spectrum of learning needs in formal and non- formal educational settings, whether inclusive education is an approach that seeks to transform education systems in order to respond to the diversity of learners, EEPs are to be a premium component of the new process. In the frame of TOPOS programme broad common cognitive goals were defined for all students, including skills and values to be acquired. A flexible module structure was chosen to facilitate responding and providing diverse opportunities for practice and performance in terms of content and level of participation

After a two-years project of Environmental Education Programme the school group has gained not to be afraid of the museum and the archaeological place, has learned that educational field visits may not be boring monologues, has been encouraged to recognize knowledge, joy and inspiration at a project, to seek for the educational programme at the museum instead of gathering around, to participate actively at the workshops, the last seen, not as loss of class, but as a new, friendly way to gain knowledge.

The Environmental Education Programme TOPOS was developed at thematic modules-acts, which internally were organized in typical steps:

- Classroom activity based on the thematic unit of elements using the school book with re organization of curriculum units' flow where necessary.
- Collaborative Library research.
- Classroom approach / presentation using extra-curriculum educational material.
- Parallel trans -disciplinary session.
- Activities Workshops: art, narration/story telling, dramatization/role playing.
- Educational Field visit/trip.

In official schooling, because of curriculum demands and time constraints, it is often a challenge for the teachers willing to implement alternative approaches to select content which is based on being meaningful, combine student's needs and interests, support the environmental learning and provide more than just learning facts. Curriculum content may be simply what is prescribed by the ministry of education, thus in curriculum differentiation

projects teachers are trying to modify the content to some extent to help students reach the programmes' outcomes.

The aim of instructors of EEP TOPOS was to support the school group to recognize and recall former gained knowledge, to facilitate interpretation and thus promote the creation of meaning and understanding, to support analytical and constructive cognitive functions, to enhance cognitive taxonomies and to provide help in order to re-organize information at a new, collectively evaluated, synthesis.

Emotionally, the aim was to support the evolution and development of intellectual procedures of value selection and perception, the enhancement of self cognition and self-esteem, the cultivation of collaborative ethics as well as the will for correspondence and, finally, the cultivation and deliberation of imagination.

At a psychological level, the instructors were interested at the strengthening of each pupil's representation for its body and the kinetic abilities, the development of concentration and of focused attention.

Finally, it was an ambition for the instructors, the contribution of the environmental educational programme to the understanding of the idea of historical time, of the concepts of continuity and discontinuity, to the understanding of the dynamic relation and inter-dependence of humanity, social formations and natural environment. It was an aim to encourage secondary education level students to understand and adopt the interdisciplinary scientific synthesis as a means for interpretation and understanding of the world. Last but not least, the support of collective memory as a contribution to the construction of presently aware citizens was meant to be the final goal.

All above are seen as construction elements for the built of environmental consciousness, defined not as abstract love for green or as simple group study of environmental phenomena, but as political consciousness for both the environment and human act, according to the principle think globally, act locally.

Moreover, all the above time/space/environment thematic frame was implemented based on the belief and in order to prove that EEPs are not simply convenient ways to speak about specific issues as energy, forests, biodiversity, water resources et al, but also - and may be mainly - they are vivid cognitive frames for the evolution of educational plans concerned with abstract concepts, ideas and values, such as time, citizenship, action, social representations and reflections.

A special school space was organized to meet the EEP' needs, dedicated to interactive teaching and learning. This space was devoted to exploration and discovery through interaction with works of art, science and mathematics. Everybody loved the place, where learn through exploration, play, and experimentation with tools, materials, and other educational resources was not questioned.

The Environmental Classroom was organized by the reuse of a forgotten storage room, painted and elaborated as a colourful learning

environment, organized to promote interactive learning through explorations, investigations, and pursuits of ideas. All material used consisted an ever-changing museum exhibition within the school ground. In-class library was organized and children's artistic creations were exhibited all year round. In this frame, learning and teaching was meant to be both intellectual and seductive.

Environmental Education programmes implemented within the frame of formal education should be concerned also with the informal or 'hidden' curriculum, the 'unplanned' learning that occurs in classrooms, in the school compound or when the students interact together with or without the teacher present.

For TOPOS EEP, when learning is treated as an active process, it is a logical step to try to help learners by making the process of learning itself self-conscious. To this point the hidden curriculum had been a concern, whilst it may reflected on the projects goals. In order to engage a meta-cognitive process in the frame of an EEP, an effort was done to accomplish a social learning context in which the struggle to make sense and reveal meanings was articulated. Shared meanings n the classroom can be powerful means of supporting new learning.

The EEP TOPOS includes three Thematic Modules:

Act I - TOPOS in Antiquity/ Ancient City and Urban Landscape

Curriculum elements: ancient Greek language, History units, contemporary Literature, Mathematics/Geometry, French language and literature

Educational Material: Printed material form the The Acropolis Centre for Educational Programmes and material designed for the programme itself.

Units:

I. Ancient Agora of Athens, Festivals and Theatre

Educational game/construction panel for the spatial organisation and uses of the city centre with guides figures from a role-playing game.

II. Anemone, Narcissus, Yakinthus

Educational Card Game with mythological and botanical information for plants and trees nominated after a Hellenic myth.

III. Learning the Pythagorean Theorem at the Freeze of Parthenon – Sculpture within Triangles

Math-History interdisciplinary Educational game with cards and pawns for 5 to 8 players on a triangle carton base including alternatively elements of the freeze and questions.

IV. A l'Agora, à la table

educational game in the form of a path across a labyrinth garden, concerned with the herbs and plants of ancient Agora used in ancient

Greek and contemporary French cuisine recipes, such the rosemary, the origanon, the daphne et al.

V. Le Sumposium- De la Cuisine grécque anciénne à la gastronomie contemporaine francaise
Educational Card Game.- puzzle construction

VI. Learning about the Eukleide's Algorithm at the Parthenon columns
Field study, jointed Math-History project on classical architecture, applications of geometry and ways of construction.

Act II - TOPOS in the Medieval Era:
Curriculum elements: History units, contemporary Literature Mathematics/Geometry, French
Educational Material: Printed material from The Byzantine and Christian Museum of Athens, material from the joint project MELINA – Hellenic Ministry for Culture, Hellenic Ministry for Education- ICOM From Antiquity to the Byzantine World and material designed for the programme itself.
Units:
I. Volissos, the Castle of Velissarios
CD Rom design and production and Activities Workshops : Water, Foundains and Mills, The Painter named Markianos, At the Byzantine Seas, Byzantine Inlays.

II. Fortifications and Habitat.

III. Interdisciplinary Activities Worksheets:
- The Golden Bull and the Castle of Olympoi, educational game for children group from 5 to 8 players with cards and pawns, result of field workshop of the whole school group, in the model of Treasure Hunt.
- I Count at the Castle Unapproachable Points
- Companion to the field activity on the Thales Theorem, area calculating by similar triangles
- Water, Sacred and Destructive

Activity for the perception of water in Christian thought
- Natural Resources and Fortresses Architecture
- Problem Solving Activity
- Le Fantome au Castle Medieval
- Companion to the role-playing game at the field.

Act III - TOPOS Across Time : Settlements, Nature and Tradition
Curriculum elements: History units, contemporary Literature, Art, Science

Educational Material: Printed material from museums of Natural History and from the Hellenic Ministry for Culture and material designed for the programme itself.

Units:

I. From Aggelos Fountain to Malangiotis River: Nymphs, Fairies and Phantoms. CD-Rom design and production on water flora and fauna, folklore tales for the river.

All above educational material designed by the environmental school group specially for and used at the frame of TOPOS EEP concluded and formed the content of two Educational Modular Activity Units (EMAU) – after the model of the Museum's Activities Boxes.

The EMAUs called POLIS and TESSERA, The School Activities Boxes, are two articulated trans-disciplinary lending units for classroom and field-study use, in the frame of environmental programmes. The School Activities Boxes stand as innovating displays and results of collaborative work of the children's group which is oriented towards the pupil's needs and interests, and, thus differentiated form relevant material available in the market. Flexible and with multiplying effect, the School Activities Boxes may tour the schools of several regions and stand as a critical pedagogy paradigm for participation and awareness.

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PATHWAYS TO CHANGE. REPORT OF THE SUPPORTING SCHOOLS PROGRAMME 2004/05

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Preface

This report shows how "Pathways: A Development Framework for School Sustainability" and its support system elements provided practitioners with the confidence they needed to take forward Learning for Sustainability forward and place it at the heart of their schools. The Pathways process – flexible, adaptable, self-facilitated and based around a learning approach – enabled practitioners to involve the whole school community and embed Learning for Sustainability within school plans, leading to changes in practice.

In their action plan for Sustainable Development, the Department for Education and Skills (DfES) refer to the exploration of a "whole school approach to ESD" and "a network of sustainable development practitioners at the regional and national level". WWF would like to contribute this "Pathways to Change" report to such an exploration, as well as to local and regional organisations involved in supporting schools in this work. We welcome the DfES' "Sustainable Schools" website where the Pathways framework for a whole school approach will be highlighted as a model of good practice for schools to use.

Introduction

In a rapidly changing world, visions and strategies for sustainability are vital. If we are each to make positive contributions to the local and global community, now and in the future, we all need to develop appropriate knowledge, skills, values and attitudes.

WWF believes that whole school communities need to come together, to share their own visions of sustainability and to place Learning for Sustainability at the heart of school life and the Formal Education system. WWF-UK is therefore working with schools and their communities to assist them in making Learning for Sustainability an underpinning approach.

Learning for Sustainability

Learning for Sustainability refers to all the different processes that advance knowledge, skills, values and attitudes, and empower individuals, schools and communities to pursue social justice, economic security, environmental stewardship and civic democracy as complementary goals – now and in the future.

Eenvironmental education, citizenship, peace education and others have been challenged by Education for Sustainable Development (ESD). WWF continues to recognise and promote work in all these fields; this includes work that contributes to ESD, as well as work that can be more appropriately described as "Learning for Sustainability".

WWF-UK's schools programme sets out to explore how schools can develop and improve using a Learning for Sustainability approach, as well as how formal education systems could change to support them. Pathways and its support system elements play a key role in this programme.

They form the basis for placing sustainability at the heart of schools, and discovering how the whole school community can work and learn together, in the way it manages itself, its culture and ethos, and its teaching and learning.

Pathways and its support system elements

This report describes the learning from a pilot carried out from January 2003 to June 2005. The aim of the pilot was to explore what is needed to place sustainability at the heart of a school. Based on WWF-UK's experience of working with schools since 1988, a system of support for schools was designed to provide schools with the skills and opportunities to advance Learning for Sustainability throughout the whole school community. Eleven very different schools from across the UK - primary and secondary, urban and rural - participated in this pilot.

The support system elements included:

- An organising framework
- Building the team
- Professional development opportunities
- Technical support
- A learning community.

An organising framework

Pathways: a development framework for school sustainability offers a process, activities and tools that can be used by a school community to

explore their understanding of sustainability, assess their current practice and inform planning. The activities are participatory. The aim is to help widen school involvement and create a sense of shared ownership, move beyond a single initiative and embed Learning for Sustainability in the culture of the school. The structure of Pathways is based on the idea that self-evaluation leads to effective action planning. It is not prescriptive: each school will adapt it to determine their own path.

Schools are encouraged to explore their understanding of Learning for Sustainability and self-assess their practice against a framework of Learning for Sustainability themes and elements (see box below). This framework has evolved from schools WWF-UK, has observed and worked with over the past 10 years. (See One School at a Time: A Decade of Learning for Sustainability, WWF-UK, 2004, for more information on the work of these schools.)

Learning for Sustainability themes and elements in schools:

- School culture and ethos – whole school approach and policy;
- Monitoring and evaluation – action learning.
- Teaching and learning: curriculum, teaching, professional development, and diversity.
- Pupils: empowerment and participation, and a safe and supportive environment.
- Links with the community: governors, parents, local and wider community.
- School estate: resource, grounds and building management.

Building the team

Implementation of Pathways needs to be initiated by a practitioner of ESD, usually self-selected, although practice varies from school to school. The key role of this person is to bring together a team or steering group committed to an inclusive, participatory approach to Learning for Sustainability in order to facilitate wider involvement. The team can consist of up to five people who share responsibility for planning, organising, facilitating and following up the activities. Ideally this team would include people from senior management, the teaching staff, the non-teaching staff, and even parents or school governors. The role of the team is to be the catalyst to ensure that the whole school participates in decision-making.

A training day for all the school teams was essential. The format of the day allowed participants to explore Pathways, Learning for Sustainability and a whole school approach, as well as offering

opportunities to share and create ideas for implementing Pathways back in their schools.

Professional development opportunities

The support system offered professional development opportunities to those leading Pathways. In addition to the Pathways activities, a minimum of one teacher from each team participated in WWF-UK's online "An introduction to ESD" course. This, or a similar opportunity, is fundamental to developing an understanding of ESD in the school. The WWF-UK online course uses a participatory learning approach to professional development in ESD. It aims to build an online community and enable educators to take action in their workplace.

The course content looks at different approaches, frameworks and skills for ESD, enables participants to reflect on their practice and that of other course members, trying out and discussing new approaches.

Technical support

Each school was offered support from WWF-UK to initiate and encourage activity. This interaction was not intended to be ongoing but simply to stimulate the process. Examples of the support that teams found useful were: help with INSET sessions, raising the profile of the project with senior management, asking questions, promoting action and general encouragement.

The process required WWF to question practice, ask for progress reports, collect stories and ensure that what was happening related to the needs of the school. In addition to this support an amount of money was granted to the schools for supply cover to give them the space and time to initiate change.

A learning community

A key aim of Pathways is to create learning communities as a vehicle to broaden engagement and deepen thinking. A learning community enables a school to celebrate achievement and have this recognised beyond that community. This is a means of ongoing support beyond the initial project, whatever form that took. In this project the learning community element was provided through the following:

- One Year On: evaluation event.
- The 11 schools came together to look at what they had done over the year, share practice and support each other in moving forward. This event also included all those who had been involved in the programme in order to evaluate and draw conclusions together.

- WWF Annual Teachers conference.
  In 2005, WWF ran its third teachers conference. The aim was to support schools by creating an environment that enabled participants to share ideas and concepts, and to move thinking on together. The pilot schools led workshops to share their practice and stimulate debate.
- Support materials.
  In order to disseminate practice and learning from schools, WWF created a variety of materials for others to use. These include a DVD of Learning for Sustainability practice (Pathways: real schools, real experiences, and Signposts, a publication capturing examples of practice). Case studies and an online area are being developed which will link to the DfES TeacherNet "Sustainable Schools" website.
- Outcomes.
- From this pilot WWF has learnt what can best enable and facilitate change towards sustainability in schools.
- Whole school community.
  If schools are to include Learning for Sustainability in their professional practice and change the culture, they need to be self-organising and organic, placing emphasis on informal relationships.(Roberts, 2001). From this programme we have identified some of the key learning that can enable these changes to occur. Schools enter at different points on their journey, depending on their situation, level of understanding and participation as a school.
- Motivation to bring about change.
- When starting out, a practitioner needs to feel motivated to take Learning for Sustainability beyond their own practice (see "Confidence building").
- Develop team understanding.
- Engaging more people in Learning for Sustainability needs a personal or team understanding of the theory and concepts.
- Develop a communications approach.
  Before widening out the approach, it is important for each practitioner or group to think about what they are going to communicate and how they will get the messages across. This can be one of the most daunting times. There is a need to make sure that the language is not alienating or jargon-laden or threatening, and that messages are clear.
- Raise awareness.
- Once the communications tools are created, a process of awareness raising can begin: this is the beginning of the engagement process.
- Involve others
  Starting to involve others can be a difficult process but can bring many rewards, not least due to the variety of perspectives and ideas a diverse range of people can bring. In order to facilitate this approach

and move beyond a level of awareness, one of the most useful elements of this programme was the forming of a team or task group.

- Increase dialogue.
  Crucial to increasing dialogue is to start from where people are and to ensure that there is time and space for people to come together. WWF recognised this need and allocated money to each school for supply cover so they could attend training and develop the process. Some schools created this time within their own school allocation of INSET time, school meeting and development time. With DfES driving "a major commitment to staff development" in their five-year strategy (2004), it should be easier for more schools to adopt this approach.
- Whole staff decision-making.
  Once the school community is engaged, be it a small group or everyone, they can start to make decisions together. The number of people involved depends on where the school is along its journey, with the more advanced stages involving the whole school community. This particular process broadens school involvement rather than nurturing a deep shift in values towards Learning for Sustainability. However, once the staff is on board, ongoing training, discussion and debate can start truly to transform the ethos of the school.
- Professional learning community.
  The benefits of this dialogue, communication and participatory decision-making are that the school community start to share their practice amongst themselves. This assists the spread of positive practice within schools (Michael Fullan, www.nsdc.org/libary/publications/jsd/fullan241.cfm).
  These benefits can be expanded when schools build learning communities amongst themselves, locally and nationally, within a context such as Learning for Sustainability.
- Plans and policies.
  A school policy and plan makes a visible commitment to Learning for Sustainability, its themes and elements, as well as acting as a mechanism for articulating its mission and vision within the formal structure of the school.
- Understand and define Learning for Sustainability.
  An understanding of Learning for Sustainability needs to be created amongst the staff involved, so as to create clarity, comprehension and their own definition. Who is involved will depend on where a school is on their journey (see "Whole school community"). Some schools already have an articulation: however, bringing as many people on board with its creation can lead to greater ownership.

- Adopt a strategic approach.
  A strategic approach needs to be developed or adopted so as it complements and informs the school's planning process. The activities and themes in Pathways can help with this process.
- Identify the schools needs.
  Schools should identify their needs and place Learning for Sustainability within their own context. This will assist them in determining their next steps.
- Create a plan.
  A plan for future progression and practice can then be created. This can be used by the originating group, it can be placed within the school development or improvement plan, or it can be the process that becomes the school development plan. Involving as many people as possible can start to embed the Learning for Sustainability plan at the centre of the school.
- Embedding the plan within the school.
  The creation of a plan can immediately increase the status and raise the profile of Learning for Sustainability. (A supporting process that originates from a respected brand, like WWF, also assists with profile.) A plan with clear achievable goals, created by the whole school community and with buy-in from those who will be implementing it is more likely to gain the approval of senior management and thus to take Learning for Sustainability forward. Once within the formal structure of the school, its implementation is also much more likely to be sustained.
- Self-evaluation.
  A coherent approach to self-evaluation, conducted in a participatory way, can underpin a whole school approach and policy to Learning for Sustainability. It can help bring about changes in culture, allowing schools to develop their own agenda. This approach complements the new inspection for schools in England, which places a greater emphasis on school self-evaluation. Pathways can therefore enable schools to self-assess their practice using Learning for Sustainability as a framework.
  Through self-evaluation schools gained an overview of their practice and consequently decided to change and develop practice and thereby make it more coherent. These two examples demonstrate a deeper culture shift in the school.
- Involving pupils.
  Involving pupils can place learners at the centre of their school, as well as giving them citizenship and leaderships skills for sustainability. This is an important step towards involving the whole school community in decision-making.
- Teaching and Learning.

Developing and changing teaching and learning practice – a school's core business – is crucial to changing the deep-rooted elements of the ethos and culture of the school.

- Confidence building.
  The process of achieving a whole school approach needs facilitation either within or from outside the school. Practitioners of Learning for Sustainability do not always see themselves as leaders of the approach within their school or organisation. It is important, therefore, to help leaders develop facilitation skills, increase their confidence and enable them to feel valued. The elements that enabled the leaders to take on this role included: the provision of professional development through a WWF online course; training; attendance at the WWF conference; support documents as well as individual support and encouragement.

All these were designed in such a way as to encourage and enable learning and the sharing of ideas, skills and experiences. WWF staff took on the role not of experts but of enablers and observers of practice. In addition to external support, network building was seen as essential to the process. Leaders of practice within schools need continuing support through training and access to a wider learning community at a variety of scales and levels.

Recommendations: the context.
Pathways: a model

In November 2003, England's Department for Education and Skills (DfES) launched its "Sustainable Development Action Plan for Education and Skills" committing to "explore a whole school approach to ESD and identify models of good practice" to improve the content and engagement with schools. In August 2004, DfES approached WWF and proposed that they adopt the Pathways framework as a model for developing a whole school approach to Learning for Sustainability on their TeacherNet "Sustainable Schools" website.

Supporting school improvement

In 2003, Ofsted published "Taking the first step forward… towards an education for sustainable development". The study noted that primary and secondary schools around the country had developed good practice using an ESD focus, but could only offer anecdotal evidence that this approach had contributed to better performance. HMI have embarked on a three-year survey to investigate the potential of sustainable development as an approach to whole school improvement.

The results will provide additional evidence of how school improvement benefits from a whole school participatory approach to

Learning for Sustainability. HMI will be looking at 12 schools that have embarked upon Pathways (five from this cohort).

This Ofsted survey will be shadowed by independent research into teachers' and pupils' ESD-related knowledge, skills and values, and on pupils' attainments in the short- and medium-term. In responding to the Environmental Audit Committee's report on ESD, the government stated "consideration will be given to extending the Ofsted survey work in 2007/08 to a more widespread review to explore how one would go about inspecting sustainable development in education".

Recommendations

Working with schools, WWF has learnt what it takes to place sustainability at the heart of school life and how such an approach can be implemented by local, regional or national "supporters" of schools.

Schools

Implementation of Learning for Sustainability across a school requires a commitment: it needs enthusiasts and leaders to carry a programme like Pathways forward. From our experience we have found that these leaders need:

- Confidence and motivation to engage the school in Learning for Sustainability.
- Skills in facilitation (or willingness to learn such skills) to lead this process forward in their school.
- Skills in communicating the process and ideas of Learning for Sustainability.
- A communications approach, ways and strategies to engage other members of the school community.
- A process, and activities that engage the school community in understanding, auditing and celebrating practice so as to create a plan or policy across the school.
- Time and space for developing professional learning, collaboration and partnership working.
- A way to ensure it is an embedded and is a continuous process within the school.

School supporters

If other organisations that support schools – e.g. local authorities, education centres – were to implement Pathways and its support system elements or design a similar programme of support for schools, there are three important conditions that would enable success.

A learning approach

The learning approach WWF-UK took to this work was reflected in Pathways and its support system elements. Particular emphasis should be placed on:

- Participation and participatory approaches.
  The space and time given to sharing, reflecting and providing mutual support; partnerships with schools based on equality and democratic principles; a cycle of questions and learning to assist people to take action and move forward.
- Facilitation by the school.
  Setting up mechanisms that enable the school to facilitate Pathways themselves – such as creating a team within the school to take it forward – was crucial to its success.
- Flexibility and adaptability.
  All schools will approach Learning for Sustainability differently according to their situation and needs. Therefore a flexible approach is needed to acknowledge these differences. Each school should be encouraged to choose their own pathway, adapting their approach as they progress.
- Regional approaches.
  As seen, Pathways does help to foster whole school change towards Learning for Sustainability. WWF recognises that it does not have the capacity to deliver Pathways and its support system on a national level. WWF, in fact, is challenged to offer such a direct service to more than a dozen schools at a time. WWF has run a variety of workshops and training sessions with others using the experience demonstrated in this report; this has included working with two Local Authorities in depth.
  WWF hopes that this report and a forthcoming supplementary technical manual will offer a local and regional model for school supporters, such as Local Authorities, education centres and other NGOs. This model could be used regionally to assist local brokerage with schools as well as offering a strategic direction and approach to bring together support and provision in Learning for Sustainability. This collaboration and partnership is what is required by the DfES' five-year strategy. WWF recognises that there is no uniform support mechanism, locally, regionally or nationally for schools and their supporters.
  At the same time WWF appreciates that differences and variations in support can result in local and regional initiative and leadership.
- A learning community.
  WWF has explored what learning networks, at a stage of information exchange, look like through face-to-face evaluation events and our annual teacher conferences. In order to progress,

schools need to be enabled, locally and nationally, to work together in networks, building Learning for Sustainability best practice.

This might be through feeder primary schools working with their secondary schools, local groups supporting a group of schools, or schools who have already started the process supporting more schools. A learning community is needed to support the learning needs of sustainability practitioners in their efforts to cultivate and mainstream these approaches.

WWF welcomes DfES' exploration into a network of sustainable development practitioners at the regional and national level, and hopes that a wider learning network and community can be developed.

Looking towards the future

Pathways and its support system offers opportunities for schools and their staff to make personal choices about their future, thus giving pupils the skills to fulfil their role as world citizens. It supports DfES' drive for more freedom and independence in education, whilst offering them a way to show their commitment to staff development and assisting schools in creating partnerships that maximise school improvement.

For more information visit www.wwflearning.co.uk/pathways, or contact abirney@wwf.org.uk.

EDUCATION FOR SUSTAINABILITY. ESSAY OF A CONCEPTUAL AND METHODOLOGICAL FRAMEWORK

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Abstract

We live in a complex globalized world immersed in deep crisis, with expressions in several interlinked domains (environment, society, economy, politic, culture). Even if we are all affected, developing and impoverished countries are especially impacted. This crisis has its roots in a certain kind of totalitarian Northwestern epistemology, used by the global capitalism networks.

The characteristics of this crisis are so clear and its consequences so unpredictable and threatening, that even some of those that have believed in capitalistic globalisation, have begun defending the necessity of change. The concept of development based on continuous economic growth is now being severely questioned. Since the 70s, and particularly after the Bruntland Report (1987) the generality of nations, governments, institutions of all kinds, have been talking about new perspectives of development, in general known as Sustainable Development (SD). After the Conference in Rio (1992), and more recently Johannesburg (2002), the role of education in promoting SD has been highly stressed, and the United Nations have declared the UN Decade on Education for Sustainable Development (2005-2014). Emphasizing the importance of promoting Education for Sustainability we defend the necessity of promoting an epistemological rupture and reunification, as well as adopting new methodological approaches.

The crisis of our world and its epistemological base. The boundaries of the crisis

We live in a complex world, globalised or undergoing a certain kind of globalisation. This globalisation has always been presented as a great conquest that will improve people's quality of life, all around the world. However, even in the opinion of authors who had really believed in it, (Stiglitz, 2002) globalisation has been having catastrophic effects in several countries (namely developing countries) and especially among the poor. The globalised world we live in is immersed in a deep global crisis with extended expressions in several interlinked domains.

"Over the past fifty years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history" (Sarukhán & Whyte, 2005). "Approximately 60% – fifteen out of twenty-four – of the ecosystem services evaluated in this assessment – including 70% of regulating and cultural services – are being degraded or used unsustainably". This has resulted "in a substantial and largely irreversible loss in the diversity of life on Earth". It is established "that changes being made in ecosystems are increasing the likelihood of non-linear changes in ecosystems (including accelerating, abrupt, and potentially irreversible changes), with important consequences for human well-being" and "the exacerbation of poverty for some groups of people". So it is scientifically clear that "these problems, unless addressed, will substantially diminish the benefits that future generations obtain from ecosystems".

After the rupture of the Keynesian capitalist model, that lead to some degree of economical prosperity and social stability in some countries, the international economical power was successful in imposing, all around the world, some general common economical rules (Capra, 2002), based on very complex global financial networks, that we aren't sure exactly how they operate (Hutton & Giddens, 2000, quoted by Capra, 2002). The difference between rich and poor has increased substantially at both the international as well as national levels (Capra, 2002). According to UN data, the difference in the income *per capita* in the North and the South was in 1993 three times larger than in 1960. "Globalisation is questioned all over the world" (Stiglitz, 2002), "international bureaucrats are under fire in every place" and great changes are being claimed.

The ascension of global capitalism has been accompanied by a large increasing in social inequality and polarization (Castells, 1998, quoted by Capra, 2002). Urban concentration and rural exodus are associated with a phenomenology of social exclusion that creates ghettos, linked to an increasing number of homeless people. It's a new and miserable segment of society constituted by "people that have no place to live or food to eat and in general don't know how to read or how to write; they have sporadic work, they change occupation" and sometimes they pass through multiple hunger crises, chemical-dependence, promiscuity, criminality, prison (Capra, 2002). Migratory fluxes, ethnical/racial and/or religious conflicts, female discrimination, different forms of marginality, are other evidences of the crisis in the social domain.

The communication networks that have moulded our economy, in closed relationship with the "global networks of news, art, diversion and other cultural expressions" (Capra 2002), are changing our culture, having extended consequences in beliefs, values and attitudes, and are creating a new world (Castells, 1996, quoted by Capra, 2002). When sounds and image come together and mix with text, in the form of hypertexts (e.g. television transmission of court proceedings as if they were soap operas or news reports on war updates as if they were action movies) and/or when the objectives of certain events are intentionality subverted (e.g. great sportive

events are transformed in commercial parades), it becomes more and more difficult to distinguish between real and virtual.

In the network society "the generation of new knowledge, the economical productivity, the political and/or military power and the media are linked to global networks of information and richness" (Capra, 2002, based in Castells, 1996). The crisis is also political. Under the pressure of the complex global financial networks, governments are no longer able to give the same guarantees as those offered by the social welfare state. With the emergence of new forms of political organization that Castells calls network state (from which European Community is a paradigmatic example), national states have lost a part of their power and authority.

Organized crime (including economical crime) also acts in the context of complex networks, namely global communication networks. International terrorism, generated in a complex context of cultural, ethnical, ideological, religious an economical factors, also escapes the democratic political control. On one hand, they generate waves of fear (with deep individual, social and economical repercussions) while, on the other hand, they are used as justification for military actions that cause new terrorist behaviour and/or different forms of socio-political instability, within complex positive feedback systems. Conflicts emerge all over the world and some of them assume catastrophic proportions. We are witnesses to new and bloodier genocides. Refugees are increasing in several regions of the globe, such as Sub Saharian Africa, Middle East and some regions of Asia.

Bateson (1979) highlights the difficulty in detecting gradual changes, especially with those things that are continuously changing, such as the weather. It is also "very difficult for us to perceive changes in our only social affairs, in the ecology around us, and so on". Remembering a quasi-scientific fable of a frog boiled gradually and very slowly in a saucepan of water (because he cannot perceive the moment to jump), Bateson questions: "Is the human specie changing its environment with slowly increasing pollution and rotting its mind with slowly deteriorating religion and education in such a saucepan?"

Epistemological basis of the crisis

Several authors, from different fields of study, even though using different designations[14], (Von Wright, 1979; Erasmie & Lima, 1989; Figueira, 1990; Montalenti, 1974; Toulmin, 1977; Geymonat & Giorello, 1986; Santos, 1987; Mayr, 1988; Atlan, 1993; Edelman, 1995; Pereira, 1997) consider that it is possible to identify two different great traditions in the Western (and Northen, I will add) way of thinking, that are related, but are not coincident, with the classical philosophical dichotomies

14. "Aristotelic tradition" and the "Galilaican tradition" (Von Wright, 1979); " positivist" and "antipositivist" systems (Harré, 1972); "metaphysical" and the anti-metaphysical" approach (Geymonat & Giorello, 1986); "empiricism" *versus* "rationalism" (Erasmie & Lima, 1989);

idealism/realism and rationalism/empiricism. In this paper is not possible to analyse, in detail, the emergence, confrontations and evolution of these epistemological Northwestern traditions (Freitas, 1999). However, we will emphasize those are, in our opinion, the main traits of the North/Western epistemological dilemma (for more than 2 000 years). We are aware of the risk of doing such a hyper-synthetic analyse, but we think this is essential for the comprehension of the crisis we are living in, as well as to imagine ways of building a more sustainable future.

It's common to consider that the so-called modern science is a way of thinking and explaining the world that emerged in the XVI/XVII centuries. In the epistemological debate from which this modern science has emerged we can identify, however with new dynamics and borders, some similarities with the ancient Greek epistemological confrontations, which occurred four or five centuries before Christ (that is to say, more than 2.000 years ago). In fact, behind the "actors" of the modern science (Galileo, Bacon and Descartes, among others) we can identify the "shadows" of the "actors" of the old science (Democritus, Platoon and Aristotle, among others). A pre-mechanicist, reductionist and atomist vision of nature (defeated in ancient Greece), (re)merged with new powerful characteristics. The platonic dualism, partially knocked down by Aristotle's ontological monism, returned triumphantly and explicitly by means of Descartes' paradigms, and the implicit acceptance of Bacon and Galileo. The platonic formal-mathematical[15] approach (partially questioned in ancient times by Aristotle's common sense approach[16]) gained a new expression in the galilean-carthesian position.

The introduction of systematized observation and experimentation (even in different epistemological contexts) set off a true revolution in the essence and nature of knowledge and science, up to that time dominated by Aristotelian ideas, distorted by the scholastics.

In synthesis, we can consider that modern science is based on a dualistic paradigm and wants to be mechanicist, causal, reductionist, and physic-mathematical. In general (perhaps with the exception of some traits of the Aristotelian philosophy and some modern approaches), rationalism/idealism and empirism/realism/materialism approaches are dualistic, either in an ontological and/or a gnosiological point of view, and this has important consequences in North-Western classical way of thinking and living (Freitas, 1999).

Modern science aims to control nature. That is very clear when Bacon talks about making it possible for "the human gender to recover their rights over nature that belongs to them by divine gift". This idea – that fights against the Aristotelian's cosmic integration Man-Nature – could seem, at a

15. The term "formal-mathematical" wants to emphasize some kind of eastern traditional rationalistic mathematical approach in opposition to an ethno-mathematical or common sense mathematical approach (D'Ambrosio, 2005).
16. Probably related with a certain kind of "mathematics of the common sense".

first glance, emancipative. But it is not. In fact it leads to a complete separation not only between nature, culture and society (Santos et. al., 2005), but also to a separation between mind and body, reasoning and emotions/feelings, and forms the basis of the complex crisis we live in.

Sustainable development and education for sustainability. About sustainable development

It as been asserted (Jiménez Herrero, 1997; Bifani, 1999; Freitas, 2000 e 2004b), emphasize that the genesis of the concept of sustainable development (SD) can be related to the preparation of United Nations Conference on the Human Environment (1972), held in Stockholm under the motto "Only one earth". Jiménez Herrero (1997) also relates the notion of SD to the concept of eco-development, introduced by Sach (1973) to refer a new stile of development environmentally suitable and based on "the integration of ecological, and socio-economical dimensions in development processes".

Fien & Tilbury (2002) consider that the term sustainable development "was first given currency by the World Conservation Strategy (IUCN, UNEP, WWF, 1980) and later reinforced by the Brundtland Report (World Commission on Environment and Development, 1987)", which is considered, by the majority of the authors, as the crucial moment in the formalization of the SD concept.

Based on an anthropocentric ethical perspective, the Brundtland Report presents a definition of SD centred on inter generations' principle: "Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs. Even though this definition is considered by some sectors "the globally most authoritative definition of sustainable development"[17], it is only one among many others we can find in literature. It can be included in the group of the most conservative SD definitions, which give preference to "sustainable economic growth". It is a reformist approach of SD that conceives natural environment "in a utilitarian way with conservation treated as one of a range of policy" (Fien & Tilbury, 2002).

It "does not support the transformation of current social or economic systems" and place great emphasis "on the role of technological and economic tools in shifting individual, group and industry activities towards a more sustainable path of economic development".

In contrast, the definitions included in the "sustainable human development view"[18] demands "radical departures from the current system",

17. Leaflet of the International Consultation Education for Sustainable Development "Learning how to change our world", promoted by the Swedish Government, 4-7 of May, 2004

18. Typified by *Beyond the Limits: Global Collapse or a Sustainable Future* by Meadows, Meadows and Randers, 1992

and focuses "issues of social equity and ecological limits and, thereby, questions world views and development models that are predicated on assumptions of unlimited economic growth" and claims for a deep "challenge to established interests" (Fien & Tilbury, 2002).

Sustainable development can be seen as "an inspired way in which a bridge can be built between two conflicting paradigms, between the paradigm that has underlain past Western approaches to the environment and an emerging new environmental paradigm" (Yencken 1994, quoted by Fien & Tilbury, 2002). In the opinion of Fien & Tilbury (2002) a "bi-polar, either-or way of thinking in absolutes could be seen as symptomatic of the reductionist way of thinking of the Western scientific worldview that is one of the root causes of social and ecological decline".

The same authors argue that those who "question the value of the concept of sustainable development as a metaphor or heuristic for a social ideal tend to be thinking about sustainable development as a 'product' " which is "inconsistent with the holistic, ecological worldview that looks more to process than product, and recognizes the interconnectedness and interdependence of all aspects of human and non-human nature and the systemic view of change associated with this". "A holistic or systemic view of sustainable development sees it as a process of change guided by two sets of values or principles": "one related to our responsibility to care for nature (or ecological sustainability) and another related to our responsibility to care for each other (social justice)" (Fien & Tilbury, 2002).

In synthesis, we can conceive sustainable development as a process of questioning and reflecting human development that reclaims the right to:

- Question the inefficiency of the hegemonic way of thinking about the world and development; the consequences of classical socio-economical mechanisms; the failure of what the world leaders promised in Rio 1992; the totalitarian power of a global capitalism networks that, instead of accomplishing the promise of a better quality of life for all, is increasing more and more the difference between rich and poor.
- Question the consistency and adequacy of other ways of conceiving human development, including the more extreme positions that emphasize the need for stopping any kind of economical growth.
- Defend the right of a democratic participation of all people from different countries, cultures, religions, in defining their future, and discussing all issues, including the more "sacred", that usually are reclaimed with exclusivity by all sorts of specialists. In figure 1 we present a synthetic diagram for conceiving the discussion on sustainable development as a process of constructing a new and better future.

Such a process view of sustainable development is flexible and open to community (re)definition in the light of general principles and values, local circumstances and interests (Chris Maser, 1996; Fien & Tilbury, 2002).

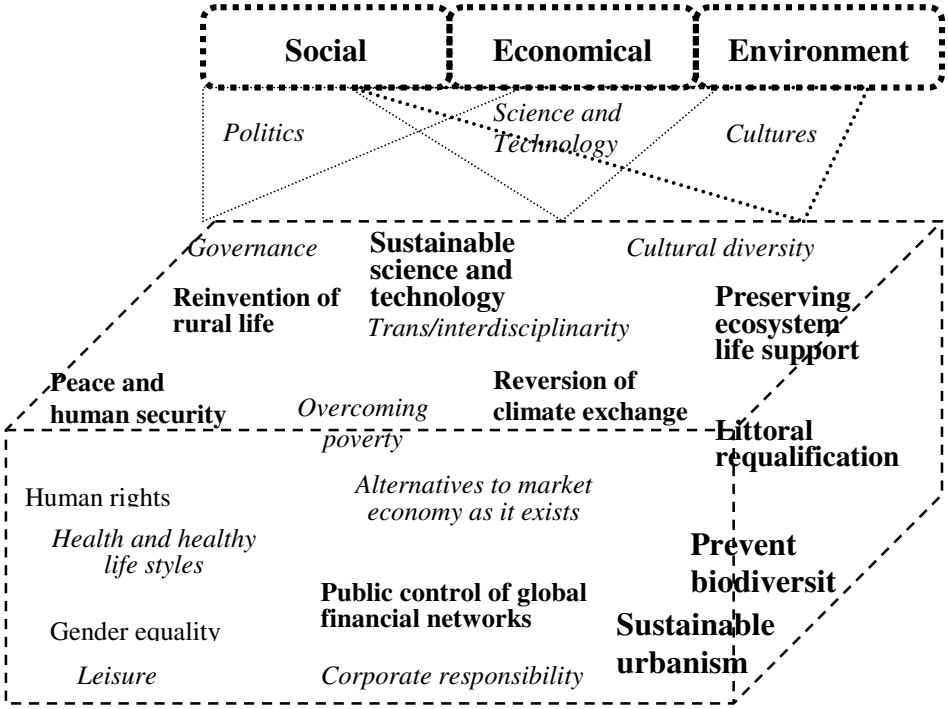

Fig. 1. Sustainable development considered as an oriented process of reflection and action

To make this possible, we need to change some very well established mechanisms of control, generated by the reductionist and "either-or" way of thinking of the North-Western scientific worldview. Based on this hegemonic perspective, and in the context of a hegemonic colonialist and neo-colonialist capitalistic world order, the North-Western dominant ideological-financial-political elites imposed some abusive ways of thinking and conceiving the future. It is a non-contextualized, simplified, linear and non-critical way of thinking and living. It is a dualistic way of conceiving man and nature, body and mind, reasoning and emotions/feelings, subject and object. It is some kind of "closed future" based on the neo-liberal principle of the regulatory power of the free market, and the non-stopping capacity of science and technology in inventing solutions for all human "needs".

A flexible and open to community definition of sustainable development is possible if we change the "exclusivity" of this tradition of thinking and acting. Education is one of the most important motors of sustainable development implementation.

Education for sustainability

The idea of Education for Sustainable Development (ESD) or Education for Sustainability (EfS) has been in discussion since 1987, when SD was determined an aim in the UN General Assembly (Hopkins & McKeown, 2002)[19]. The concept of ESD/EfS matured between 1987 and 1992 and took on a more precise form in the Chapter 36 of Agenda 21, "Promoting Education, Public Awareness and Training", under the designation "education for environment and development". In the Thessalonica Conference (1997), and the Johannesburg Conference (2002), ESD/EfS was stressed as an important way of promoting SD. The United Nations proclaimed the UN Decade on ESD (2005-2014) and some strategic documents were produced and disseminated. The European Community, some regional organizations (like the group of Baltic countries) and several individual countries had approved their own strategic documents for ESD implementation.

Even though some words are seen as being more ambiguous then others, the problem of the meaning is more a language problem then a specially word problem. Live in language (Maturana & Varela, 1990) creates a world in which the negotiation of meanings plays a central role. We can't banish words and we shouldn't abandon the debate about their meaning (namely when we are talking about "powerful" words such as "development" or "sustainable development").

In this way we will be facilitating the incorrect or opportunistic use of the words by the sectors that are responsible for the world crisis we now face. However, we think that it is better to talk about Education for Sustainability (EfS) than Education for Sustainable Development (ESD). Firstly, because using EfS we are focusing on a quality or state of things, a certain kind of Cosmo vision (including, but not restricting to development), with a set of principles and values; and using ESD we are talking only about a different kind of development. Secondly, though in exaggerated terms, some environmental educational communities in certain countries (namely the developing countries of South America, among others) strongly react to the use of the term ESD.

As Hesselink et. al. (2002) stressed, "less agreement can be found with regards to the relationship between ESD and EE". However, many of the specialists that participated in ESD Debate view ESD as "the next generation of EE, which includes issues of ethics, equity and new ways of thinking and

19. However, as pointed out by some authors (Fien & Tilbury, 2002), and as happened with SD, the genesis of ESD concept can be found in the World Nature Conservation Strategy.

learning", other opinions were expressed. Caride & Meira (2004), for example, seem to defend that ESD should be, eventually, a part of EE.

These and other authors (namely the Brazilian authors) are concerned about the possibility of an ESD trying to occupy the EE field of action and legitimating the same orientation of "development, culture and economical politics that have been generating the existing socio-ecological problems" (Caride & Meira, 2004). On the other hand, some authors defend EE as a part of ESD while others (Mckeown & Hopkins, 2002) defend EE and ESD as two complementary but different perspectives that should cooperate by maintaining their own agendas.

We continue defending the opportunity and importance of considering EfS as another educational perspective different from EE, at least in its actual phase of evolution. However the more representative authors in the field defend EE as an approach similar to our EfS approach.

We think there are other very strong and representative tendencies inside EE that have different and more restricted objectives. At the same time, the tradition and necessity of acting in different fields (nature conservation, waste management, and so on) of the "environmental question" in a more restrictive sense and separate way (even though stressing the relationship with socio-economical issues) is still strong. At last, the term environment and environmental have acquired a strong meaning that links to natural environment or to the relationship between man and his surroundings.

The designations used by some political organs in our society[20], the day-to-day use of the term, the necessity of a term to designate human (natural and sometimes social) surroundings, the massive use of the term by media, etc., has reinforced this connotation of the words "environment" and "environmental".

Epistemological framework: pluralism and knowledge ecology

As we have already indicated, the modern science is based on a double epistemological demarcation, related to what some authors call double epistemological rupture (Santos, 2003) and double epistemological plurality (Santos et al., 2005).

In fact, the modern science promoted a demarcation between (figure 2): a) science and common sense (external demarcation), related to the first part of the double epistemological rupture (Santos, 2003) and the problem of the external science pluralism (Santos et al., 2005); b) true/hard science, with a hard physical-mathematical nucleus, and the dirty/soft science, that is to say, the other "sciences" (internal demarcation), related with internal science pluralism (Santos et al. 2005).

The construction of a new (post-modern) or sustainable scientific approach, more than a double rupture (Santos 2003), needs a triple rupture

20. Ministry of Environment separated from Ministry of Economy or Ministry of Social Issues or Ministries of Culture.

and reunification – (1) science versus common sense, (2) "hard" sciences versus "soft" sciences and (3) a rupture with these two ruptures – based on a triple reunification – (1) man and nature, (2) mind and body, and (3) reasoning and emotions/feelings (figure 2).

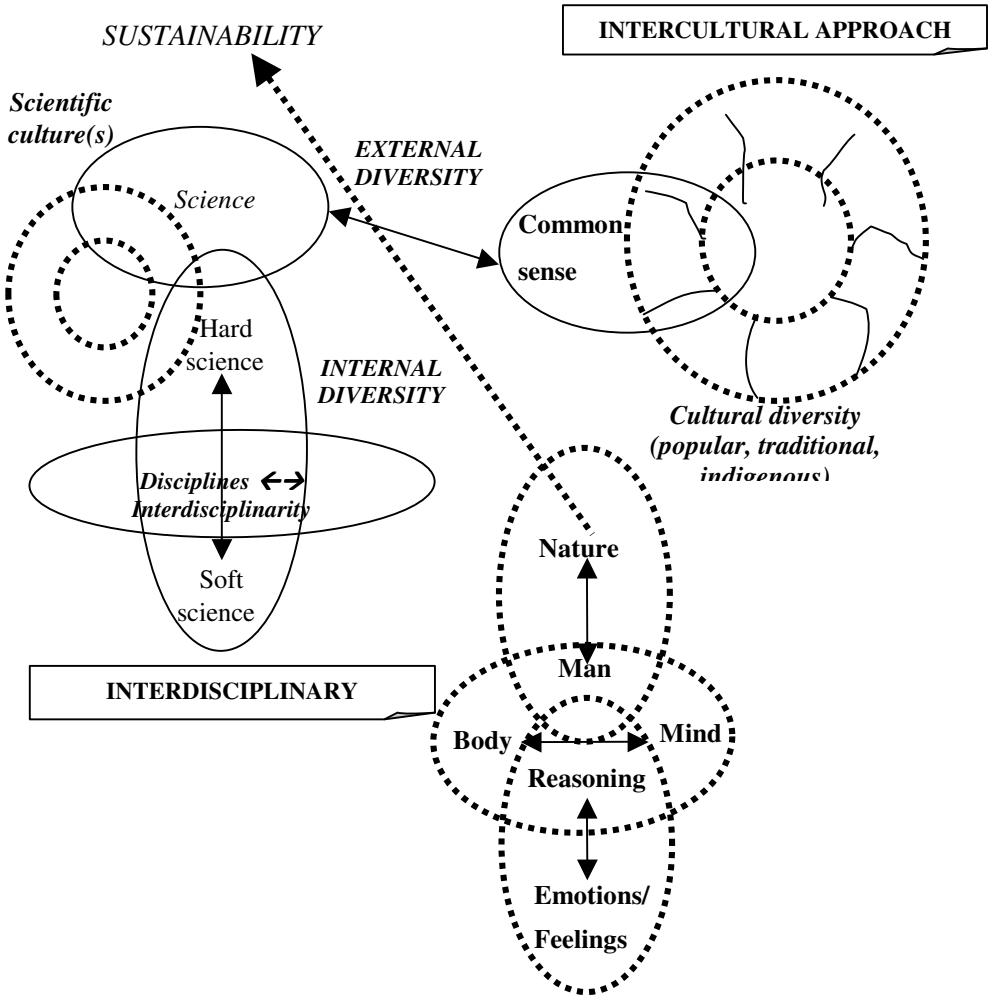

Fig. 2. Triple epistemological rupture and reunification

Methodological framework

Hesselink et al. (2002) refer to some features that participants in ESD debate indicated as being significant:

> More future-oriented (careful examination of probable and possible futures); critical of the predominant market and consumption driven society; more sensitive to the different realities that challenge people around the world (sensitive to context); more systemic in dealing with complexity; more community and solidarity oriented (as opposed to individualistic and self promoting); less concerned with product (behavioural outcomes); more concerned with process (creating the right conditions for social learning); more open to new ways of thinking and doing; preoccupied with linking social, economic and environmental equity at the local, regional and global level

We believe that the discussion about the methodological characteristics of EfS is, in first place, a discussion, which should be the learning theories we should consider. Based on theoretical considerations about learning and education, made in other moments (Freitas, 1999; Freitas in press), and against the old dichotomies reception versus discovering, or literal versus significant, we defend the idea of learning as a selective process of the entire body (with embodied mind), in which reasoning as well as emotions play an equilibrated role. This perspective of learning is related to the epistemological framework designed above and is supported buy some pioneer biological reformulations (Maturana & Varela, 1990), and subsequent biological (Edelman, 1995) and neurobiological (Damásio, 1995) studies and conceptualisations. It is based on modern evidences that emerged from a scientific approach of mind and consciousness.

Based on this theory of learning we defend the use of diversified methodologies, strategies and activities selected with the idea that knowing is doing and doing is knowing (Maturana & Varela, 1990). Factors such as the age (children, adolescents or adults), context (scholar, non scholar), place (country, local community, etc.), culture, are important in the selection of each set of methods and activities.

However some features are or can be common to several methodological approaches. Among the suggestions of several authors (Fien & Tilbury, 2002; Mckeown, 2003; Tilbury & Wortman, 2004; Scoullos & Malotidi, 2004; Freitas in press) we point out the importance of giving relive to:

- Envisioning methods and activities, as an important approach of "opening the future", against the "closed" or "either-or" typical conceptions of future.
- Critical thinking methods and activities, as an important complementary tool for analysing developmental options and

their consequences.

- Thinking-linking methods and activities, to facilitate the establishment of meaningful connections between environment, society and economy (and also with politics and culture).
- Systematic and complex thinking methods and activities in order to help people analyse the complexity of man and the world.
- Participative methods and activities in order to prepare people for cooperating and participating in public policies and decisions.
- Intercultural based methods and activities, to facilitate the establishment of new relationships between scientific approaches and other knowledge approaches.
- Artistic centred methods and activities, with the same proposal and also for establishing connections between different ways of expression and language.
- Body centred activities, in direct connection with what referred before, in order to facilitate the experience of feel body and mind together.
- Case study analysis, as a way of working with the real world, anticipating examples of things we can/should do or not do.
- Problem solving activities, with real or simulated problems, in order to promote solving problem capacities as well as situations in which they can train several kinds of competencies.
- Field work, for allow direct contact with the real world and real problems.
- Reflexive methods and activities in order to train the capacity of monitor evaluate and reconstruct decisions and the results of their implementation.

As pointed out before, these and other methods and/or activities can be integrated in different sequences, logic, depth, etc., according to the different situations in which they will be applied. In our practise we have been involved in testing and validating different methodological sequences.

Making reference to a few examples, we can refer to the different methodological approaches utilized in the context of: in-service teacher training workshops; reorientation activities for the syllabus of Environmental Education in a Education Program, at the University of Minho (Portugal); developing and implementing an optional course in Master Education Programme at the University of Minho and more recently at the Federal University of Santa Catarina (Brazil); in designing an e-learning first grade teachers training programme at the State University of Santa Catarina (Brazil).

In a poster presented at this Congress we describe the detail of some of our experience in designing and implementing optional programs in the Masters Education Course of The University of Minho.

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ENVIRONMENTAL PERFORMANCE INDICATORS IN A UNIVERSITY CONTEXT: CRITERIA OF CHOICE AND MEASUREMENT EFFICIENCY. THE CASE OF THE UNIVERSITY OF MACEDONIA (UOM) - GREECE

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Abstract

Through their operations, organizations continuously transact with their environment. Transactions result to physical and monetary flows impacting both the organizations' financial prospects and their external physical environment. The simplest way to achieve efficient monitoring of the latter is through the use of environmental indicators.

The UoM developed an array of indicators as proxies of its actual environmental performance in partial fulfilment of its obligations to implement the EU Environmental Management and Auditing Scheme (EMAS). Trying to develop its own set of indicators, the Institution came across a number of questions and attempted to provide answers. This paper presents in a concrete way the answers provided, the indicators selection criteria, and the limitations and delimitations set. The rationale followed draws on a framework, suggested by the OECD and Eurostat, and reveals the reasons for the extended convergence between the environmental indicators developed by the various International Universities.

Introduction

One of the most important tools in achieving efficiency and obtaining the maximum effort from the employees of an organization is to set clear and well known criteria for measuring their performance in specific actions. Management spins around three basic groups of activities: plan-act , measure and control. A critical part of the last group involves the design and development of a successful performance measurement system (PMS). At the same time, management involves extensive decision making, i.e. choosing rightly among alternatives.

In the case of devising a new PMS, such choices would involve the selection of the proper key variables, based on the strategic objectives of the company and the assignment of measures to the key variables chosen

(Brandon and Drtina 1997). By devising the proper PMS, managers and employees keep close watch on early warning indicators of deterioration in the corporate effectiveness, efficiency, and / or quality.

The term "measure" in this context refers to a scale on which to evaluate performance. Scales related to the efficiency of operations measure how well (economically) the input resources are transformed into products or services. Scales related to the effectiveness measure the degree to which the strategic objectives of the organization have been met. Both types of scales enjoy the same advantages: they can take the form of a ratio and thus can be used to assess and compare operations on a temporal or intra-company basis. They also can be computed in financial or non-financial (physical) terms, a critical feature for the environmental cause. The term "indicator" in this context refers to a variable that describes the state of a system and is equally applicable in both for-profit (firm) and non-for-profit (institution) organizations.

This paper examines the development and application of a system for the measurement of the environmental performance of a higher education institution, the University of Macedonia located in the city of Thessaloniki, Greece. During the last two years, the UoM has developed an Environmental Management System (EMS), which is currently in the process of certification according to EMAS regulation. To monitor the performance of the University's EMS, a set of indicators was developed through a careful procedure, the main steps of which are analysed in the present paper.

The theoretical framework on which the selection of indicators was based is presented in Sections 2 to 4. In order to build on solid ground, emphasis was placed in gradually moving from the general PMS to an Environmental PMS and finally to the development of environmental indicators for the case of academic institutions. In section 5 we proceed to the application of the theory in the UoM case. Section 6 presents the main actions taken by the UoM, while Section 7 presents the criteria used to choose the specific environmental indicators to measure the performance of the University's EMS. Section 7 concludes the paper.

The selection of the appropriate performance measures

A necessary and highly important step an organisation has to take before the development of a PMS, is to identify the high-risk, critical, strategic activities that should be closely monitored. Since a successful organization is one that monitors continuously and promptly its internal and external environment, and efficiently adjusts the former to the latter, the key-variables chosen should gauge both external characteristics (expectations, technical requirements, social values) and internal operations (consumption rates, pollution produced). Following this step, the first stage in developing a PMS involves the selection of the proper key variables, tailor-made to the needs of the department or responsibility centre that will use them. Key features that must characterize these variables entail (Anthony & Govindarajan, 1995):

- Easy and objective measurement.
- Sensitivity and volatility (quick response to changes in performance).
- Explanatory in nature (able to indicate potential reasons of failure or success).
- Prompt collection (to allow for corrective action if needed).

Depending on the type of objectives the key-variables are attempting to promote, one can distinguish five broad groups of variables; those concerned with:

- shareholder value
- quality
- market position
- flexibility
- productivity.

Obviously, the key variables selected at an operational level should be integrated with those selected at a divisional level, and the latter with those chosen at a facility and at a corporate level.

The second stage in developing a PMS involves the attachment of measures to the key variables chosen. These measures are the indicators that determine exactly how the variable will be evaluated. To qualify for an indicator, a measure should be simultaneously:

- appropriate
- error-free
- timely provided
- easily understood
- cost-effective (Brandon and Drtina 1997).

Further, the World Bank (1999) suggests that the indicators be directly relevant to the project objectives, limited in number, clear in design, reliable, with easily identified causal links to what they attempt to measure and be produced with the participation of the organization's employees.

Environmental performance measures for a University

Performance monitoring *vis-à-vis* the environment is applicable to many types of projects and organizations assuming that the primary or secondary characteristics of these projects / organizations directly address environmental issues or have an indirect effect on the environment. Given the diversity of the environmental problems, the variety of contexts in which they arise and the numerous possible pressures and solutions to manage these problems, no single universal correct set of indicators exists (Segnestam 1999). This paper is designed to provide a framework for selecting and applying environmental performance indicators for Universities and to apply this framework in the case of the UoM.

For the selection and application of Environmental Performance Measurement Indicators (EPMI) at a University level, certain adjustments and changes to the above described general pattern and content of actions should take place. EPMI aim at describing changes in the consumption rates, level of pollution and state of the local environment with the help of few selected representative variables (Walz 2000). The characteristics of these key-variables still apply but the type of objectives to be promoted differs. For example, in the case of a state tuition-free University, variables concerned with shareholder value are meaningless, though the same axiom does not apply in the case of private Colleges. Variables concerned with quality and market position are relevant under a number of assumptions but irrelevant when those assumptions do not hold. For instance, if the University operates under a stringent evaluation and control system and it's funding relates to its performance, the pursuit of high quality or a competitive market position becomes a critical element. This holds true for state Universities that compete in the same market with private Universities or have to meet state-defined clear and measurable evaluation targets.

The flexibility is another criterion to measure the Institution's ability to promptly detect changing patterns in the societal quest for its services and adapt its curriculum accordingly, for as long as the school serves fast developing, turbulent fields. Finally, as it regards productivity, Universities render services, an output, which is difficult to evaluate in quantitative, not to mention qualitative, terms. So, not all key-variable groups will be equally critical in all cases and thus, deciding on the crucial EPMI that will measure a University's performance starts with defining the Institution's primary overall objectives.

Corporate environmental management embraces both technical ("hardware") and organizational ("software") activities. The former aim at the straight reduction of a firm's pollution output and the latter exert an implicit impact on the environment affecting the formal systems of the organization (Alvarez Gil et al., 2001). While technical measures are industry-driven, organizational activities are similar across industries. The latter activities are those upon which emphasis is placed when tackling a University PMS. Efficiently devising a University EPMS is critical for the following four major reasons:

- Environmental legislation has a lesser importance for the service industry and in particular for Universities which authorities hardly ever oversight.
- Environmental issues are mostly neglected by the Universities.
- Studies on organizational environmental practices benefit the most when they focus on a single industry – type of establishments (Handfield et al 1997).
- The success of a University EPMS can have high pedagogical value to its students, who could transfer their experience on their work environment.

The ISO 14031 is the most widely used standard on environmental performance evaluation in relation to environmental management. (ISO 1999). The standard provides guidance towards the design and the use of EPMS, based largely on industry perspectives. It suggests that three types of indicators can be used:

- Operational environmental performance indicators (EPI), covering the organization's environmental aspects;
- Management EPI (evaluating management systems);
- Environmental condition indicators (covering environmental impacts).

In the case of a service organization management, performance indicators are of primary importance, followed by the environmental condition and operational performance indicators. Normally, the opposite applies in the case of a manufacturing, highly polluting company with the operational performance indicators being of utmost importance, followed by the environmental condition, and the management performance indicators. Further discretions can be made among Universities. For example, the terms "output" and "product" in the case of Universities, mostly refer to the values and information added on the perceptions and knowledge base of their graduates: the teachers, politicians and business decision makers of tomorrow.

Improving the "product" is the ultimate priority for Universities teaching economic and social sciences (such as the UoM), with their main expected contribution to sustainability being the efficient integration of the environmental concerns in their *syllabi* and the positive multiplying effect that their graduates are expected to have to the society. Improving the production activities is critical for most other Institutions such as Polytechnic and Medical Schools, which could benefit the environment mostly through the proper management of the abundant hazardous materials used in their laboratories, such as radioactive substances, fertilizers, pesticides and refrigerating systems (Smith 1993).

A framework for developing University EPI

The framework suggested in this paper draws heavily on the Pressure State – Response model developed by OECD (1994) with the necessary modifications to optimise its applicability in a University context. The adjustments were required since "the relevance of the policy chosen will be additionally improved by a planned sectoral subdivision of the pressure indicators" (Walz 2000). The framework, presented in its general form in Figure 1, provides the means to choose and structure sets of indicators in a way that facilitates their interpretation and interrelations.

The pressure variables describe the causes of the problems arising from the operations of the Institution. The state variables usually describe some physical, measurable characteristics of the environment, resulting

from the pressure. The response variables involve policies, instruments, or investments introduced to solve the problem. The Pressure - State - Response model has been widely used for developing EPI in all types of settings ranging from general environmental assessments, (for instance, the basic framework of the UN Millennium Ecosystem Assessment Report, available at www.milleniumassessment.org.) to single organization's environmental assessment.

Eurostat has elaborated on this model and has developed the following framework to measure the environmental impacts of various projects. The new framework (Figure 2) adds two more nodes: the driving forces and the impact. For a University, the driving forces involve the underlying factors influencing the critical variables, such as the number of students, number of commuters that use private vehicles, number of labs, number of A/Cs.

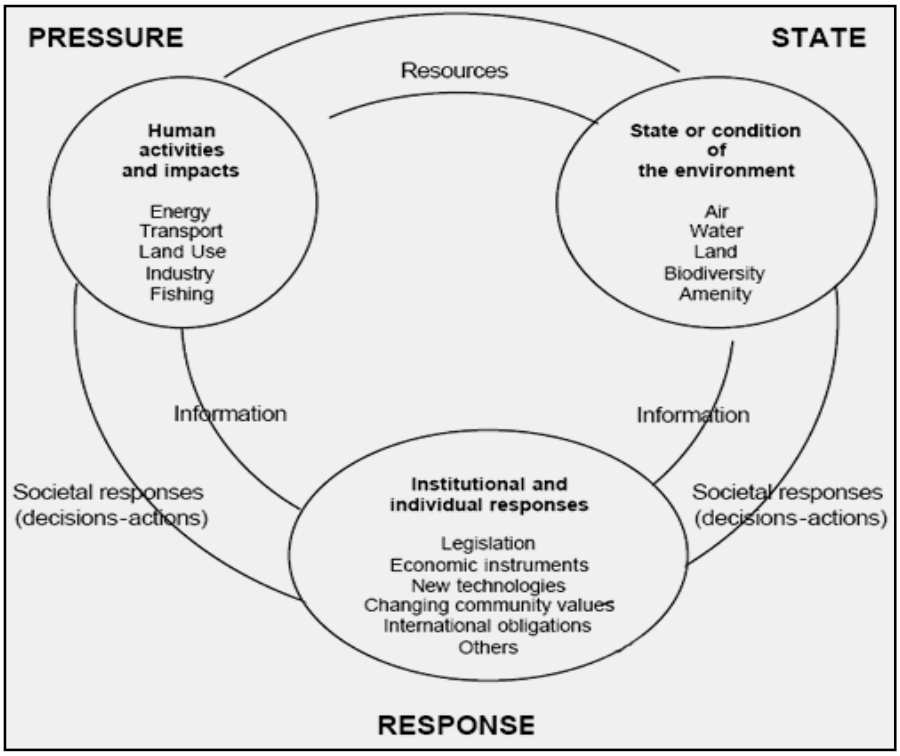

Fig. 1. The Pressure - State -Response model. Source: OECD (1994)

Pressure indicators describe the variables which (may) cause environmental problems such as the amount of solid waste produced by the students, water and paper consumption, CO_2 emissions, and shortage of local parking space. State indicators show the current condition of the micro-

environment (for instance indoor air-quality, noise levels) while Impact indicators describe the ultimate effect of the pressures on the state (decreasing number of students attending the courses, asthma attacks or allergic reactions, noise-induced heart attacks, traffic accidents in the campus. Finally, Response indicators demonstrate the efforts of authorities or the society to solve the problems and meet the strategic targets set by the organization (by, for example, hiring new parking spaces, introducing paper and aluminium recycling programs, improving the in-door air quality by implementing proper ventilation systems).

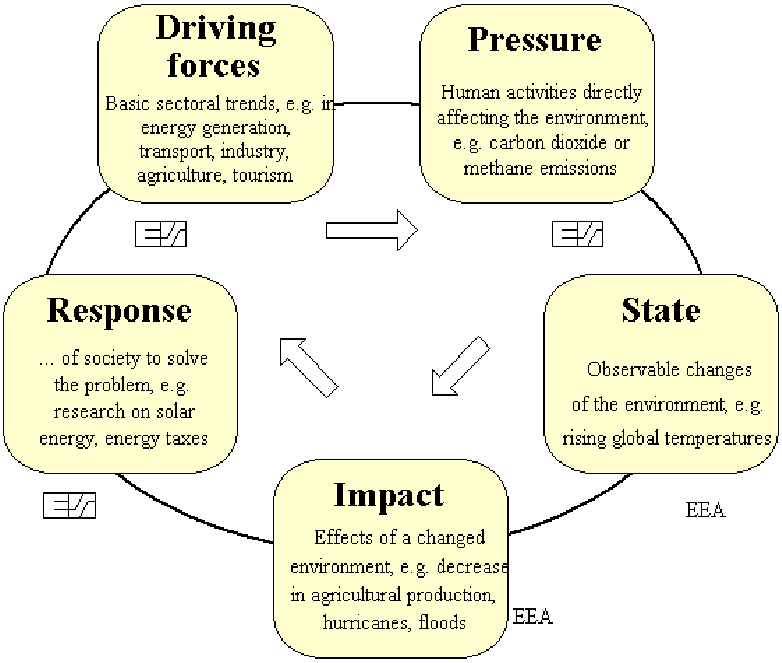

Fig.2. The Driving force-Pressure State-Impact Response (DPSIR) model. Source: Eurostat 1999

Using the basic elements of the general framework for developing University EPI, laid out in this Section, we developed a set of indicators for measuring the environmental performance of the UoM.

In section 5, we describe briefly the context in which these actions were undertaken and in section 6 we proceed to analyse the main indicators and their selection process.

The development of an EMS in the University of Macedonia

The UoM, located in the city of Thessaloniki in Northern Greece, has developed and implemented during the last two years an Environmental Management System according to the EMAS scheme (Environmental Management and Audit Scheme, EU Regulation 761/2001). The project was co-financed by LIFE-Environment, European Commission, and DG Environment. Although the focus of the project was on the development of the EMS, a number of other environmental awareness-raising activities were undertaken targeting University's staff and students but also kids at the primary education level. Thus, the set of indicators developed was necessarily quite broad. It is not limited to physical flows but it includes measurements of educational impacts, and furthermore, it is not confined in the limits of the University campus. The UoM's goal is to serve as a focal point for the development and dissemination of environmental best practices and environmental awareness. Beyond the registration under the EMAS scheme, we aim at the continuous minimization of the University's environmental impact, and the enhancement of its contribution to sustainable development through its role as an educational and research institute, and an active member of the local community.

For the purposes of EMAS registration, following the Environmental Review of the University and the Occupational and Health and Safety Assessment, we proceeded to the development of quantified environmental targets and goals, which were briefly presented in University's Environmental Policy and elaborated in the University's EMS System Procedures. These environmental objectives, which are mostly related to physical flows – such as energy consumption, recycling of paper, aluminium, etc. –, were directly linked to indicators, as it is presented in detail in Section 6. Very crucial for the monitoring of these indicators was the development of an information system, specifically designed for the needs of the University of Macedonia. The University of Macedonia's EMS has successfully completed the environmental verification, by an Accredited Verification Body, and awaits the formal registration to EMAS.

As was discussed above, the environmental performance of a University, and especially of one that specializes in economic and management disciplines, cannot be judged only by its impact directly on the environment. A University's main contribution to sustainability should be the impact that could have on its student's attitude towards the environment. The awareness raising could have substantial impact on students' every day activities, while a well-structured environmental curriculum could have important effects on long-run businesses' behaviour, since our students are the managers of the future. The environmental education and training activities are targeting two groups. For these reasons, we structured a body of environmental awareness raising events, we developed a ten-hours Seminar on Environmental Economics and Management, in order to point-out to student the link of environmental issues to their academic subjects,

and finally we gradually increase the number of environmental courses offered in the curriculum.

Awareness-raising events and activities were also designed particularly for the University's staff. Such activities include the training on EMS implementation procedures, first-aid seminars, simple practical techniques of environmentally friendly attitudes, and seminars on energy conservation and health and safety at the workplace. Other activities, such as visiting National Conservation Parks, and picnics following cleaning up of beaches were occasionally chosen to enhance a collegial environmentally friendly attitude in a more relaxed environment.

The educational and environmental awareness raising activities are not confined within the limits of the University campus. Our belief, that environmentally friendly attitudes are build primarily in early stages, led us to develop a short program, forty-five minute of presentations and activities, for young kids between the age of five to eight. This program is presented to the student in the Environmental Information Kiosk, which was constructed in collaboration with the Municipality of Thessaloniki, and co-financed by Life-Environment, in one of the city's main parks. We consider this activity as an excellent example of the social benefits that can be derived from the collaboration between academic institutions and regional authorities.

In order to evaluate the performance of all the above activities we developed a set of indicators that closely monitor each one of them. The selection criteria of these indicators are briefly described in the following Section.

The selection of indicators in the case of the University of Macedonia

Over fifty indicators were initially selected, of which twenty-six were finally chosen to monitor the performance for the first five years of the project. These indicators were chosen based on the following main criteria:

- Ecological significance for the local area.
- Ability to quantify, data availability and cost-efficiency.
- Comprehensibility and relevance for the user groups.

The selection process was further greatly influenced by the EMAS reporting requirements, since part of the indicator system was used for the EMAS certification. Thus, the EPI were developed, primarily, in such a way as to follow up the progress of the adopted environmental actions and programs on an annual basis, and to allow the periodical evaluation of the University's EMS. Another factor influencing the selection of indicators was the compatibility with other Universities' EPI systems, so as to allow for direct comparison. Other factors that played a role in the selection of indicators were the reduction of complexity and the minimization of the number of indicators. Table 1 presents the key environmental objectives and the associated indicators selected to measure the UoM's environmental performance.

Environmental Objective	Environmental Performance Indicators	Means of Measuring
Electrical Energy Saving	Ratio of total annual electrical energy consumption to the operating hours of the UoM's premises (kWh_{el} /h $_{operation}$)	The amounts of energy used (electricity or thermal) are estimated from the correspondent bills, whereas the operating hours from the University's on-line reservation system.
Thermal Energy Saving	Ratio of total annual thermal energy consumption to the operating hours of the UoM''s premises (kWh_{th}/h $_{operation}$)	
Reduction of Paper Use	Ratio of the amount of paper used per capita (employees)	Data provided by the UoM's Provision Office.
Paper Recycling	1. The amount of recycled paper per annum (kgr_{paper} /yr) 2. Percentage of recycled paper per annum	Recycle bins are weighted each time they are emptied. Data recorded to a database.
Reuse of Toners - Cartridges	Percentage of re-used toners and cartridges	Data provided by UoM's Provision Office
Environmental Awareness Raising actions for Employees	1. Number of environmental awareness actions and training courses 2. Number of employees participating in the environmental sensitisation actions and training courses 3. Number of employees actively engaged in the operation of the Environmental Management System	The EMAS Office records the number of participants via the filling of participant lists or the evaluation sheets of the training courses.
Environmental Awareness Raising actions and Training for University's Students	1. Number of students participating in the environmental awareness actions and training courses 2. Number of seminars, conferences and modules organized and related to sustainability 3. Number of students that attend modules related to sustainability	The Admissions Office provides data on the number of modules related to sustainability - environmental management, and of the students attending.

Improvement of Health and Safety Conditions	1. Number of Health and Safety Seminars and Courses 2. Number of employees that have attended the seminars 3. Number of accidents - injuries	The EMAS Office organizes the seminars in collaboration with the University's Health and Safety Manager.
Environmental Awareness Events and Training for Elementary Schools' Students	1. Number of events and participants 2. Number of elementary students that attended the environmental lessons 3. Number of official participations in Environmental Conferences	The EMAS Office records the number of participants at the events and the environmental lessons.
Participation in E.U. or National Funding Programs related to Sustainability	The number of proposals submitted	Data provided by UoM's Research Office.
Use of Green Products and Services	Number of Green Products or Services purchased. Amount of money spent on Green Products	The Provision Office follows up the related contracts.

Table 1. UoM Environmental Objectives and Performance Indicators

Further, a number of additional indicators have been developed and used to contribute to a more thorough monitoring of the University's overall environmental performance. These indicators include:

- Total energy consumption (kWh) per capita (students and employees).
- Water consumption (m^3) per capita.
- Carbon Dioxide emissions (tons) per capita.

Furthermore, since the UoM is committed to continuously improve its environmental performance, new objectives are set every year and the necessary actions are taken. In accordance, the set of indicators is expanding to provide the necessary measurement of performance. For example, for the coming academic year 2005-2006, the following indicators were added to monitor the three newly introduced recycling programs:

- Quantity and percentage of recycled aluminium.

- Quantity of recycled batteries.
- Number of recycled electrical and electronic devices.

As mentioned above, one of the criteria in selecting the indicators was the comparability of the University's environmental performance with that of other similar Institutions that have adopted Environmental Management Systems (not necessarily within the framework of EMAS or ISO 14000).

As the available literature indicates (Viebahn, 2002; Dahle & Neumayer, 2001), the most commonly used environmental indicators by academic institutions are the ones related to such Institutions' daily activities and operation and mostly involve the measurement of:

- Energy use and conservation.
- Greenhouse gas emissions.
- Water consumption.
- Paper consumption.
- Reuse and Recycling of materials.
- Procurement Policies & Options.
- Sustainability-Related Courses.
- Environmental Awareness.

Comparison of the above list of indicators to the indicators listed in Table 1 indicates that we have used all key indicators that other academic institutions has used, and thus, direct comparison of the UoM's performance will be possible when a complete set of data for a number of years is developed.

There are some minor differences, which primarily concern the way in which particular results are measured. For example, the energy saving indicator, in the case of the University of Macedonia is measured per hour of operation, instead of energy consumption per capita or square meter, which is the most common measurement. The specific indicator was selected in order to take into account the continuous increase in the University of Macedonia's activity (for example, two new undergraduate and another two graduate programs were introduced in the last couple of years during which data are reported) and the use of its premises for the operation of several non-academic seminars, life-long learning programs, and courses of the Greek Open University.

All these activities have increased drastically the utilization of the University premises' capacity, far more than the increase in the actual number of staff or students. Thus, the modification of the reported indicator was necessary. Despite such minor differences in reporting, we still believe that the set of indicators used by the UoM will enable the direct comparison of its own environmental performance with that of other academic institutions.

Conclusions

In their quest for sustainability, Universities must develop and implement a number of indicators, measuring the environmental impact of the activities they perform. The relevant literature provides an extensive array of indicators that qualify for this role, as well as guidelines on the criteria applied to identify critical variables, select representative indicators and assign values to them.

Contrary to relevant expectations, the literature review has proven that individual, non-cooperating Universities from different countries or regions come up more or less using the same set of indicators.

This paper posits that the convergence of the indicator systems chosen by the various sustainable Universities does not reflect an imitative attitude; rather it results from the application of the same Pressure-State-Response framework. It is well expected then that, since all Universities maintain related structures and operate through the same activities, the "pressure" and "state" parts of the model will be alike and differences in the "response" will mostly result from secondary characteristics of the physical environment of the Schools and - most importantly - from administrative differences in the institutional context in which they operate, such as the national environmental policy, the authorities' oversight, the University evaluation criteria, the financing means of the school, and its interest and motivation to implement an EMS.

The paper concludes that managing these secondary characteristics will improve not only the arithmetic values of the indicators but also the prospects of the University for a more sustainable future.

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DEVELOPMENT AND CONSTRUCTION OF AN EVALUATION INSTRUMENT FOR ENVIRONMENTAL EDUCATION AT UNIVERSITY IN TAIWAN

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Introduction

Among the tertiary education, the university plays an important role in the area of environmental education. Especially, roles of teachers are crucial to the success of teaching. In addition, teaching is an important media leading to the success of environmental education. Currently, it still lacks of a systematic and valid assessment with regard to the teaching index for environmental education in Taiwan. As a result, it motivated us to construct the evaluation instrument.

Methodology

This research included three stages. In the first stage, literature review, interview, questionnaire analysis and discussion were carried out for constructing initial index system. Through the experts' symposium and Delphi, the importance and suitability of the index were evaluated and evidenced by the findings of statistical analysis. According to the input-process-output model, three fields, ten layers, twenty-nine indicators and eighty-nine items were constructed in the context of environmental education.

After the accomplishment of environmental education indicators, the selection and conceptualisation of the indicators were carried out in order to construct the evaluation instrument for environmental instruction. We consulted published literature and figured out that capacities that environmental education teachers need include: "foundational competencies

in professional education", and "competencies in environmental education content" (Wilke, Peyton & Hungerford, 1987). May (2000) indicated that the key factor for successful teaching in environmental education relies on "teaching practice", "teacher competencies" and "teaching condition". After integration, three major categories were mainly carried out for evaluation with respect to the university environmental education teachers. The research framework consisted of "teaching condition", "general competence in education", "specific competence in environmental education". It can be classified as three fields including "resources", "teaching curricula" and "environmental literacy" as well as six indicators, thirteen items and twenty-nine evaluation contents.

In terms of evaluation content, the database pertaining to item was established through the literature review, in-depth interview with experts and subsequently the assessment tool was constructed. The assessment tool was also modified based on insights collected from experts' symposium and Delphi. In order to truly reflect the results of the investigation event and to emphasize the difference of relative importance of the evaluation items, the weighted method of index items was performed using Analytic Hierarchy Process (AHP). The standard of assessment tool was finally established for the sake of demonstrating that the constructed evaluation instrument is able to concretely display the meaning of the evaluation results. Therefore, we conducted a large-scale nationwide status investigation using the developed evaluation instrument. Additionally, ten experts representing senior environmental education professionals and university teachers were invited to review the research results. On-site experts' negotiation and adjustment was conducted and standard scores were adjusted for EIEI.

Results

Research results contained three parts, including EIEI, Weighted Index Item, and Standard of evaluation instrument. EIEI was developed for the university based on the current research consisting of four layers, three major fields. It further contained six indicators and thirteen items (each of the items includes a thorough list of evaluating content). Four different levels of written description were constructed pertaining to the item design. Evaluation content contained "degree of relative importance", "frequency", "degree of coverage" and "degree of typology". Likert scale was employed using 1, 2, 3, and 4 for calculation. 1 represented "not very close to" and 4 represented "very close to" ideal teaching of environmental educators. For example (table 1), considering the spirits of environmental education in the relative importance, teachers who can incorporate campus (2 points) and community resources (3 and 4 points) were better than merely classroom teaching (1 point). Regarding the measure of frequency, seldom (1 point), sometimes (2 and 3 points), often (4 points) were used for layer transformation. As to the measure of coverage dimensions, the number of coverage dimensions was considered. 4 point represents the highest number of coverage dimensions,

such as classroom teaching, use of campus resources, and linking to community resources. On the other hand, mainly considering the "ideal extent of evaluation type" multiple curriculum assessment and feedback (4 points) is better than subjective evaluation (1 point).

Evaluation Content: Mastery in employing and linking external resources Description: The curriculum is ideal using classroom teaching as foundation combination of with outdoor teaching, integrating community resources.	
Point 1	Teachers seldom make use of campus environment or community resources in accordance with teaching activity.
Point 2	Teachers occasionally make use of campus environment as teaching resources without applying community resources.
Point 3	Teachers occasionally make use of campus environment and community resources as teaching resources.
Point 4	Teachers frequently make use of campus environment and community resources in accordance with teaching activity.
Evaluation Content: Diverse Curriculum Assessment and Feedback Description: It tends to use multiple curriculum assessment and operation-oriented environmental education. Curriculum is adjusted according to students' performance using student-oriented evaluation.	
Point 1	There is a lack of objective curriculum assessment and grades are subjectively given by the teachers.
Point 2	Teachers use a single assessment to give students' semester grades.
Point 3	Teachers use multiple assessments according to students' performance (e.g., observation, test, operation, self-evaluation or evaluation for each other, learning files) as evaluation and record; however, they seldom adjust their design for teaching method and activity.
Point 4	Teachers can use multiple assessments to record and to assign students' performance and students the job. As a result, they adjust their teaching method and strategy according to students' grades.

Table 1.

Weighting was calculated after the assessment. Weighting was processed through AHP. After adjustment, original score 1, 3, 5, 7, 9 became 1, 1.5, 2, 2.5, 3, ready for further statistical analysis.Both teaching curricula and environmental literacy accounted for about 40%, however, resources only accounted for 21.0%.

Environmental educators obtained scores of 3.08 points in "environmental literacy", 2.97 points in "teaching curricula", and 2.28

points in “resources”. The mean score was 71.51 points after adjustment. From experts’ perspective, the standard of environmental literacy was the highest dimension. Among 5 items, 3 items stood at 4 points in the context of environmental literacy (60%) and the rest stood at 3 points. Among 6 evaluation items, 2 items were 4 points in the context of teaching curricula (33.3%) and the rest were 3 points. In terms of resources, 2 items were 3 and 2 points, respectively, showing its relatively least importance. The standard set by experts was roughly 80 after weighting conversion. Thus, the standard score was set at 80 after weighting.

Experts also constructed the layer score in order to concretely reveal the meaning of evaluation results. Standard score was 80 points, accounting for 25%. The layer score are as follows: “Outstanding” was 90-100 points accounting for 5%, “Excellent” 80-90 points accounting for 20%, “Good” 70-80 points accounting for 30%, “Poor” was under 70 points accounting for 40%.

Conclusion

This research selects important dimensions and indicators in relation to educators’ teaching based on “university environmental education index system”. In terms of the design of evaluation instrument, four different levels of written description were employed as multiple description items. The index content was classified according to the degree of execution. This design made the assessment index concrete and valuable. This assessment tool employs AHP for construction of weighting. The priorities pertaining to index items would be taken into account when the real assessment is carried out.

This research also included a survey that investigates current teaching condition. The results indicated that the evaluation system possessed the characteristic of representing the actual condition, matched with the ideal of environmental education, and of great importance in environmental education evaluation.

This research has completed the database of “Investigation of Teaching Condition among University Environmental Educators”. It can be used for self-evaluation or evaluation across different universities. Governments can use the research results leading the trend of environmental education.Apart from teaching, there are other indexes for further development. The course of development for evaluation instrument provides a useful reference to environmental educators, researchers and decision-makers. In turn, it will form further evaluation instrument for environmental education in order to enhance its teaching efficacy and quality.

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ENVIRONMENTAL EDUCATION IN AN INTERCULTURAL PERSPECTIVE

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Environmental education and ecology of the human development

The environment education requires a systemic consideration upon the themes and the ways, the individuals it addresses to and the places where it is accomplished.

Everyone perceives the importance of the envinroment education in the contemporary world, which is exposed more than ever to the break of the socio-anthropological and geo-political balances and to climate and pollution issues. The latter issues in particular cause widespread fears regarding the destiny of the planet and the human species, but they are not always considered in connection with the socio-anthropological imbalances, such as the migrations. The interdependence between the perturbations of the geo-physical balance and the social upsets is not always perceived and managed with a consistent awareness: the former is part of a category where there is a clear possibility to establish a discussion based on the commune interest, and the latter part arises defensive attitudes connected to opposed interests and values.

This work aims to provide an educative proposal, that can be called ecological, not simply for the subjects it proposes – the knowledge and the protection of the natural eco-systemic balances, but rather considering the ecology of the human development and, therefore, the age and the skills, the aptitudes and the interests of people different in culture or age.

The environment education is one of the possible ways to overcome the borders each culture restricts the education within and to spread the metacultural knowledge about the human being and the nature. This knowledge must rekindle everybody's sensitiveness and be a recall to the experience and responsibility in the different geographical, cultural, social and life contexts.

The question we ask is: what can we do to make the new generations grasp the relationship between the protection of the ecological balances and the different cultural ways to the plausible development?

The awareness of the environment as an expression of nature and culture develops by experiencing the near and the far and is linked to the times and the ways of the process of becoming and of the personal growth,

to the development of the needs, of the instincts, of the interests, of the reasons and of the values.

Environmental education and ecological conscience

For a discussion about the common ecological conscience, it is necessary to specify what awareness means and what the environment is in the individual experience.

Since childhood the I-world interactions produce the awareness as a classification and record of the events' meaning; the conscious experience leads then to transformations of the subjective behaviour: from environment-sensitive it becomes gradually able to grasp the sense of things and to reply adequately to the environment questions.

The relationship with reality develops along the evolutionary path starting from the emotion-instinct-based *reaction* towards the affection-feeling-based *reply*, in order to get to the construction of conscious motivations of value (A. Perucca, 1998).

Thanks to the attention of the differences, the environment education in intercultural perspective can encourage a development from the reactive attitudes to the *conscious reply behaviours*; as a consequence, it starts a progress, which is useful for the people's growth – because it induces a development of their skills at relating with the surrounding reality, and profitable for the environment – because it permits to take into account the needs, the laws, the rhythms and the harmonies ruling the different cultural habitat.

So, in order to foster the ecological conscience, it is necessary to bear in mind the usual reference level of cognitive competence; but apart from that, it is necessary to keep in mind also the path of emotional, affective and social development, in order to measure the ways of proposal to the evolutionary course of the individual and to foster an open way to think about the differences, the reciprocity, the respect and the responsibility in connection with the surrounding environment.

An ecological education in intercultural perspective makes it possible to identify in the different approaches to problems a factor of growth of their awareness; it permits to obtain positive reply attitudes rather than emotional reaction ones; it can lead to distinguish among *desire, project* and *fulfilment* and to adapt to the needs of reality, while we are involved in transforming it so that it fits our own intentions.

Origin of the ecological learning

During the development, the levels of awareness of the perceived environments follow the principles of the ecology of the human development; here, perception ability and environment change move gradually from the near to the far (U. Bronfenbrenner, 1986). The ecology of the human development is composed of two kinds of environment

experience: a direct one, regarding the near environment, and an indirect one, regarding a remote environment.

Pupils can be prepared since the school for a good relationship with the nature starting from the different levels of awareness and of *experience of the near environment*. They can therefore reply with the adequate reflection paying attention at the others' experiences. When they go beyond their own experience, they can indeed get to a level of awareness that implies the awareness of the reasons of knowledge, of action and of intervention, and so reach a pro-action and protection disposition.

At a psycho-pedagogical level, it is necessary to remember that:

- the *emotional reaction* doesn't always denote cognition;
- the *adaptive reply* requires cognitive awareness and affective significance;
- the *protection initiative* involves an awareness oriented towards the constructive interaction between the reasons of the Ego and the environment needs.

The antagonism humankind-nature so falls and it becomes simple to understand that an approaching path is to be followed towards the environment:

- to know and understand;
- to adapt and protect;
- to intervene and transform with respect and love.

A constructive relationship with the environment needs therefore to cultivate at least *three aspects of the personal growth: cognitive, adaptive and pro-active*, in order to avoid the break of the ecological balances and to make the progress get plausible orientations.

The *experience of the far environment* is always mediated by the cognitive aspect and, with regard to it, it is not always likely to fulfil an adaptive or pro-active experience.

Certainly, not everyone has the logic ability to understand the causal links and the ecological balances of the macro-system; not everyone possesses the abilities of enquiry and critical recognition necessary for an adaptive reply or a shaping intervention; not everyone has the economic and ethical evaluation tools to ponder the results of pursuing an aim, of intervening and of transforming the natural balances. Nevertheless, everyone perceives personally, even intuitively, the world in its entirety and has a notion of the environment-world and, because of how widely they are used, of the television frames and of mass information. The educative intercultural mediation can lead, as it is possible to, the problems of the far environment in the field of the subjective experience; the aim is to foster the awareness of the possibilities and responsibilities everybody has within their own culture to safeguard the environment and to prevent from the ecological disasters.

Ecological education and interculture

The intercultural aspect of the learning favours a positive approach to problems and a non-traumatic familiarity with the wider fields of reality. Intercultural education and ecology are the new horizons of the social education and have some common principles:

- the difference principle;
- the responsibility principle;
- the interdependence principle.

The processes of knowledge, adaptation, transformation and safeguard are, first of all, tasks of the personal development, but also aims of the ecological education; as seen above, they can be activated in the intercultural sphere, with reference to the near and the remote environment.

Fostering a widespread ecological education doesn't mean to expect the mastery of problems above the abilities of the individual. It is necessary instead to propose pedagogical criteria linking the educative objectives with the tasks of the social and personal development; furthermore, it is necessary to encourage relational experiences fit to go beyond widespread stereotypes and cultural prejudices; it is necessary to foster the awareness of the interdependence among the socio-anthropological contexts, going beyond the personal experience and the local environment.

Ecological education and intercultural proposal are general objectives of the education, not just subjects to study and, thanks to them, all the learners can orientate, considering the evolutionary course, the mental skills, the social dispositions and each one's cultural differences.

The orientation of values is not fulfilled through fragmented and specialised learning, but through the formation of reciprocity and responsibility attitudes and the development of skills at understanding and respecting world different from our subjective universe.

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L'EDUCAZIONE AMBIENTALE IN PROSPETTIVA INTERCULTURALE

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Educazione ambientale ed ecologia dello sviluppo umano

L'educazione ambientale richiede una considerazione sistemica oltre che dei temi e dei modi anche dei soggetti cui ci si rivolge e dei luoghi in cui si attua.

L'importanza dell'educazione ambientale è avvertita da tutti nel mondo contemporaneo esposto, più che mai, alla rottura degli equilibri socio-antropici e geo-politici oltre che ai problemi climatici e di inquinamento. Questi ultimi soprattutto entrano a far parte di diffusi timori riguardanti il destino del pianeta e della specie umana ma non sempre vengono percepiti in rapporto a squilibri socio antropici come ad esempio le migrazioni. L'interdipendenza fra le perturbazioni dell'equilibrio geofisico e i rivolgimenti sociali non è sempre avvertita e gestita con coerente consapevolezza: i primi fanno parte di una categoria di preoccupazioni in cui è chiara la possibilità di far sorgere un dialogo fondato sull'interesse comune, i secondi destano atteggiamenti difensivi correlati a interessi e a valori contrapposti.

In questo lavoro si intende tracciare una proposta educativa che si possa definire ecologica non tanto per gli argomenti proposti (la conoscenza e a tutela degli equilibri eco-sistemici naturali) quanto in considerazione della ecologia dello sviluppo umano e, quindi dell'età e delle capacità delle attitudini e degli interessi delle persone, diverse per cultura o per età.

L'educazione ambientale è una delle vie possibili per superare i confini in cui ciascuna cultura circoscrive l'educazione e per far circolare saperi meta culturali sull'uomo e sulla natura, conoscenze che risveglino la sensibilità di ciascuno e fungano da richiamino alla esperienza e alla responsabilità nei differenti contesti geografici, culturali e sociali e di vita.

La domanda che ci poniamo è: come fare perché le nuove generazioni possano cogliere il rapporto fra salvaguardia degli equilibri ecologici e differenti vie culturali allo sviluppo sostenibile?

La consapevolezza dell'ambiente come espressione di natura e cultura si sviluppa attraverso i percorsi dell'esperienza del vicino e del lontano e si connette ai tempi ed ai modi del divenire e del crescere personale, all'evolvere dei bisogni, delle pulsioni, degli interessi, dei motivi e dei valori.

Educazione ambientale e coscienza ecologica

Per discutere di una comune coscienza ecologica, occorre precisare che cosa si debba intendere per consapevolezza e che cosa sia l'ambiente nel vissuto soggettivo di ciascuno.

Sin dall'infanzia, l'esperienza delle interazioni Io-mondo, genera la consapevolezza come costrutto e registrazione del significato degli eventi; l'esperienza consapevole induce, poi trasformazioni nel comportamento soggettivo che da reattivo all'ambiente si fa gradualmente capace di leggere il senso delle cose e di dare risposta adeguata alle richieste dell'ambiente.

Il rapporto con la realtà matura lungo la linea evolutiva che muove dalla *reazione,* a base emotivo-pulsionale, verso la *risposta*, a base affettivo-sentimentale, per giungere a costruire consapevoli motivazioni di valore (A. Perucca, 1998).

L'educazione ambientale in prospettiva interculturale può favorire, con l'attenzione alla differenze, una evoluzione dagli atteggiamenti reattivi ai *comportamenti di risposta consapevole*, conseguendo un progresso che è funzionale alla crescita del soggetto, perché induce una evoluzione delle sue capacità nel rapportarsi alla realtà circostante, e proficuo per l'ambiente, perché consente la considerazione delle istanze, delle leggi, dei ritmi e delle armonie che governano i differenti habitat culturali.

Per promuovere la coscienza ecologica occorre, quindi, tener presente, nell'ordine generale dell'educazione, oltre che il livello di competenza cognitiva cui di solito si fa riferimento, il percorso dello sviluppo emotivo, affettivo e sociale, per calibrare le modalità della proposta all'iter evolutivo del soggetto e promuovere una riflessività aperta alle differenze, alla reciprocità, al rispetto e alla responsabilità nel rapporto con l'ambiente circostante.

Un'educazione ecologica che dia spazio alla prospettiva interculturale, può consentire di riconoscere, nella diversità degli approcci ai problemi, un fattore di crescita della loro consapevolezza, può far conseguire atteggiamenti di risposta positiva più che di reazione emotiva, condurre a *distinguere fra desiderio*, *progetto* e *realizzazione* e ad adattarsi alle istanze della realtà mentre ci si adopera a trasformarla per adeguarla alle proprie intenzioni.

Genesi degli apprendimenti ecologici

Lungo l'iter dello sviluppo i livelli di consapevolezza degli ambienti percepiti seguono i principi dell'ecologia dello sviluppo umano che vede la capacità di percezione e di modificazione dell'ambiente muoversi nella direzione che dal vicino si spinge gradualmente verso il lontano (U. Bronfenbrenner, 1986) e riconosce due tipi di esperienza dell'ambiente, uno diretto, che riguarda l'ambiente prossimo, uno indiretto che riguarda l'ambiente remoto.

Già nella scuola si possono preparare gli alunni ad un positivo rapporto con la natura a partire da quelli che sono i diversi livelli di

consapevolezza e di *esperienza dell'ambiente prossimo* per predisporli a rispondere con adeguata riflessione ponendo attenzione al vissuto degli altri. Quando si supera il vissuto egocentrico si può, infatti, giungere ad livello di consapevolezza del proprio ambiente che comporta la consapevolezza dei motivi del conoscere, dell'agire e dell'intervénire e, quindi, una disposizione proattiva e di tutela.

Sul piano psico-pedagogico occorre tener presente che:

- la *reazione emotiva* non sempre indica cognizione,
- la *risposta adattiva* richiede consapevolezza cognitiva oltre che significato affettivo,
- l'*iniziativa di tutela* comporta una consapevolezza orientata alla interazione costruttiva fra i motivi dell'Io e le istanze dell'ambiente.

Viene così destrutturato l'antagonismo uomo-natura e si giunge a capire che vi è un cammino di approssimazione da compiere nei confronti dell'ambiente:

- conoscere e comprendere,
- adattarsi e salvaguardare,
- intervenire e trasformare con rispetto e amore.

Un rapporto costruttivo con l'ambiente richiede, quindi, che siano coltivate almeno *tre dimensioni del crescere personale: quella cognitiva, quella adattiva, quella proattiva,* onde evitare la rottura degli equilibri ecologici, e consentire che il progresso assuma direzioni sostenibili.

L'*esperienza dell'ambiente* lontano è sempre mediata dalla dimensione cognitiva; non sempre nei suoi confronti, è possibile realizzare un'esperienza adattiva o proattiva.

Certamente non tutti hanno la capacità di comprensione logica dei nessi causali e degli equilibri ecologici del macro sistema, né le capacità di indagine e di ricognizione critica necessarie per una risposta adattiva o un intervento plasmativo, e tanto meno possiedono gli strumenti valutativi economici ed etici che consentono di ponderare gli esiti del perseguire un obiettivo, dell'intervenire, del trasformare gli equilibri della natura. Ognuno, tuttavia, ha una percezione, sia pure intuitiva del mondo nella sua globalità, una nozione di ambiente-mondo e, per l'ampia fruizione che ha delle immagini televisive e della informazione di massa. La mediazione educativa di matrice interculturale può ricondurre, per quanto è possibile, nell'ambito dell'esperienza soggettiva i problemi dell'ambiente lontano; l'obiettivo è quello dì promuovere una consapevolezza della possibilità e della responsabilità che ciascuno ha, all'interno della propria cultura per la tutela dell'ambiente ed alla prevenzione dei disastri ecologici.

Educazione ecologica e intercultura

La dimensione interculturale degli apprendimenti favorisce una positiva approssimazione ai problemi, una familiarità non traumatica con dimensioni più ampie della realtà. Educazione interculturale ed ecologia sono i nuovi orizzonti dell'educazione sociale ed hanno in comune alcuni principi:

- il principio differenza,
- il principio responsabilità,
- il principio interdipendenza.

I processi del conoscere, adeguarsi, trasformare, tutelare che, come abbiamo visto, sono obiettivi dell'educazione ecologica, ma innanzi tutto compiti di sviluppo personale, possono essere attivati, in dimensione interculturale, con riferimento all'ambiente prossimo come a quello remoto.

Per promuovere una coscienza ecologica diffusa, senza pretendere la padronanza di problemi che superano le capacità del singolo é opportuno proporre criteri pedagogici che consentano di connettere gli obiettivi educativi ai compiti di sviluppo personale e sociale; occorre, inoltre, promuovere esperienze relazionali idonee a superare stereotipi diffusi, pregiudizi culturali ed è necessario favorire la consapevolezza dell'interdipendenza dei contesti socio antropici andando al di là delle dimensioni dell'esperienza personale e della esplorazione dell'ambiente locale.

L'educazione ecologica e la proposta interculturale, non si esauriscono nelle discipline di studio, ma sono obiettivi generali dell'educazione, in ordine ai quali tutti gli apprendimenti si possono orientare, tenendo conto dell'iter evolutivo, delle capacità mentali, delle disposizioni sociali e delle differenze culturali di ciascuno. Non è attraverso la frammentazione e la specializzazione degli apprendimenti che si consegue l'orientamento valoriale, ma attraverso la formazione degli atteggiamenti di reciprocità e di responsabilità e con lo sviluppo della capacità di comprendere e di rispettare mondi diversi dal nostro universo soggettivo.

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CREATING STUDENTS' ATTITUDES DURING THE REALIZATION OF ECOLOGICAL PROJECT

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Abstract

The main aim of the research was preparation and initiation of ecological project and evaluation of ecological consciousness of the students at the secondary school level in view of their activity for the benefit of eco-development.

As a result of environmental evaluation, which was carried out, task priority was established. The evaluation of the project, had different forms at various stages of realization and at the end of the project, it has been described in the paper.

The survey research was a way of gathering information. Its analysis let us identify the strong and weaker sides of practical activity and was a very important factor of improving it. The research also served as a means of evaluating the state of students' ecological and environmental consciousness and the degree of understanding the notion and principles of sustainable development. The main aim of the survey research was the study of connections between the activities for the environment and these principles.

260 students took part in the research. Apart from the didactic evaluation of the undertaken activities also an attempt at social and educational evaluation was made. It required the following criteria:

- General and subject abilities of students
- Motivation of undertaken activities
- Students' behaviour during work on the project and after it
- Students' social attitudes

During the realization of the project main emphasis was put on learning teamwork, which is closely connected with ethical aspects, which were taken into account.

The research results point to the fact that the forms of environmental activity, which were proposed help to increase students' ecological awareness and their proper pro- environmental attitudes.

Key words: sustainable development – biodiversity – ecological project – students' ecological and environmental consciousness – environmental attitudes.

Introduction

The task of ecological education is, on the one hand, to provide human with knowledge about the environment as a system, the way it functions and the influence of various human activities on the system, as well as mechanisms and processes occurring within it, while on the other hand to develop environmental consciousness on the basis of the knowledge. In consequence, ecological education should lead to the development of a sense of responsibility for the present and future condition of the environment. It is possible when human perceives the environment as a vital value, both for an individual and for the whole society.

Ecological and environmental education particularly emphasizes the following attitudes: acting in accordance with the rules of eco-ethics and ecological culture connected with coexistence with the surrounding nature, sensitivity to the beauty of nature and the effects of its destruction, emotional and practical involvement in protecting nature and the environment. Positive examples given to young people by teachers and all the people who do not display egoistic and consumer approach towards nature may be determinants of such attitudes.

The conviction concerning the values existing in the environment and complex relations between human and the environment must result from current knowledge on natural phenomena and processes and on the contemporary problems of the natural environment.

The concept of sustainable development refers both to social and cultural development, and to economic development as well. It is also connected with the changes occurring in nature, development of the animated nature, succession of ecosystems and global sustainable processes occurring in the biosphere.

Biodiversity, to put it simply, is the diversity of life-forms along with all their variability on the level of genes, species and ecosystems, on the scale of Earth or lower biogeographic units. The issue of biological diversity became one of the main paradigms of ecology, contemporary environmental protection and environmental policy.

Environmental education strengthening sustainable development

Developing and improving ecological and environmental awareness of students in the field of personal responsibility for environmental protection and protection of its resources, as well as presenting the need for living in accordance with the idea of sustainable development, both in reference to every human and the whole society, became the overriding aim of ecological education.

The aims of education should be clear not only for the teacher who sets them, but also understandable for students, since their clarity could result in their creative actions, thanks to greater and better motivation.

According to the regulation of the Ministry of National Education on the "Curricular basis for general education" concerning nature and ecological education at primary school level and biology and ecological education at lower secondary school level (OJ No.14 1999), as well as in general secondary schools, specialized secondary schools and technical secondary schools (MNE 2002), a small number of entries directly connected with "sustainable development" and the concept of biodiversity was observed.

These issues are reflected in the educational content of a subject on a given stage of education and in educational paths. As an example, a sample record in a general curricular basis for the subject biology for a general secondary school is given below. The aims of ecological education in upper-secondary schools should be:

- Understanding the interdependencies which exists in the biological environment.
- Developing the consciousness of the importance of preserving biodiversity and the motivation to obey rules.
- Understanding human dependency of the environment and human influence on it.
- Developing the consciousness of civilization threats.

School's tasks:

- Development of the responsibility which students take for actions undertaken in the immediate environment.

Topics:

- Anthropopressure, reasons and results of reduction of biodiversity.
- Renewable and non-renewable resources, rational resource management.
- The principle of sustainable development.

Achievements:

- Evaluation of the changes taking place in the environment as a result of human impact and their influence on the quality of life and the ability to find remedies
- Formulation of principles of sustainable development and analysis of own decisions and behaviours in this respect.

Furthermore, the aims of ecological education should be implemented in general secondary schools within the framework of ecological path (provision in the Curricular basis of 2002), e.g.:

- Making students aware of the various positive and negative impacts of human on the environment and development of ability to recognize them in practice.
- Development of the attitude of responsibility for the state of the environment and readiness for actions promoting sustainable development.

School's tasks:
- Enabling doing research activities in the field
- Creating conditions enabling integration of various disciplines in order to facilitate understanding of the idea of sustainable development

Educational topics:
- Economic and social aspects of the connections between human and their actions and the environment. The value of the environment. Profits and losses connected with its exploitation. Renewable and non-renewable resources.
- The contemporary economic order and its impact on the degradation of natural environment
- Civilization threats connected with energy. Renewable sources of energy.
- Ways of protecting biodiversity
- Intensification of agriculture and threats connected with it. Organic farming.
- Problems of biological security (e.g. genetic engineering)

Students' achievements should be:
- Perception of the contemporary civilization threats resulting from irrational resource management and uneven living standards in different parts of the world.
- Evaluation of the activities of ecological organizations, their aims and forms of acting, as well as agreement with state's ecological policy.
- Undertaking rational actions conducing to the improvement of the state of the environment on a local, regional, country and global scale.

What constitutes an important problem is interpretation of assumptions contained in curricular basis regarding sustained development and the way of covering them in curricula and textbooks. Their most important task (at each educational level) is and will be not only transmitting knowledge on the environment, explaining the essence of the global nature of the environment, but also stimulating for action, convincing to choose a certain model of life and system of values.

Aims of research

The aim of the research was to evaluate the level of ecological and environmental consciousness of general secondary school students taking part in ecological projects, as well as the influence of their realization on the level of understanding the notion and principles of sustainable development. Another aim of the research was to show the influence of educational activities undertaken by the school on the development of students' attitudes.

Characterization of the research method

The research covered general secondary school students taking part in projects regarding initiatives connected with improving their competence in botany during classes on the territory of the Ojców National Park and with complex activities continuing the local project "Mainstay of Nature" ("Ostoja Przyrody"). The initiation of the first project /1/ "Mainstay of Nature" was supported by the Environmental Partnership for Central Europe (Fundacja Partnerstwa dla Środowiska). The series of biology lessons and weekly class meetings was students' preparation to the realized task. The aims of the lessons, defined in particular categories, assumed among others familiarity with and understanding of the concept of sustainable development, ability to interpret the rules of eco-development in the ecological, economic and social context and developing students' attitudes and beliefs concerning the need to introduce and undertake particular activities for the natural environment in their lives. This phase differentiated a group of young people (leaders) who were most interested in the realization of the project. The group worked out and formulated the aims of the project (Table 1).

Environmental aims	**Educational aims**
– Creating possibilities of life and development for living creatures (birds, insects), trough enriching species biodiversity of plants in the environment – Enriching species biodiversity – Creating breeding sites for birds – Extending the green area on the school premises	– Creating possibilities of carrying out biological observations – Developing students' practical skills concerning decision making, planning and task organization – Developing pro-environmental attitudes among young people. – Stimulating social activities with participation of young people, parents, teachers, head of the school, aiming at maintaining and improving natural features of urban areas – Integrating the whole school community – Creating an educational path

Table 1. Aims of the project /1/

Environmental aims of the present project /1/ in the scope of understanding the meaning and enriching species biodiversity of plants in the environment required continuation. Also the educational aims of the project made the teacher organize the educational process in such a way that it would support the students and people not belonging to the school community in the sphere of the undertaken activities. It was reflected in the second part of the project (Table 2).

Environmental aims	**Educational aims**
– Specifying the main contemporary orientation of activities of the Ojców National Park and the influence of development of biological knowledge on possible changes; – Adaptation of specific plant species occurring on the area of the Park to "Mainstay of Nature".	– Specifying educational tasks of the Ojców National Park / historical sketch; i.e. what has been changing, which orientations used to be dominant ones/; – Getting familiar with world tendencies reflected in educational activities of Polish national parks; – Familiarity with and understanding of the methods of popularizing biological knowledge in the Ojców National Park – Ensuring more acceptance, tolerance and respect for other people, – Ensuring more acceptance, tolerance and respect for other people.

Table 2. Aims of the project /2/

As a result of the environmental evaluation carried out, a priority of tasks realized within the framework of both projects was established.

Evaluation of projects comprised evaluation of pro-ecological attitudes and ecological consciousness of students participating in both projects on the basis of their answers given in survey research regarding personal characteristics in the scope of intellectual, emotional and spiritual, as well as moral and social development. The survey was supposed to provide information, the analysis of which, identifying strong and weak sides of the practice undertaken, constitutes one of the important factors of its constant development.

It also regards the intellectual sphere. Emotion can be defined as a subjective mental state, launching a priority for the action connected to it (Niemierko, 2002), thus the aim belonging to the spiritual and emotional sphere was dedicated special attention to in the context of development of attitudes (graph 2). Experts project consultants provided students with comprehensive information on district development plans, ways and possibilities of development of urban areas, birds breeding sites, and ways

of attaining materials and tools. Furthermore, a series of classes in the Ojców National Park was aimed at learning species of plants together with their living requirements before their adaptation at the chosen site. Both projects combined social, biological and economic aspects, which were evaluated and taken into consideration during later planning and foreseeing the results of various decisions.

Organization of research

- The research was carried out in two stages (Table 3).

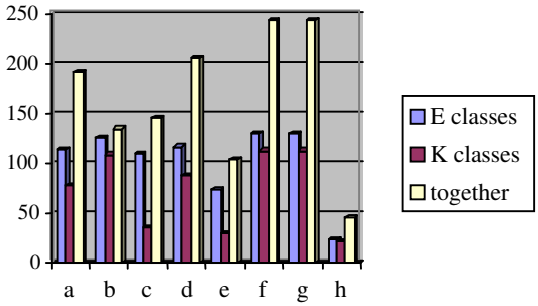
Stages of research	The number of students in control groups	The number of students in experimental groups
2003/2004 initial research	61	61
2004/2005 actual research	69	69

Table 3. The number of students taking part in particular stages of research

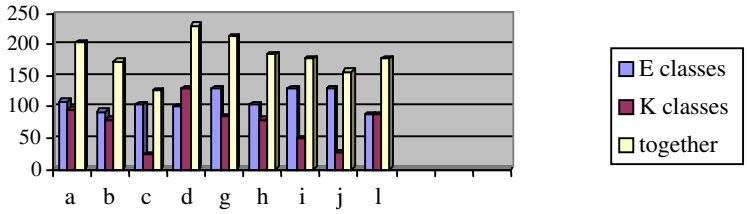
During the realization of the project, methods and techniques of student activation were applied: metaplan as a method of successful discussion in order to consider a problem and find a common solution, the "U-procedure" in order to carry out analyses, evaluation and description of the actual state of affairs and possibilities of introducing changes, associogram technique in order to diagnose the current state of affairs and create a list of ideas on how to solve problems, decision tree technique in order to present the problem along with positive and negative consequences of the decision. The mentioned methods and techniques conduced to the development of abilities to make choice and make a decision with full consciousness of its consequences. In the process of evaluation of the project, the Delphic method was applied. The method is a way of predicting the future, specifying probability of occurrence of events and defining estimate values of some variables. The method boiled down to carrying out a survey among the whole group of students, covered by the previous obligatory course in ecology. The questions in the survey were of an open character and were connected with the analysis of data collected by the students during interviews, lectures and consultations. In the next phase, with preserving anonymity, they were mutually confronted in so that the students could work out an agreeable stance. Simultaneously, the level of details was increasing. Students were also making attempts to extrapolate trends in order to predict events in the future.

Results of the research

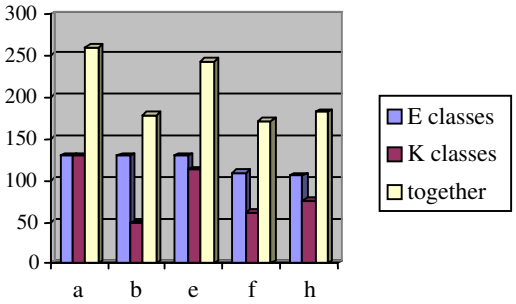
The results of the survey carried out by means of the Delphic method prove that when the students of experimental groups learned the gist and meaning of the rules of sustainable development and biological diversity, it helped them to understand the surrounding world and make decisions which are responsible and respect the rights of nature. Opinions of the students taking part in the project proved that they understood the need to preserve biodiversity and their consciousness concerning the value of biological diversity increased. The students taking part in the project (E classes) to a greater extent than students of K classes noticed the importance of school knowledge in the context of its use in everyday life (graph 1 b), they thought that familiarity with one's own strengths and weaknesses and the ability to fight one's own weaknesses are the features which help in life (graph 1 e, f). The ability to make self-evaluation, understood as a sense of one's own value resulting from internal and external sources (graph 2 b), were revealed earlier during teamwork on preparation and implementation of the project. Externally, they manifested by means of comparisons with other people; internally, they were determined by the level of their own aspirations, i.e. the set of realized needs and life aims of a person (Niemierko, 2002). Social and educational evaluation, which is different from didactic evaluation, in this case required adopting, among others, the following criteria: general and subject skills of a student, motivation of undertaken actions and behaviour during the work on the project and after its completion, social attitudes. During the realization of the project the emphasis was put on learning team work activities which was strictly connected with taking into account ethical aspects. Thanks to working together, the students of E classes were getting familiar with the rules and they had to follow them. Friendliness, tolerance, requirements, friendly criticism, consequences, mutual help, responsibility for the final product are only chosen sample rules which enabled the students to fulfil the task in the team well and in a good mood. The students from the classes taking part in the project ascribed a lot of importance to the rules (graph 3).



Graph 1. Listing of answers of surveyed students



Graph 2. Listing of answers of surveyed students specifying general secondary school graduates' specifying general secondary school graduates' characteristics in the sphere of intellectual characteristics in the sphere of emotional development and spiritual development



Graph 3. Listing of answers of surveyed students specifying general secondary school graduates' characteristics in the sphere of moral and social development

Conclusions

The totality of social and natural reality comprises many spheres: natural, cultural, economic, technical. Each of them has its own value and character, both as to its substance and educational quality. The spheres must be understood in their closest and far away parts to each human being.

Economic, social and cultural diversity requires decisions right for the particular region and observance of the universal and supranational values, such as human rights, tolerance and understanding, sense of responsibility, universalism and cultural identity, environment protection.

School and non-school education must serve the society as the tool for creating, improving and popularization of knowledge (*Learning: the treasure within. Report to UNESCO of the International Commission on Education for The Twenty-first century, 1996).* A student should be equipped not only with knowledge concerning protection and forming of the environment, human activities in the environment and contemporary environmental problems, but the knowledge they acquire should influence the ways of thinking and acting in the environment.

The projects undertaken have led to an increase of ecological consciousness of the students and changes in their attitudes, which manifests e.g. in preferring a lifestyle agreeing with the idea of sustainable development, which should be characteristic for a human living in 21st century.

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CULTURAL GEOGRAPHY PROMOTING SOCIAL AND CULTURAL SUSTAINABILITY

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Abstract.

Sustainable development comprises three aspects, which cover ecological, economic and socio-cultural issues. All should be included in school education. In environmental education practice, however, ecological sustainability has often been strongly emphasized at the expense of social and cultural sustainability. My present aim is to argue for culturally oriented geography, which could be used in strengthening the socio-cultural aspect of sustainability education and in seeking out opportunities to broaden environmental education.

The "cultural turn" has prompted geographers to find new approaches to geographical issues and brought them closer to discourses in other culturally and socially oriented disciplines. It has occasioned a broader alertness to how people, understood as highly differentiated and multiply positioned but always distinctly social beings, build up shared repertoires of cultural meanings. In the context of environmental education, the re-defined concepts of identity and subjectivity as well as the importance of popular culture offer new opportunities and pose important challenges. Geographical education in schools could apply many of the ideas of the cultural turn; these new approaches could help teachers attain a better understanding of the daily lives of young people, as well as providing students with some "tools" for interpreting the social and cultural realities they live in.

Key words: Social sustainability, cultural sustainability, environmental education, cultural geography, identity, subjectivity, popular culture.

Introduction.

This article deals with environmental education from the viewpoint of cultural geography. I will show that contemporary geography has many interesting views on the people-environment relation, which could bring school education closer to everyday life. Social and cultural aspects of sustainability could be promoted in schools better employing these approaches. First, I will offer a brief overview of the cultural turn in geography. I will then raise some issues from cultural geography that I find especially important for the school

context. I will finish by describing some notions that could be valuable for sustainability education.

The "cultural turn" in geography.

The so-called "cultural turn", which has occurred in all the social sciences, has also had a great impact on geography since the late 1980s. The cultural turn emphasizes new ways of comprehending the concept of culture in the social sciences; for example, the ways of seeing and communicating, and the construction of values and multiple identities have been taken into account more than before (Shurmer-Smith, 2002). In geography, the multiple meanings of "culture" and the conceptualisation of the new cultural geography provoked heated debate in the early 1990s (e.g., Philo, 1991; Cosgrove, 1993; Jackson, 1993; Price & Lewis, 1993; McDowell, 1994; Mitchell, 1995; Barnett, 1998; Cook et al., 2000). The outcomes of the cultural turn were often criticized as simply playing with theories without any visible connection with the real world. Cultural geographers have since reacted to criticism of the de-materialized character of the new approach by paying more attention to the social and material aspects of the culture (Pain & Bailey, 2004).

There is much of interest in the new cultural geography. The shared character of environmental meanings, the importance of locally based cultures, and the significance of distinctive social groups have been subjects of study. Topics in media studies and popular culture, for example, have become popular in cultural geography. The construction of meanings has become central to this approach, as well as the idea that landscape reflects power relations and dominant ways of seeing the world. Literary theory, semiotics, art history and discourse theory have provided some key concepts and new ways of conceptualising the landscape. It has been seen as a text that can be interpreted, or "read" (e.g., Barnes & Duncan, 1992; Duncan & Ley, 1993).

Socially and culturally produced spaces have been central to the new cultural geography. The meanings of identity and subjectivity have been redefined in the new approaches, and have often been understood through the meanings of bodily experience. Studies concerning the body and place became increasingly popular during the 1990s (e.g., Routledge & Simons, 1995; Duncan, 1996; Longhurst, 1997; Ainley, 1998; Nast & Pile, 1998). Feminist, post-colonial and post-structural approaches have challenged traditional views by showing whose viewpoint is represented and whose voice is left out. This has led to studies concerning identity and difference, and power and resistance. Subjectivity is seen as a production of spatialised power relations, and is contested in everyday life.

The "cultural turn" goes to school.

In the context of geographical education, the re-defined concepts of identity and subjectivity, as well as the meaning of popular culture, offer new opportunities and pose important challenges (Tani, 1997; Morgan, 2001, 2002). Geographical education could apply many of the ideas of the cultural turn in practice; these new approaches could help teachers get a better understanding of the daily lives of young people, but could also provide students with help in their own lives, in various social groups and sub-cultures. The cultural turn has occasioned a broader alertness to how people, understood as highly differentiated and multiply positioned but always distinctly social beings, build up shared repertoires of cultural meaning. The cultural approach is essential in geographical education if schools wish to help children and young people to become active citizens who can understand and act critically and responsibly in their local and global environment. John Morgan (2000) has written about the potential of cultural studies in geographical education. Culturally oriented geography education would "start from the lived experiences of young people; be concerned to examine the "texts" that young people use to construct their identities; and be deconstructive in that it seeks to prise open new meanings and provide resources for the construction of new identities" (Morgan, 2000).

The main approaches deriving from the cultural turn that could be applied in schools are:

- "Reading" the world through various representations (media education, thinking skills, critical thinking).
- Understanding the global through the local (understanding different scales and their interdependence; taking responsibility for the individual's own actions).
- Socio-cultural diversity in different environments (understanding difference and various cultural and social backgrounds; tolerance and empathy).
- The meaning of neighbourhood for residents (active participation; responsibility; the importance of emotional geographies).
- Social spaces, uses of public space (understanding power and resistance; local interests and ways of taking possession of space; participation).

Environmental education in cultural geography.

The aims and methods for successful teaching and learning practices have been studied in environmental education, but the concept of the environment and it's use have seldom been defined. Because the tradition of environmental education has been related to nature conservation and environmental problems and their solution, environmental education has often concentrated on studies of the physical environment, especially of nature. Ecological sustainability has thus been crucial, while economic, social

and cultural aspects of sustainability education have been rarely considered. Ecological sustainability is an important aim for environmental education but, I argue, it is not enough. Environmental education associated only with the natural environment is easily separated from people's everyday lives in the present situation, where the majority live in urban surroundings. The effects of environmental education may remain modest if people do not see it as relevant to their daily environment. More attention should thus be paid to social and cultural aspects of the environment in the future. New cultural geography can offer important "tools" for environmental education in schools. It will put more emphasis on social and cultural aspects of environmental education by paying attention to young people's relations with their environment. Their identities will be strengthened and their cultural and social sensitivity, tolerance of difference, and understanding of others will be promoted. By doing this, their opportunities for active citizenship, environmental awareness and empowerment will be enhanced.

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PROMOTING ENVIRONMENTAL EDUCATION AT KINDERGARTEN LEVEL IN SAVONLINNA, FINLAND AND IN SAKU, ESTONIA

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The aim of this study

The aim of this study was to develop a program for environmental education in kindergarten both in Savonlinna, Finland and in Saku, Estonia. The project lasted for four years, and every year the program was slightly improved. The university researcher and the kindergarten personnel tried to find different ways to educate small children environmentally.

The methodology and methods of this study

This study was mainly qualitative and the approach was hermeneutic and phenomenological. It means that the researcher tries to understand and explain experiences of the people and tries to interpret them. (Denzin & Lincoln, 1998.). The study was a case study, actually the multiple case studies, and an action research. We can talk about tree main case studies, two in Savonlinna (Tenavatalon and Nojanmaan päiväkoti), and the third in Saku (Lasteaia Terake). (Yin, 1994). The main cases have also sub-cases; it means that every kindergarten group is one single case, because every group has their own program. The action research means that the personnel has an idea, how to develop the action. The researcher goes with them, she (or he) is both inside and outside in action. This position gives her (or him) some ethical problems, too (Kemmis & Wilkinson, 1998.).

A typical action research is going on with cycles: planning, doing and evaluating and make it better. We planned, educated, evaluated and then repeated our kind of action research cycle. We planned in many cycles: for instance, in a kindergarten group we planned the program weekly, for whole kindergarten monthly and for integrated education once a half year or a year. In this case we tried to educate small children to perceive and understand both natures, man build environment and ecological way of living.

During the education the researcher made observations and interviews. The kindergarten teachers took videos during the trips and wrote diaries. These have analysed according to our educational themes. The members of staff and also parents have interviewed.

Theoretical ground

Behind our thinking were experiential (Dewey, 1916/1966; Kolb, 1984) and outdoor education theories (Brugge, 1999, Åhlberg & Dillon, 1999). The way to see the action was system theoretical.

Results

In both countries we found that the most important result was that all kind kindergarten education could be interpreted as environmental education. The change was mainly in the thinking of the teachers, not in the activities of the children, but it had an effect how the adult gave feedback to children.

For every learning event an environmental goal can be created. Environmental education can be realized in music, mathematics, arts, etc. It can be integrated in all "normal" activities in kindergarten. In Finland it was usually during trips in the forest or in the town, in Estonia they had one day/ week environmental mathematics, environmental sport, and so on.

Accordingly every behaviour is also behaviour for or against environment (Palmer, 1998). The teacher should tell, for instance, how to behave in the forest (e.g.: leave plants and animals to live in peace) or in the man made environment (no "arts" on the wall!). It's important to give children the possibilities to experience nature and man-made environment. It takes time and the children should not have over-planned program.

How to educate the Estonian teachers had better knowledge about plants and animals and they told more environmental folktales to their children than the Finnish teachers. The Finnish teachers educate more indirectly and were more child-cantered than the Estonian teachers. But both teacher groups made very good work and educated children excellently.

Motto: Too many boundaries inhibit learning (e.g. in planning, during trips)!

Reports of research/Rapports de recherche
Rapporti di ricerca

A STRATEGY TO GREEN UNIVERSITY DEPARTMENTS. THE EXPERIENCE AT THE UPC

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Abstract

Lastly, because of the environmental crisis, some universities are doing a great effort to integrate environmental issues within them. Usually, in order to achieve this goal actions are proposed in four areas: Education, Research, University Life and Coordination and Communication. Therefore, the full and successful integration of Sustainable Development (SD) in the university in order to catalyse the university's greening process should be carried out by linking the previous areas with schools, departments, university and campus life greening.

We present a general action plan to green university departments. This action plan is based on different aspects:

1) definition of objectives (actions on the awareness of faculty and staff for SD; flexibility, change and evolution of dept rules; actions on education (bachelor, master and postgraduate studies): greening curricula; actions on the research and technology transfer: greening research);
2) definition of the environmental indicators according to several approaches (economical, ethical, ecological, social, technological aspects);
3) definition of the process;
4) phases of the process. The Technical University of Catalonia (UPC) inside its First Environmental Plan (1997-2001) has developed the greening of different departments by their own greening Plans that guide the decision-makers at the University.

Keywords:Department Greening Plans, curriculum greening, research greening, transfer technology greening, sustainability.

Objectives

The greening of the UPC departments carried out (http://www.upc.edu/mediambient) during the First Environmental Plan (1997-2001) has had as the main goal:

- To green the set of activities of the University (undergraduate training, postgraduate training, research and university life).
- To define an environmental global model exportable toward the society.

The departments have also shown considerable progress with regard to greening. During 2000 and 2001, eighteen departments (out of forty) at the UPC elaborated their own Department Greening Plans (DGP), with three main objectives:

1. To establish the basic environmental issues which define the department's activities.
2. To priorize the greening lines of action in pre-graduate and post-graduated studies, as well as the general research lines, the projects and the technology transfer.
3. To elaborate a short-term action plan to introduce the high-priority lines of action into pre-graduate and post-graduate educational programmes, as well as doctorates and research lines.

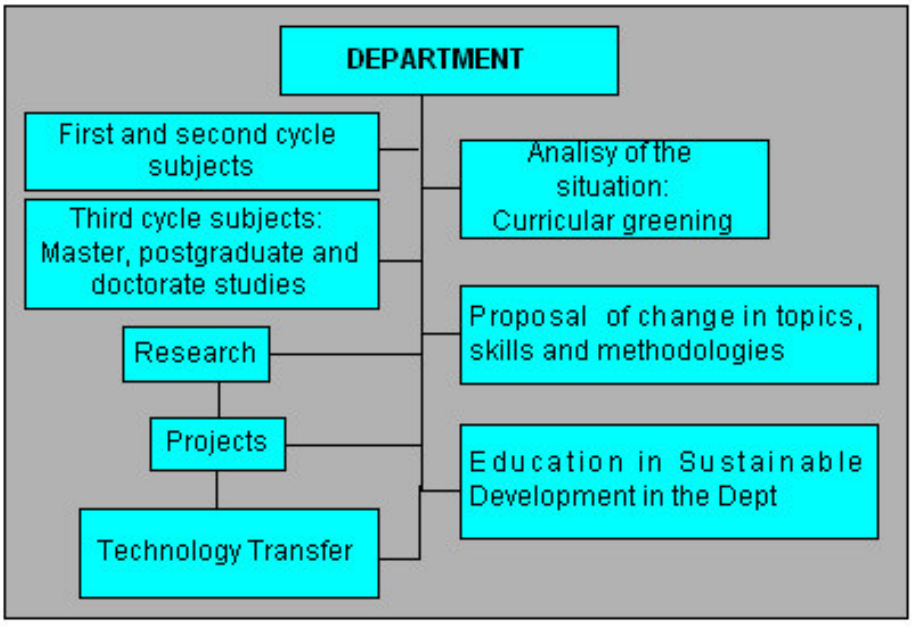

Fig. 1. Diagram of department's activities and purposes.

To develop the greening cycle of the departments it is important to link the activities carried out by the academic staff together with the environment, where these activities are elaborated and executed. It is important to not forget the great incidence of the daily activities in the generation of waste and the wrong use of the resources. For this reason any global environmental plan must include the following two aspects (Grau, 2002):

- Greening the own activities of the academic staff. Task carried out in the first part of analyse.
- Greening the environment in which the university department activities are developed. These aspects were treated in the Integral Selective Collection Plans (ISCP).

This first point includes:

- The curriculum greening of the first, second and third cycles (undergraduate and postgraduate) adapting these taught to the greening norms already established. That means that the curriculum greening includes the introduction of knowledge, criteria and sustainable values in the university curriculum. It supposes the inclusion of the study of concepts and tools that allow understanding and appreciating the environment and its complexity, to understand the relationship between the human activity and the environment and to integrate the green factor in the human professional activity. Thus, it represents a radical change in the conception and explanation of many subjects taught in the University.
- The greening of the research adding environmental and sustainable elements into the research and into the doctoring programmes of each department.
- The greening of the transfer of the technology in such a way that all the proceedings carried out in this framework take into account the environmental topics.

Methodology

To carry out this plan department's administrators must follow these steps:

- To explain to the department's faculty the importance of their subjects for the real world (industrial, social, economic, etc.) and the necessity to green the theory, problems and labs including environmental examples.
- To give to the faculty the necessary formation and tools to carry out the renewing of themes, exercises and/or practices.

Once these two previous points have been reached, teachers will begin the work of greening their subjects. Then, to reach correctly the

objectives related with the Curriculum Greening Plan of the departments, we propose the next methodology.

To achieve the objective 1 the two following actions must be carried out:

- Collection of information about environmental responsibilities and greening the tasks of training and researching in the department. The first task is carried out surveying the present environmental opinions of the faculty and researchers in the department.
- Proposal of a formal environmental declaration of the department. In this declaration must appear a set of commitments that the department will fulfil to implant and follow the Curricular Environmental.

To achieve the objective 2, the high-priority intervention lines in the different docent and research frameworks are established. Administrators are responsible to implement such recommendations. Faculty are responsible of the pedagogical changes (methodological, procedures, concepts, etc.) and the possible actions and necessary tools (greening guides, seminars, courses, educational resources: web, environmental bibliography, etc.) to achieve the greening of the curriculum.

The main educational actuation of the teachers should be centred in: integrating the respect for the environment and the challenge of sustainability in the educational process; intensifying the research into scientific or technological alternatives designed to prevent, correcting and solving the impact caused by the interrelation between mankind and the environment; and developing specific schemes for environmental management that can be exported to society.

To achieve the objective 3 to elaborate the Environmental Plan of the department, previous objectives should have been achieved. It is of special interest the help of environmental engineering experts in such a work. The UPC has set up an "Environmental Office" to coordinate all the departments' actions.

Acknowledgments

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APPROACH TO THE ENVIRONMENTAL HIGHER EDUCATION

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Environmental education is an important task at any level of education, but it assumes a relevant role at the University level. Environmental Science curricula have many subjects of common interest with Natural Science curricula; the most important difference is the study of the interrelationship between the human activities and natural resources; therefore the teaching programs of Environmental Science include subjects such as economics and law in order to prepare professional people able to help politicians and administrators to make decisions involving the scientific aspects of environmental issues.

University and post-graduate environmental education to be effective requires that the analysis of environmental problems be performed throughout a quantitative training in more than one discipline: the aim is the creation of awareness of the physical, biological, social, political and economical effects due to the anthropic pressure on the environment. The students should experience a truly interdisciplinary program that goes beyond a mere coursework in several disciplines, but it is able to create a coherently integrated approach based on blending teaching, research, and real-world problems.

Figure 1 represents the classic scheme of the Bologna Declaration: a first curriculum of three years (180 credits) (figure 2) where basic scientific knowledge plus some fundamentals on law, economics and assessment methodology are delivered; a second step of two years (120 credits) (figure 3) expressly addressed to create a specialist in specific fields, such as marine environment, green processes, land planning, etc. The degree in Environmental Science gives access to different kinds of job, including positions in public and private organizations, consulting and engineering companies, municipalities and local authorities, national and regional environmental authorities.

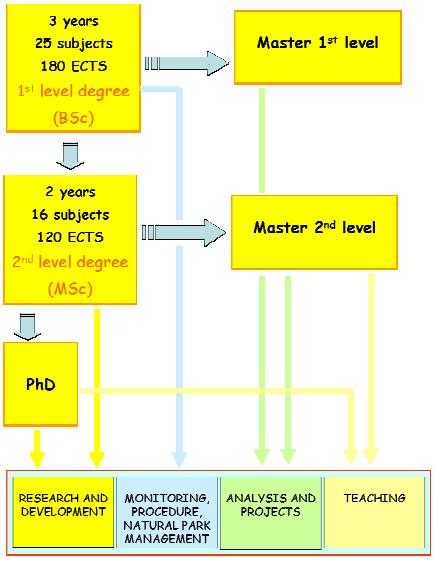

Fig. 1.Higher education curricula in Environmental Science & Engineering

Training Activity	Disciplines	Ects (Indicative Figures)
Basic	Naturalistic Mathematics Physics Chemistry	40
Characterizing	Biology Ecology Earth sciences Agriculture Chemistry Physics	65
Integrative	Environmental Law Environmental Impact Assessment Environmental Management System Life Cycle Assessment Economics	20
Student choice	Miscellaneous	30
Interdisciplinary laboratory	Experimental activities	20
Final test	Technical report	5
Total	-	180

Fig. 2. Typical structure of three-year course in Environmental Science (1st level degree)

Training Activity	Disciplines	Ects (Indicative Figures)
Basic	Mathematics Physics Chemistry	20
Characterizing	Biology Earth sciences Agriculture Chemistry	15
Integrative	Environmental Law Environmental Impact Assessment Environmental Management System Life Cycle Assessment Economics	15
Student choice	Miscellaneous	20
Interdisciplinary laboratory	Experimental activities	25
Final test	Technical report	25
Total	-	120

Fig. 3. Typical structure of two-year course in environmental sciences (2nd level degree).

As shown in figure 1, at the end of three year curriculum it is possible to attend to one year (a Master course of 60 credits) (figure 4) devoted to students already graduated in scientific disciplines (physics, chemistry, biology, geology, natural sciences, etc.) having the aim to deliver competencies in specific fields of environmental issues.

Module 1 Ethical & Juridical Fundamentals	The principles of sustainable development	11 ECTS
	The principles of environmental protection	
	Legislation on sustainable development.	
Module 2 Environmental Assessment	Local, regional, global impacts	8 ECTS
	Environmental prevention methods and tools	
Module 3 Environmental And Economic Management	Models for environmental analysis	17 ECTS
	Sustainable management of energy systems	
	Methods and tools for environmental management	

	Environmental accountability	
Module 4 Application Training	Tools for supporting decision making	10 ECTS
	Case studies	
Stage		16 ECTS
Final Test		4 ECTS
Total		66 ECTS

Fig. 4. Typical structure of a Master Course on Management of Sustainability (Master 1st level)

FROM THE BIODIVERSITY TO THE CONJUGATION OF DIFFERENCES AS AN EXISTENCE MODEL

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The topic of *diversity* in pedagogy involves, among many others, two areas of reflection that tend to intersect, even if they have numerous operating difficulties. These areas are:

- in what way the meeting between different people can become occasion of development and exchange, instead of crash and conflict;
- in what way the *diversity* can be seen as a source of mutual enrichment, instead of source of problems and difficulties that push to homologation.

Up to now, the way to face every single difficulties related to the conjugation of differences has been realized in educational attempts for the acknowledgment of the "right to difference".

This approach has turned in the construction of a learning too much related to the knowledge, which has been progressively consolidated as a central value of the modern culture and as a basic principle of the information society. However, this kind of knowledge has not be able to generate stable and durable competences.

An education that watches to the complexity of the society and of the culture generated for and from the same education, postulates different approaches that operate on several plans and cross not only several subjects but also different dimensions (for example cognitive, emotional and pragmatic ones). This kind of education can be able to generate learning for the life and to motion growing and change processes.

Routes and itineraries of research in "environmental education" can be considered a good example of the difficulties in generating meaningful and durable learning. The "environmental education" is able to combine knowledge, being able to do and being able to be.

The educational intertwining between knowledge and experience, identity and environment, values and change, will enable to an instruction and to an "ecosystem learning" (therefore, to a school system as formal context of learning) of establishing strong motivations for the adoption of the "metaphor of environment" as a strategic paradigm of educational, value and didactic choices.

In the wide context of the "ecological theory of development", one of the possible tracks of didactic and educational research is the attempt of

an approach related to the items of diversity. On the one hand, this approach can lead to the awareness of the great importance of the respect and of the value of the *natural biodiversity*; on the other hand, this approach can lead to a gradual construction of educationally meaningful relations on the intercultural area. These relations will be founded on *solidarity* and *reciprocity*, based on the comparison and the dialogue between people, different because of individual or socio-cultural features.

The biodiversity for a new environmental culture

The term "biodiversity" was used among scientific international literature at the end of 80es, spreading with extraordinary rapidity. Used for the first time by the American scientist Walter G. Rosen in September 1986, in occasion of the conference "National Forum on Bio-Diversity" in Washington, the term "biodiversity" - thanks to several studies and researches - has broadened its original meaning from the ecosystems to the landscapes, the bio-geographical regions and the biosphere.

Apart from the definitions and the technical-scientific improvement, the thematic of *biodiversity* increases more and more its horizons of epistemological research, as we said before, also to the respect and the defence of the cultural diversities, the safeguard of that is unavoidable. For this reason *biodiversity* supplies an effective contribution and support to the intercultural pedagogy and didactics.

Moving from the knowledge of the deep operating biological mechanisms operating in nature, in fact, biodiversity & *interculture* can supply to the next generations indelible examples of relation life, of models of solidarity and of social development. In synthesis, biodiversity & *interculture* can establish an irreplaceable union between the protection (recovery, conservation, improvement) of the environment and the intellectual evolution of people.

To study and to investigate *biodiversity* have, therefore, a high formative value, not only in the construction of the scientific thought, but also in all the educational processes to the "complex" thought and to the "ecological thought", which should be favoured in today education and in the future education (Morin E., 1993).

The multidimensional and complex nature of *biodiversity* causes many difficulties in the didactic and pedagogical communication, without the necessary knowledge and abilities "to read" socio-cultural and environmental relations and interactions, also because *biodiversity* often remains related to the meanings assigned by cultural traditions or the common sense.

To interpret and live natural and cultural biodiversity means that we have to reach to its knowledge interrogating, inquiring and trying relations (and new attitudes), constructing scientific coherent and structured knowledge, and engaging on the didactic-pedagogical and ethical-social

areas, without pretensions of assimilation, so to reach a mutual development based on solidarity.

In this sense, to develop an "intercultural mediation" (as dialogue between different people and cultures) becomes necessary, in educational-environmental perspective, and realizing concrete opportunities of integration and cohabitations of every people with the social group.

To cover this road means to pass from the *discovery* of the "your own environment" - in local sense and, gradually, planetary - to the knowledge of the characteristics and conditions that make the environment sustainable for us and for the next generations. This can lead young people to a level of *judgment*, interest, "pro-active" disposition, of protection and improvement (Perucca A., 1998).

The synergy between school and institutions, in local, national and international contexts, is essential in orienting the young generations not only to the protection, the preservation and the care, but also and above all to construct meaningfully and authentically empathic relations with the *other*, the *different* one and *faraway* from yourself.

Programs and routes of environmental education from an *intercultural* point of view can promote an awareness, even if only intuitive and analog, and, at the same time, value the effort for the acquisition of a responsible and virtuous life style, towards the close environment (and, therefore, in the systemic meaning), and also towards the distant environment, activating relations of solidarity with the other *different*, near or far away.

The pedagogical and cultural proposal on the *diversity*, privileging the differences (as a value) but also the social-anthropological connections and characteristics of the local communities and of the natural environment, will refuse to generalize the cultural homogeneity, encouraging, on the one hand, the usual scientific-naturalistic experiences and, on the other hand, it will stimulate the education to the perception and to the aware reflection, beginning from immediate and narrow levels (diversity among *species*, expression of *genetic diversity*, *diversity between species or groups* etcetera), to more complex levels.

The disappearance or the impoverishment of *biodiversity* is a real serious problem, that we must face with the maximum consideration in the educational relation, according to the criterion of *responsibility* (Jonas H., 2002).

The *natural extinction* are integral part of the history of life on the Earth, but a greater and greater number of species are becoming extinct with a rate of loss without precedent in the history of the planet, because of the anthropic action: pollution, excessive sampling of resources, destruction of the habitats, etcetera.

The goal of *the stability of the natural and human ecosystems* is perspective far from the daily life and generally not perceived in one generation life time. This goal can become a concrete and permanent cultural patrimony if we "sprinkle" the education not only with knowledge but also with new kinds of thought and new responsible and ethical attitudes.

The "environmental-intercultural education", fully connected with *biodiversity*, lead to the acknowledgement of the *variety* and the *diversity* as a "value in itself", which we have to promote and to respect, forcing ourselves to critically and deeply re-think to the several and daily events of intolerance, incomprehension "inter-subjective" and "inter-groups", to the persistent actions of discrimination, to the clear imbalance between social groups, between riche and complex cultures and cultures of silence, forgotten and depressed.

The recovery of the knowledge of the real relational dimension with a widest environmental context – as an ecosystem of which the man is an inseparable part and in which nothing and nobody can be isolated and self-sufficient - is the educational and formative challenge of the mankind of the Third millennium.

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DESDE LA BIODIVERSIDAD A LA CONJUGACIÓN DE LAS DIFERENCIAS COMO MODELO DE EXISTENCIA

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El asunto de la diversidad en pedagogía hace referencia, entre muchos, a los ámbitos de reflexión que, aunque derivados de distintas dificultades prácticas, tienden a entrecruzarse:

- cómo el encuentro entre *diversos* puede ser ocasión de intercambio y crecimiento, en cambio de ser ocasión de enfrentamiento y de conflicto;
- cómo la diversidad puede ser fuente de riqueza, de enriquecimiento mutuo, en cambio de ser fuente de problemas y dificultades que empujan hacia intentos de omologación.

La forma de encarar cada dificultad, en la conjugación de las diversidades, ha sido traducida, hasta ahora, en tentativas educativas tendentes al reconocimiento del "derecho a la diferencia".

Este enfoque ha llegado a determinar la costrucción de un saber demasiado atado al conocimiento, que se ha paulatinamente afirmado como valor central de la cultura moderna y como soporte de la sociedad de la información, siendo sin embargo incapaz de traducirse en prácticas que engendren competencias estables y duraderas.

Una educación que mire a la complejidad de la sociedad y de la cultura, producida por y a través de estas mismas, necesita de enfoques distintos que actúen en ámbitos distintos, y atraviesen ámbitos disciplinares distintos y también distintas dimensiones (cognitiva, emocional, pragmática), capaces de engendrar aprendizajes para la vida y de empezar procesos de crecimiento y de cambio.

Un plan que, de forma estratégica, puede ayudar para solucionar la dificultad de producir aprendizajes significativos y duraderos, puede ser representado por recorridos e itinerarios de investigación en "educación medioambiental", capaces de conjugar el saber, el saber hacer y el saber ser.

De hecho, el entrelazamiento formativo entre conocimiento y experiencia, identidad y medio ambiente, valores y cambio, hace posible que una enseñanza y un aprendizaje (es decir, un sistema escolar como contexto formal de conocimiento) "ecosistémicos" motiven decididamente hacia la adopción de la "metáfora del medio ambiente" como paradigma estratégico de las decisiones educativas, axiológicas y didàcticas.

En el amplio contexto de la *teoría ecológica del desarrollo*, una de las posibiles vías de investigación didáctico-educativa es la que se origina en el intento de un enfoque anclado en el asunto de la diversidad, que de un lado lleve a la conciencia de la enorme importancia del respecto y del valor de la *biodiversidad natural* y del otro a una paulatina costrucción de relaciones significativas desde el punto de vista de la educación intercultural, fundamentadas en la *solidariedad* y en la *reciprocidad*, en la comparación y en el diálogo entre sujetos diferentes por características individuales o socio-culturales.

La biodiversidad para una cultura medioambiental nueva

El término "biodiversidad" ha aparecido en la literatura científica internacional a finales de los '80 y se ha difundido con una rapidez extraordinaria.

Utilizado por primera vez por el científico americano Walter G. Rosen en el mes de septiembre de 1986, con la ocasión de la conferencia "National Forum on BioDiversity" en Washington, como consecuencia de muchos estudios e investigaciones, el término ha adquirido un sentido más ancho del originario hasta incluir hoy no sólo los *ecosistemas* sino que también los *paisajes*, las *regiones biogeográficas* y la misma *biosfera*.

Además de las definiciones y de las profundizaciones técnico-científicas el asunto de la *biodiversidad* amplía cada vez más sus horizontes de investigación epistemológica, como ya se ha dicho, hasta llegar a tomar en cuenta el respecto y la defensa de las diversidades culturales, cuya salvaguardia es ya insoslayable, otorgando una contribución eficaz y soporte a la pedagogía y a la didáctica interculturales.

En efecto, a partir del conocimiento de los profundos mecanismos biológicos que actuan en la naturaleza, permite ofrecer a las generaciones futuras ejemplos indelebles de vida relacional, de modelos de solidariedad, de desarrollo social; en resumen, permite establecer una insustituible unión de la tutela (rescate, conservación, valoración) del ambiente con la evolución intelectiva de una población.

Estudiar e investigar la biodiversidad tiene, por lo tanto, mucho valor formativo, no sólo en la construcción del pensamiento científico, sino que también en todos los procesos de educación para el pensamiento "complejo" y el pensamiento "ecológico" que tendrían que ser privilegiados en la educación hodierna y en la futura (Morin E., 1993).

No son pocas las dificultades que su naturaleza multidimensional y compleja origina en la comunicación didáctico-pedagógica, si no se tienen los necesarios conocimientos y la capacidad de "leer" las relaciones e interacciones socioculturales y medioambientales, además porque a menudo permanece atada a las significaciones que las distintas tradiciones culturales o el sentido común, muchas veces estereotipados, le atribuyen.

Interpretar y vivir la *biodiversidad natural* y *cultural* significa llegar a conocerla preguntando, investigando y buscando relaciones (y actitudes nuevas), construyendo conocimientos científicos coherentes y estructurados,

y comprometendose en el ámbito didáctico-pedagógico y ético-social, sin miras de asimilación y con vistas a un desarrollo recíproco fundamentado en la solidariedad.

En este caso, es más preciso que nunca desarrollar una "mediación intercultural" (entendida como diálogo entre poblaciones y culturas distintas) en una perspectiva educativo-medio ambiental creando posibilidades concretas de integración y convivencia de cada persona con el grupo social.

Recorrer este camino significa pasar del *descubrimiento* del "propio medio ambiente" – entendido en sentido local y también planetario – al *conocimiento* de sus características y de las condiciones que lo hacen aceptable para nosostros y para las generaciones futuras, para llegar después ad un nivel de *juicio*, de interés, de actitud "proactiva", de tutela y de valoración (Perucca A., 1998).

La acción sinérgica de la escuela, de las instituciones, en los contextos locales, nacionales e internacionales se manifiesta asì fundamental para guiar los jovenes en proteger, preservar o curar pero, también y sobre todo, en construir relaciones significativa y auténticamente empáticas hacia con el *otro*, el *distinto*, el *lejano* de sí.

Programas e itinerarios de educación ambiental en una perspectiva intercultural pueden promover una conciencia (aunque sólo intuitiva y analógica) y, al mismo tiempo, valorar el esfuerzo para la consecución de un estilo de vida responsable y virtuoso, hacia el medio ambiente *cercano*, y por eso, en su acepción sistémica, también hacia el medio ambiente *lejano*, iniciando relaciones solidarias con el otro *distinto*, *cercano* o *lejano*.

La propuesta pedagógica y cultural sobre la *diversidad*, privilegiando las diferencias (como valor), pero también los nexos y las características socio-antropológicas de las comunidades locales y del ambiente natural, tiene que negarse a generalizar la homogeneidad, animando, de un lado, las usuales experiencias de tipo científico-naturalista y, por el otro, impulsando la educación a la percepción y a la reflexión consciente, desde los niveles más inmediatos y reducidos (diversidad de las *especies*, expresión de *diversidad genética*, de *diversidad entre especies o grupos*, ...) hasta llegar a niveles más complejos.

La desaparición, o el empobrecimiento de la *biodiversidad* es un problema de enorme relieve, que tiene que ser encarado con la máxima consideración en la relación educativa según el *principio de responsabilidad* (Jonas H., 2002).

Las *extinciones naturales* integran la historia de la vida en el planeta Tierra, pero un número cada vez mayor de especies està extinguiendose con una rapidez nunca vista hasta ahora en la historia del planeta, por efecto de la acción humana: polución, excesivo consumo de recursos, destrucción del hábitat, ...etc.

La meta de la estabilidad de los ecosistemas naturales y humanos es una perspectiva lejana del vivir cotidiano y, generalmente, no es percepida en el tiempo de una generación; para llegar a ser concreta y patrimonio

cultural permanente, hace falta "rociar" la educación no sólo con conocimientos sino también con formas nuevas de pensamiento y nuevas actitudes responsables y éticas.

La educación ambiental de marco intercultural, íntimamente relacionada con la *biodiversidad*, lleva al reconocimiento de la *variedad* e de la *diversidad* como "valores en sí mismos" a promover y respectar, obligando a revisar crítica y profundamente las muchas y cotidianas manifestaciones de intolerancia, incomprensión, intersujetiva e intergrupal, las persistentes acciones de discriminación, los evidentes desequilibrios entre grupos sociales, entre las culturas ricas y variadas y las culturas del silencio, olvidadas y desanimadas.

La recuperación de la conciencia de la susistencia de una relación real con el amplio contexto medio ambiental, como ecosistema del que el hombre hace parte de forma insoslayable, y en el que nada y nadie puede ser aislado y autosuficiente, representa el desafío educativo y formativo para la humanidad del Tercer Milenio.

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DALLA BIO-DIVERSITA ALLA CONIUGAZIONE DELLE DIFFERENZE COME MODELLO DI ESISTENZA

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Il tema della *diversità* in pedagogia comporta, tra i tanti, due ambiti di riflessione che, pur rivenienti da numerose difficoltà operative, tendono ad intersecarsi:

- come fare affinché l'incontro tra *diversi* diventi occasione di scambio e di crescita, e non di scontro e di conflitto;
- come fare affinché la *diversità* risulti fonte di ricchezza, di arricchimento reciproco e non sia, invece, generatrice di problemi e di difficoltà spinte a tentativi di omologazione.

Il modo di affrontare le singole difficoltà, legate alla coniugazione delle diversità, si è concretizzato, sinora, in tentativi educativi finalizzati al riconoscimento del "diritto alla differenza".

Tale approccio si è risolto nella costruzione di un sapere troppo legato alla conoscenza, che si è venuta progressivamente a consolidare come valore centrale della cultura moderna e principio portante della società dell'informazione; conoscenza incapace, tuttavia, di tradursi in condotte generatrici di competenze stabili e durevoli nel tempo.

Un'educazione che guardi alla complessità della società e della cultura che, da essa e per essa, venga generata, postula approcci diversificati che operino su più piani ed attraversino non solo più ambiti disciplinari ma a più dimensioni (cognitiva, emotiva, pragmatica), capaci di generare apprendimenti per la vita e di innescare processi di crescita e di cambiamento.

Un piano che può risultare strategicamente determinante della condizione di difficoltà nel generare apprendimenti significativi e durevoli, può essere rappresentato da percorsi ed itinerari di ricerca in "educazione ambientale", capaci di coniugare il *sapere* col *saper fare* e col *saper essere*.

L'intreccio formativo tra conoscenza ed esperienza, identità ed ambiente, valori e cambiamento, permetterà, infatti, ad un insegnamento e ad un apprendimento (quindi, ad un sistema scuola, come contesto formale di conoscenza) "ecosistemico" di instaurare forti motivazioni per l'adozione della "metafora dell'ambiente", quale paradigma strategico di scelte educative, valoriali, didattiche.

Nell'ampio contesto della *teoria ecologica dello sviluppo*, una delle piste di ricerca didattico-educativa possibili è il tentativo di un approccio legato alle tematiche della diversità che, da una parte, conduca alla

consapevolezza dell'enorme importanza del rispetto e del valore della *biodiversità naturale* e dall'altra, una graduale costruzione di relazioni educativamente significative sul versante interculturale, fondate sulla *solidarietà* e sulla *reciprocità*, basate sul confronto e sul dialogo di soggetti differenti per caratteristiche individuali e/o socio-culturali.

La biodiversità per una nuova cultura ambientale

Il termine "biodiversità" è apparso inizialmente nella letteratura scientifica internazionale alla fine degli anni ottanta diffondendosi con una straordinaria rapidità.

Usato per la prima volta dallo scienziato americano Walter G. Rosen nel settembre 1986, in occasione della conferenza "National Forum on BioDiversity" a Washington, il termine, in seguito a numerosissimi studi e ricerche, ha allargato il suo significato originario estendendolo al di là degli *ecosistemi* fino ai *paesaggi***,** le regioni *biogeografiche* e la stessa *biosfera*.

Al di là delle definizioni e degli approfondimenti tecnico-scientifici la tematica della *biodiversità* allarga sempre più i suoi orizzonti di ricerca epistemologica, come si è detto, anche al rispetto e alla difesa delle diversità culturali la cui salvaguardia è oramai ineludibile, fornendo un efficace contributo e sostegno alla pedagogia e alla didattica interculturale.

Partendo dalla conoscenza dei profondi meccanismi biologici operanti in natura, infatti, consente di fornire alle future generazioni esempi indelebili di vita di relazione, di modelli di solidarietà, di sviluppo sociale; in sintesi, a stabilire un insostituibile connubio tra la tutela (recupero, conservazione, valorizzazione) dell'ambiente e l'evoluzione intellettuale di un popolo.

Studiare e indagare la biodiversità ha, quindi, un alto valore formativo, non solo nella costruzione del pensiero scientifico, ma in tutti i processi di educazione al pensiero "complesso" ed al "pensiero ecologico" che dovrebbero essere privilegiati nell'educazione di oggi e nell'educazione del futuro (Morin E., 1993).

La sua natura multidimensionale e complessa pone non poche difficoltà nella comunicazione didattico-pedagogica, senza le conoscenze necessarie e le capacità di "leggere" relazioni e interazioni socio-culturali e ambientali anche perché, spesso rimane legata ai significati che le attribuiscono le diverse tradizioni culturali o il senso comune, spesso stereotipate.

Interpretare e vivere la *biodiversità naturale* e *culturale* significa, attingere alla sua conoscenza interrogandosi, indagando e cercando relazioni (ed atteggiamenti nuovi), costruendo conoscenze scientifiche coerenti e strutturate e impegnandosi sul versante didattico-pedagogico ed etico-sociale, senza pretese di assimilazione, in vista di uno sviluppo reciproco improntato alla solidarietà.

In questo senso, diventa quanto mai necessario sviluppare una "mediazione interculturale" (intesa come dialogo tra popoli e culture

diverse) in una prospettiva educativo-ambientale e realizzando concrete possibilità di integrazione e di convivenza di ogni individuo con il gruppo sociale.

Percorrere questa strada vuol dire passare dalla *scoperta* del "proprio ambiente" - inteso in senso locale e, via via planetario - alla *conoscenza* dei suoi caratteri e delle condizioni che lo rendono sostenibile per noi e per le future generazioni, per accedere ad un livello di *giudizio,* di interesse, di disposizione "proattiva", di tutela e di valorizzazione (Perucca A., 1998).

L'azione sinergica della scuola, delle istituzioni, nei contesti locali, nazionali e internazionali diventa fondamentale nell'orientare le giovani generazioni non solo a proteggere, preservare o curare ma, anche e, soprattutto, a costruire relazioni significativamente e autenticamente *empatiche* con l'*altro*, il *diverso* e il *lontano* da sé.

Programmi e percorsi di educazione ambientale in un'ottica interculturale possono promuovere una consapevolezza (pur anche solo) intuitiva ed analogica e, nello stesso tempo, valorizzare lo sforzo per l'acquisizione di uno stile di vita responsabile e virtuoso, sia verso l'ambiente *vicino* e, quindi, nell'accezione sistemica, anche verso l'ambiente *lontano*, attivando relazioni solidali con l'altro *diverso*, *vicino* o *lontano*.

La proposta pedagogica e culturale sulla *diversità,* privilegiando le differenze (come valore) ma anche le connessioni e le caratteristiche socio-antropologiche delle comunità locali e dell'ambiente naturale, rifiuterà di generalizzare l'omogeneità culturale, incoraggiando, per un verso, le consuete esperienze di tipo scientifico-naturalistico e, dall'altro, stimolerà l'educazione alla percezione ed alla riflessione consapevole, a partire da livelli più immediati e meno vasti (diversità all'interno delle *specie*, espressione di *diversità genetica*, *diversità tra specie o gruppi*, ...) per finire a livelli più complessi.

La scomparsa, o il depauperamento della *biodiversità* è un problema di enorme rilievo, che deve essere affrontato con la massima considerazione nella relazione educativa secondo il criterio di *responsabilità* (Jonas H., 2002).

Le *estinzioni naturali* fanno parte integrante della storia della vita sulla Terra, ma un numero sempre maggiore di specie si sta estinguendo con un tasso di perdita senza precedenti nella storia del pianeta, per effetto dell'azione antropica: inquinamento, eccessivo prelievo di risorse, distruzione degli habitat, ecc.

Il traguardo della *stabilità degli ecosistemi naturali e umani* è una prospettiva lontana dal vissuto quotidiano e, generalmente non percepita nell'arco di una generazione; per diventare concreta e patrimonio culturale permanente, occorre "irrorare" l'educazione, non solo di conoscenze ma anche, di nuove forme di pensiero e di nuovi atteggiamenti responsabili ed etici.

L'educazione ambientale di marca interculturale, intimamente connessa con la *biodiversità*, porta al riconoscimento della *varietà* e della *diversità* come "valori in sé" da promuovere e rispettare, costringendo a ripensare criticamente e profondamente alle molteplici e quotidiane manifestazioni di intolleranza, di incomprensione, intersoggettiva ed

intergruppale, alle persistenti azioni di discriminazione, ai vistosi squilibri tra gruppi sociali, tra le culture ricche e articolate e le culture del silenzio, dimenticate e depresse.

Il recupero della consapevolezza della reale dimensione relazionale con il più ampio contesto ambientale, quale ecosistema di cui l'uomo è parte inscindibile e nel quale nulla e nessuno può essere isolato e autosufficiente, costituisce la sfida educativa e formativa dell'umanità del Terzo millennio.

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REORIENTING HIGHER EDUCATION TOWARDS AN EfS PERSPECTIVE THE DESIGN AND DEVELOPMENT OF TWO SYLLABUSES IN MASTER PROGRAMMES OF THE UNIVERSITY OF MINHO (PORTUGAL)

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Stressing the importance of reorienting formal education (at all levels), towards an Education for Sustainability (EfS) perspective, we will present the design and the participative development of two syllabuses in two different Master Programmes of University of Minho, according to a Problem-Based Learning (PBL) approach: a) "Health, Environment and Sustainable Development" in the Master Programme of Health Education; b) "Environment and Health" in the Master Programme of Environmental Sciences. In direct relationship with some general competences, objectives and contents previously established, the development of the syllabuses started with students' suggestion and selection of some problems (Problem Market activity). Divided into groups of 3 to 5, students worked together in order of solving the problems. The syllabuses development combined collaborative group work with discussion sessions (namely for debating the solutions suggested by each group) and lectures.

Throughout the course, each student elaborated a reflexive diary and/or a portfolio. In order of empowering the outcomes of the experience we finish the process with a collective reflection and an individual evaluation.

21. Degree in Biology, Master and PhD in Education.

CASE-STUDIES FOR EDUCATION IN SUSTAINABLE DEVELOPMENT IN AUTOMATIC CONTROL

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Abstract

In this work we present a case-study teaching material suitable for Automatic Control Engineering career that can be used for teachers as well as students. The material has a web format with pictures, links and self-evaluation pages.

Keywords: Case-study methodology, didactic material, e learning, multimedia.

Introduction

The Automatic Control studies have a very close relationship with the industrial world. This proximity makes suitable the use of case studies to close the gap between students and professionals. The task of educators is to choose adequate cases to show to the students the relevance of their decisions when they will get positions of responsibility in companies. Their decisions have to make more sustainable industrial processes, generating few wastes, consuming little energy, using recyclable materials, using few raw materials to produce goods, and other precepts of interest for a sustainable development as well as introducing good ethics. For this reason, in the paper we present a very useful tool to complement the teaching of automatic control studies.

This tool is addressed to teachers as well as to students, and it is in electronic format, that is, in a web page format. The cases have been split into four main sub-areas (Industrial Computer Technology, Modelling and Control Theory, Control Technology and Automation, Industrial Robotics.) in order to clarify the organization. Each case has the following structure: a short theoretical introduction, the real case remarking the impact in the environment or in the society, and some solutions or recommendations, some of the cases also incorporate a self evaluation test and the most relevant references.

These case studies are included in an interactive CD or DVD or in the environmental website of the UPC. We, the authors of the case-study tool, also make some recommendations to teachers on how to use it, how to emphasize and how to assess the impact at the student. The result demonstrates that the degree of awareness of student for sustainable development has risen after the use of the tool. Besides the case studies, some sustainable laboratory practices are also presented with the object to be taught to students.

Methodology and Description

Control engineering is based in the fundamentals of feedback theory and the analysis of linear systems, and it integrates the concepts of network theories and communications (Dorf, 1998), (Eronini, 2001), (Ogata, 1993). Thus, this area is not limited to any discipline in engineering, and it also can be applied to aeronautical engineering, chemical, mechanical, environmental, medical, civil and electrical. In fact, the curriculum greening in Control and Automatic Engineering follows the same path that others matters, because the concepts and basic descriptors of courses are not modified, including sustainable criteria in the theory, problems, exercises and laboratory practices, either by of environmental applications as through solutions respectful with the environment.

Subjects must be greened homogenously with the same methodology and with the following actions.

Through a problems compilation along the academic year and the proposed examples in the classroom. Theses examples and exercises have to be 'for the sustainability' (or sustainable) and they could be proposed as:

- Exercises of control systems with environmental applications (where the plant is, i.e., a cleaning water central).
- Exercises where the criteria to design the controller are green (minimal consumption of water, energy) and to achieve a big energetic safe and a better natural resources management. The control systems can also use renewable energy sources.

Through the implicit introduction in the syllabus of environmental themes without changing the basic theory contents, explaining environmental applications and sustainable solutions to typical problems in every subject, for example:

- Applications related with the environment in robotics systems, such as automatic disassembling, waste cleaning.
- To take into account the possibility of using recyclable materials and components.
- To choose devices fulfilling some environmental specifications.

Through the greening laboratory practices.

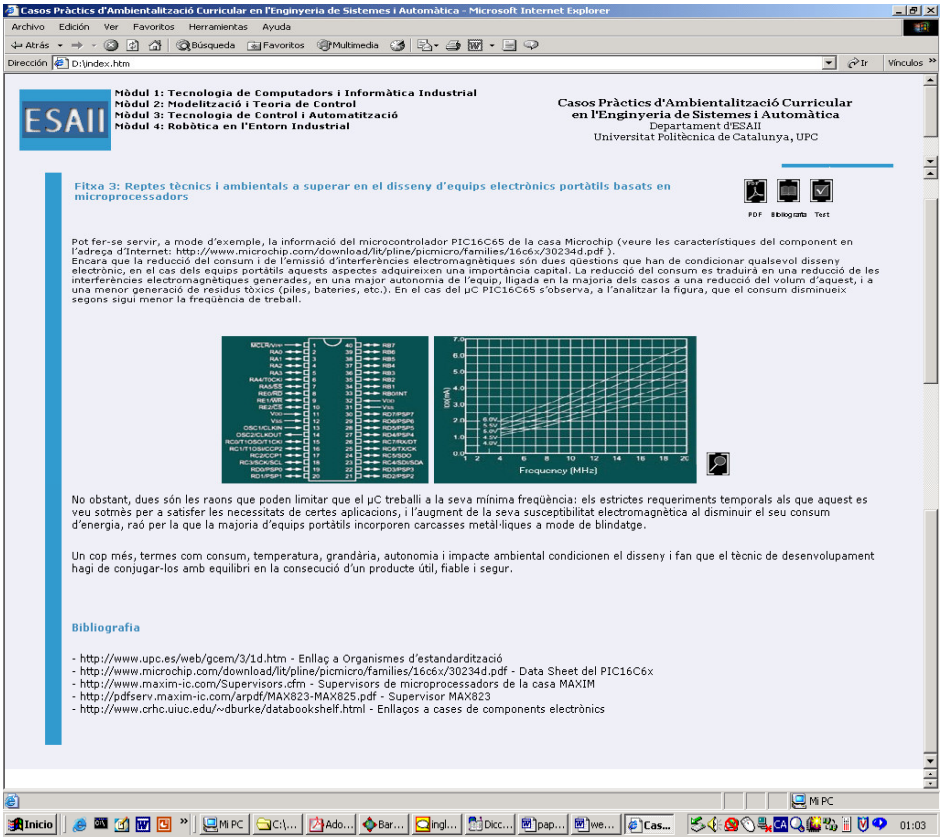

Fig.1. Case-study tool layout. In this example, technical and environmental challenges to overcome in the design of portable electronic equipments based on microprocessors

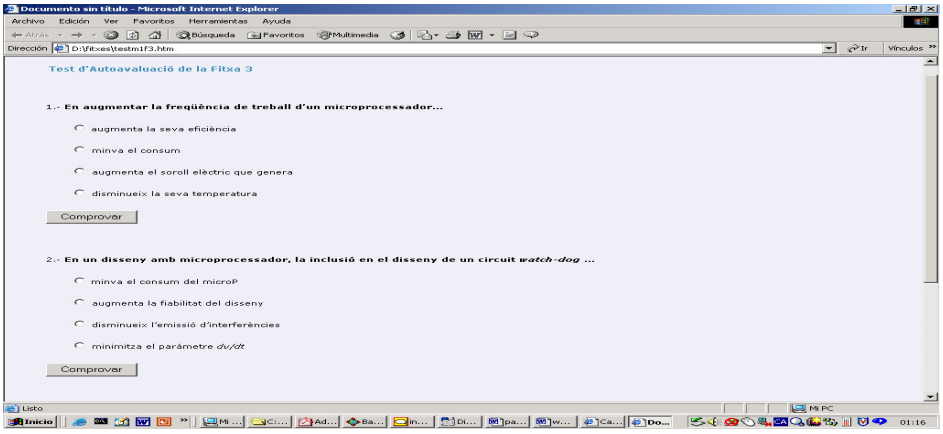

Fig.2. Self-evaluation form for the case study of the Fig.1.

The Automatic Control Dept has been working for several years in the edition and publishing of teaching materials that could be useful for introducing environmental issues in their regular subjects. An example is the Environmental Curricular Plan, (Grau, 2002), addressed to lecturers, where different publications have been done, (Grau, 2005). Now, a new step is presented in this paper.

The case-study tool has been delivered to the Automatic Control Dept, with a teaching staff of sixty-five people. After one year of evaluation use, only 15% of lecturers have introduced sustainable concepts in their subjects, a very low rate if we think that everybody recognizes the importance of environment and sustainability. But, the one hundred percent of lecturers that decided introduce these kind of concepts, have use this tool and they recognize its effectiveness. We are already working in its second edition, incorporating more cases based on real environmental problems. In the UPC web page, (http://www.upc.edu/mediambient), the complete version of this case-study tool can be found. The tool has been done completely in HTML language and it can be used in any computer with a web browser. The attached document to the case studies pages are in pdf format, also a format with free reader programs.

Acknowledgments

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A PRACTICAL COURSE TO ENGAGE UNIVERSITIES TO ESD

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Abstract

Nowadays, the awareness about sustainable development is increasing substantially all over the world as well as in all the activities we do. Even though people individually are aware, it does not happen the same with the collectivities, and particularly not all the Universities have the Education on Sustainable Development (ESD) considered as a goal. For this reason, we propose a practical course addressed to those Universities that need: first, to initiate the process of incorporating ESD and ethical values in their careers; and, second, to put in practice some slogans and good intentions but that have never been carried out. It is of special relevance to compile the obstacles to overcome before the objectives could be achieved. Finally, some assessment methods are mentioned in order to evaluate the degree of SD implantation in each university.

Keywords: ESD, environmental and sustainable development, practical course, university administrators.

Objectives

At the Automatic Control Dept in the Technical University of Catalonia, we have designed a course entitled "Introducing ESD at the University", which objectives are:

- To initiate the Education on Sustainable Development (ESD) in regular careers as well as ethical values in the Universities without a tradition on ESD.
- To empower and improve Education in those Universities with a tradition on ESD.

The course is addressed mainly to faculty, but the experience demonstrates that students, staff and administrators have to receive it for transforming the environmental and sustainability awareness into a set of real actions at the University. The effectiveness of the course will depend on the degree of engagement of the different groups involved in the course.

The idea is based on the picture in figure 1, which shows the relationship among the different stakeholders involved within the University as well as the external community. We have defined the next steps as the methodology to follow the course and execute the linked actions:

- To identify who are "key people".
- To promote actions to be done for the key people in order to create a strong network in the University.
- To propose actions to motivate the other university's stakeholders for integrating sustainable development in their activities.
- To identify the weakest points among the stakeholders: the obstacles.
- To assess the whole process.

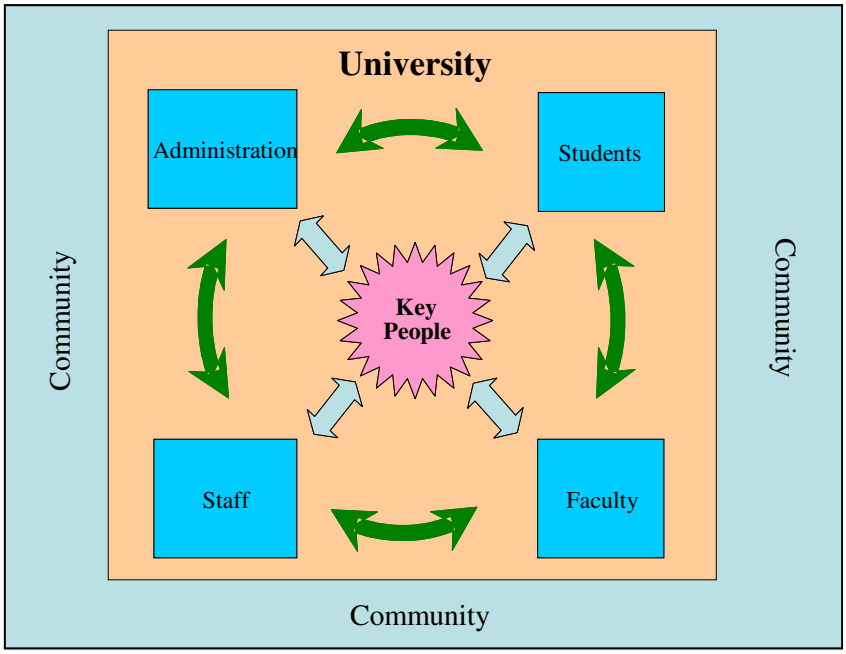

Fig. 1. Relationship among the different stakeholders at the University's system.

Methodology

In this section, for each objective the different actions to take are described. It is of special interest to identify who are the key people, because they will promote the introduction of sustainability concepts in all the university's activities, ranging from the ESD to a sustainable campus's life.

STEP 1.

a) Who are Key People?
- Enthusiastic and open people with a deep interest in sustainability.

b) Actions to take for KP:
- Sharing experience in ESD
- Think-tankers
- Attract new key people (faculty, students, staff, administrators, community leaders...)
- Involve professional associations on SD actions
- Attract external funding

STEP 2. **The Strong Network**

- Networking: eco-breakfast, coffee, lunch, home dinner
- Talk to stakeholders: faculty, head of dept, dean, provost, rector, president, head of EHS, food services
- Seminars, panels, round-table
- Media access
- Advertising board (eco-board)

STEP 3 and 4.

In the following table, the actions to take with each group are shown as well as the obstacles that will be found.

Faculty	Students	Administration	Staff
Engaging in			
• Education • Curriculum development • Itinerant professor (at department level) • Faculty development seminar • Motivation through lectures • Service learning Research	• Education • Student forum for SD • Invited Lectures: guest speaker • Service learning on SD: credit awards • Curriculum development: laboratory practices • Env. Projects: credit awards • Contact with itinerant professor	• Compliance issues • Environmental Health and Safety (EHS), assurance to campus and community environmental protection • Formal agreements for SD • Public exposure/relations/media = image • Cost-saving sustainable practices • Green campus: bike,	• Recognition and reward system • Appreciation • Creation of a reward structure • Compliance implementation • Purchasing food & supplies policy: e.g. Reusable Utensils • Energy management

• Faculty incentive and awards • Thesis/Project Topic: Heavy Env. And SD component Others • Media publication (newspapers, webs, radio station,)	Others • Oikos, students associations and unions, environmental clubs • Second-hand market • University publication (magazine, journal, news-paper) • Social events: competition, exhibitions, contests on SD • Environmental film festival • Sustainable week (inc. Earth day, no-car day,)	flex car, compost, solar cells, efficient illumination, native plants, properties interchange) • Change of habitudes (habits + attitudes) • E-mail communication instead of hard copy, • Agreement University-Government • Relationships among Universities	• Recycling infrastructure • Staff forums • Invited staff lectures • Information courses for SD
Obstacles			
• Lack of Time • Insufficient Funding • Poor Communication among stakeholders • Lack of spirituality /enthusiasm • Institutional inertia (laziness) • Lack of reward system that recognizes contributions to sustainable development	• Time: • Study, work, family, mobility, recreation • Lack of enthusiasm • Limited funds	• Image • External pressures • Budgetary constraints • Institutional inertia	• Impression of lack of value • Inertia (personal, institutional): "It's always been done that way" • Perception of being overworked • Budgetary constraints

STEP 5. The assessment

a) Quantitative
- Number of subjects, BSc, MSc and PhD Thesis including ESD concepts
- Transfer of technology in environmental and sustainable issues
- Other quantifiable issues

b) Qualitative
- Perception of doing the right thing

Acknowledgments

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SUSTAINABLE DESIGN EDUCATION FOR FUTURE ARCHITECTS

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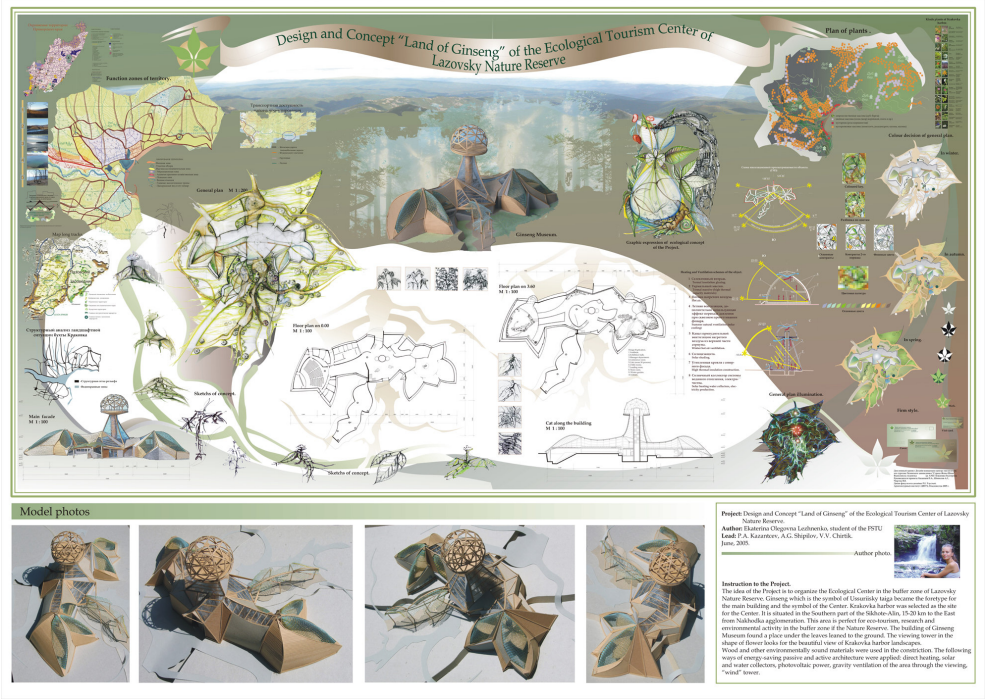


C. "Land of Ginseng" - Ecological tourism center. Diploma project, 2005. Author - E.Lezhnenko. Poster size 2.0 x 4.0 m., model.

Working for sustainable future last five years in Architectural institute of Far East State Technical University (Vladivostok, Russia), after learning the theoretical course, students design passive architectural forms. Theoretical course of Architectural Climatology (third year students, 65-75 pupils every spring; lecturer Ph.D. Pavel A. Kazantsev) describe the main principles of Green design (with the exception of natural constructions and plasters). More attention in my lections I give to modification of microclimatic conditions of open and closed space using previously architectural forms. First of all the change of wind and insolating mode of open spaces by means of architectural corrects its other meteorological

dates: temperature and damp conditions, the mode of rainfalls, and also directly influences the comfort of adjoining close spaces.

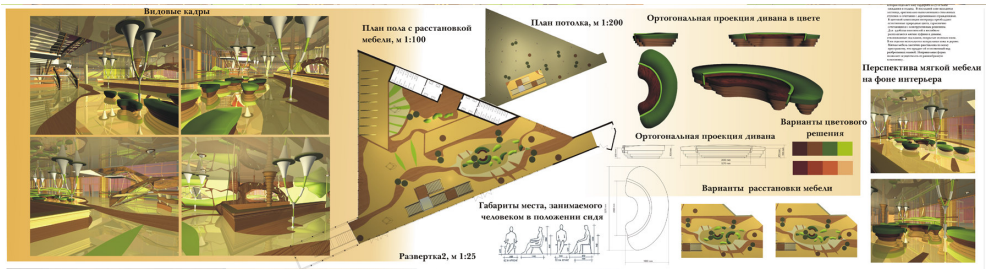
During next three years one group of students (20-25 pupils) are master green design principles in practice. Compulsory "green" design steps from simple forms to diploma drought include:

A. Design simple architectural form with wind-break and solar heating possibility. Covers for kindergarten for 10-12 children's (third year student projects, spring). Compulsory practice in framework of theoretical course.
B. Design passive heating and cooling, hot water and space heating by solar water collectors; wind-break design of building and site. Low store dwelling or single family house (four year student project, spring). Compulsory use all methods of passive and active solar design. May be natural constructions and plasters.
C. Complete design of sustainable building options. Diploma project of public building or out-of-town complex (six year student project, autumn-spring). The main part of diploma projects besides draughts is research essay about Green design principles.

In this year all five year students begin their compulsory design of sustainable City Hall and Ecology Tower for Vladivostok. There were the projects of sustainable Landscape design center only for advanced five year students two years before.

A. Simple "Green" architectural form. Three year students practice work.

B. Passive and active solar heating study. Four year student's project. Poster size 0.8 x 1.6 m., model. T.Belousova (1), E.Lezhnenko (2), 2003.



Bionic view of Landscape design center interiors. Five year student's project.
Author: Tatjana Belousova, 2004 .

Diploma project. Educational and research center of Sustainable design.
Author: Tatjana Belousova, 2005. Poster size 2.0 x 4.5 m., model.

The mover conception of a volumetric lay-out composition IGUANA, which is lying on hill and basking in the sun, and also the microclimate of the plot-the-top of the southern downhill which is blown off by strong winds, deeply demonstrated us the usage of "Green architecture" in the building volume's decision of Sustainable design center.
There where three "Green" graduates groups for the last five years: 2001, 2003, 2005 (June) – almost 50 students. And one group of 20 students will be in future – 2007, June. All projects design for local climatic conditions of south Primorye, Russian Far East.

RESEARCH PROJECT: THE CURRICULUM GREENING PROCESS IN COMPULSORY EDUCATION

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This research, coordinated by the Research Group on Scientific and Environmental Education (University of Girona, Spain) is carried out thanks to the financial support of the Ministry of the Environment and Housing and the Ministry of Education of the Government of Catalonia. The Environmental Education Catalan Society also takes part in the research team, as well as teachers from pre-school, primary and secondary schools engaged in the "Green Schools Program".

Objectives

The main goals of the project are:

- To define the concept of a curriculum greening and its characteristics in pre-school, primary and secondary education (compulsory education).
- To design concrete actions and generic proposals towards the improvement of the curriculum greening in all the stages of the compulsory education.
- To organize a shared workspace including all the different levels of education.
- To define the quality criteria in a greened curriculum and evaluative strategies as well.

This project, considered as an action-research process for all the parts involved, is articulated on the basis of three seminars and, between them, internal work in the educational centres in order to allow other teachers to participate. This process consists in interdisciplinary, collaborative and participatory work aiming at the elaboration of common shared papers answering the main goals proposed.

The first seminar aims are:

- To define the curriculum greening process in compulsory education.
- To define the key elements of this process and iii) to define its characteristics.

The first results are discussed in all the educational centres involved in the project in order to approve the definitive version on the second seminar, which main goals are.

- To propose actions to improve the curriculum greening process.
- To elaborate generic proposals which will be discussed in the centres.

During the third seminar the definitive common and shared papers are elaborated, as well as the evaluation of the whole process. In addition, participants also decide the communication plan to show the process and its results beyond the parts involved.

Definition of Curriculum Greening Process made by seminars' participants.

The curriculum greening is a reflexive and active process focused on reaching an education for a sustainable development in the curricular display, linked to the educational centre management and orientated in promoting a more equitable, solidarious and participatory society.

The curriculum greening process should permit a social-environmental reality analysis and the research of alternatives according to sustainability values. The curriculum greening process embraces all knowledge fields and promotes actions involving all kind of institutions.

The curriculum greening process means acquiring global thinking competences related to the environment and encourages responsibility, commitment and action of the educational community towards the development of environmental identity signs (trets d'identitat).

Methodology

This research project is based on a participatory and collaborative work model, developed through democratic and flexible work teams, which are created by participants owns initiative.

The dynamics of the work teams is based on the dialogue and shared goals, and the personal expertise and contributions of every component.

On the other hand, plenary sessions, in which all the teams' work is shared and discussed, are crucial for the process development. In these sessions, the discussion and reflecting based on the elaborated materials, leads to integrate diversity into a shared concept construction.

During all this process, the GRECA (Research Group on Scientific and Environmental Education) coordinates all different work teams and plenary sessions, as well as the work carried out between seminars.

Our methodological references are:

- Qualitative-Inductive research models
- Participatory action research
- Nominal groups work
- The own research as a reflective and creative process of all agents that are involved.

First provisional results (summer 2005): Curriculum Greening Process, characteristics.

- Methodology that promotes creative, critical and solidary thinking and action.
- Expressing ideas about the greening process and sustainability in the official educational documents of the centre.
- Coherence, linkage and contextualization with a sustainable management of the centre.
- Communication between the educational community and its social environment
- Assessment and valuation according to an environmental thinking.
- Existence of participatory mechanisms with the involvement of different institutions and agents.
- Individual and collective work at different scales: local, regional and global.
- Concretion of strategies addressed to an educational action.
- Interpretation of the reality as a complex and changing system.
- Interdisciplinary and incorporation of the environmental dimension in the curriculum content.

Flexible and adaptable process to the centre owns reality.