Educational material

Waste
in our life

Educator's book

European Commission
DG Environment

United Nations Environment Programme
Mediterranean Action Plan

United Nations Educational, Scientific and Cultural Organization (UNESCO)
United Nations Decade on Education for Sustainable Development (UN DESD)

Greek Government
Ministry of National Education & Religious Affairs
Ministry of Environment, Physical Planning and Public Works

National Kapodistrian University of Athens

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Waste
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Argyro Alampei & **Michael Scoullos**

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Preface

The current English educational material is actually the second updated and enriched edition of the first Greek material prepared by MIO-ECSDE, which was targeted to Greek educators and students of secondary level (Scoullos & Papadopoulos, 2003). The pilot implementation of this material in several Greek high schools during 2003 and 2004 gave useful input for amendments. The translated first draft was prepared in English in 2004.

Further to a wide e-mail consultation for the elaboration the English version, 23 experts of the *MEdIES Task Group* met in order to discuss and work on its revision. These experts, many of which represented NGOs, made concrete comments and suggestions for improvements. They proposed resources to be included referring to waste management in their countries, in order to move to a 'Mediterranean-wide' background resource, including waste topics and examples of the entire region. All this material was collected, assessed and incorporated in the original draft.

'Waste in our life' in this thoroughly revised and enlarged edition attempts to serve as an appropriate tool to facilitate formal and non-formal educators engaged in EE & ESD programmes, who work with the -not so attractive- topic of wastes, providing background information and knowledge resources, a collection of pedagogic activities, as well as methodological guidelines for its implementation.

The material is primarily targeting students of secondary level; however, it may be applied to other interested groups (e.g. women, youth, primary school pupils etc.). That is why the material offers possibilities to be adjusted in each case to the learners' skills, interests and needs, to the educators' experience and personality, to the varying national curricula as well as to national and local conditions.

Prof. **Michael Scoullos**,
Chairman, MIO-ECSDE

Greeting Messages

EU Commission for Environment

Waste management is an important policy area for the European Commission. Over the past 30 years, the European Union has introduced a range of laws that protect human health and the environment from waste, the transport of waste and potential pollution from major waste facilities such as landfills or incinerators. In my time as Commissioner, I have brought forward new policies to move the EU towards a recycling society - one in which waste should be prevented as far as possible, and otherwise re-used or recycled.

Waste is one of the environmental issues that are most visible to citizens and has a direct impact on their lives. It is also an area where citizens can do much to improve the situation, for instance by preventing the generation of waste with their decisions as consumers and separating the waste they do produce to make it easier to reuse or recycle.

To achieve the full potential for prevention and recovery we have to educate people about the difference they can make and the simple everyday actions that together can have a big impact.

I therefore very much welcome this educational pack, which will contribute to this effort by helping to explain some of the main issues relating to waste and what can be done to ensure that waste does not damage the environment.

Mr Stavros Dimas · EU Commissioner for the Environment

United Nations Scientific & Cultural Organisation (UNESCO)

As the lead agency for the promotion of the United Nations Decade of Education for Sustainable Development (UNDESD), UNESCO welcomes the efforts of MIO-ECSDE in promoting education for sustainable development in the Mediterranean, which is crucial to ensure the long-term protection of the highly diversified, yet particularly fragile Mediterranean ecosystems.

UNESCO particularly appreciates this educational initiative since it addresses the fundamental issue of sustainable consumption and production issues and highlights the importance of sustainable waste management options as pre-requisites for the future sustainability of both natural resources and global economy.

This educational package has an important role to play in educating the young generation on the impacts that lifestyle consumption habits have on our society and the environment and creating a more critical and responsible attitude towards consumerism in our everyday lives.

As such, it represents a valuable contribution to the pursuit of the main goal of the UNDESD, that is, to encourage changes in behaviour that will create a more sustainable future in terms of environmental integrity, economic viability, and a just society for all.

Koïchiro Matsuura · Director-General of UNESCO

The League of Arab States

By virtue of the geographical location of the Arab world, cooperation and partnership among the Arab countries and their neighbours in the Mediterranean, African and Asian space have become imperative in order to face the major challenges in the world.

The League of Arab States, like MIO-ECSDE, is fully convinced that education, environmental protection, the availability and rational use of natural resources which are closely linked, form one of the main challenges that should be urgently addressed.

The Arab world is afflicted by shortage of water, environmental pollution and knowledge deficiency. These represented high priority issues on the agenda of the last two Arab summits. We firmly believe that meeting these challenges successfully would contribute to achieving the prosperity that will aspire to in our region and beyond.

Aware of the fact that these problems are no longer national issues in the narrow sense of the word but have a significant regional and international dimension, the League of Arab States is looking forward to working closely with MIO-ECSDE towards a shared vision of a better future for generations to come.

Amre Moussa · Secretary General, League of Arab States

United Nations Environmental Programme (UNEP)

Economic and technological developments allied to global production and consumption patterns are dramatically increasing the levels and complexities of the world's waste streams and their potential to impact the environment and human health. These include solid, agricultural, hazardous and electronic-wastes.

It is vital that intelligent thinking is brought to bear on the issue of waste. Several promising initiatives are being developed which echo to this challenge. Under UNEP's Basel Convention for example partnerships have been forged with the mobile phone industry to 'take-back' handsets and to restore and re-sell refurbished phones with guarantees. Countries are also rising to the challenge. Japan is pioneering the 3R's—reduce, re-use and recycle and China, the Circular Economy—a concept that holds everything as a raw material for another process including heat.

Nevertheless there is still a great deal left to do and education and empowerment of the public is a key part of the solution. The United Nations Environment Programme as the principal voice for the environment within the UN system supports efforts to boost public awareness on issues such as waste. Therefore, we welcome this continuing initiative by MIO-ECSDE in providing the "Wastes in our Life" materials for secondary education.

Achim Steiner · UN Under-Secretary General and UNEP Executive Director

Hellenic Ministry of National Education and Religious Affairs

There is a wide recognition of education as a prerequisite and an efficient process to addressing environmental and sustainable development issues (See Agenda 21, Rio 1992; World Summit for Sustainable Development (WSSD) Plan of Implementation, Johannesburg, 2002; United Nations Decade of Education for Sustainable Development (DESD), 2005-2014; UNECE Strategy for Education for Sustainable Development (ESD), 2005). In line with the relevant Declarations and commitments, the Hellenic Ministry for Education and Religious Affairs is interested in contributing to the promotion of Education for Sustainable Development (ESD) and Environmental Education (EE) within Greece and beyond, particularly in the Mediterranean region. The latter could be partly obtained through the MEdIES network.

Currently, in the Mediterranean, as in almost all parts of the world, environmental and sustainable developmental concerns are in the heart of the political agenda together with the protection of biodiversity. However, although citizens become increasingly conscious of issues like climatic changes, they still lack proper understanding about energy saving, sustainable consumption and waste management. The material "wastes in our lives", produced in the framework of MEdIES, is very much welcome, as a well-prepared and useful tool in this endeavor for the teachers and students of the Mediterranean countries, addressing the issue of wastes in a holistic multidisciplinary and comprehensive way.

Giannakou Marietta · Minister of National Education and Religious Affairs

Hellenic Ministry of Environment, Physical Planning and Public Works

The Ministry of Environment, Physical Planning and Public Works acknowledging that awareness raising, education and training constitute important tools to achieve sustainability, especially as regards waste management, welcomes the present MIO-ECSDE publication.

Contemporary environmental policy in the field of waste management at European and international level calls for more substanciated analysis and different approach to environmental problems.

Guiding principles and policy directions of waste management are indorsed in the legislative and regulatory framework, in which for the first time the European and national legal order adopt legal dispositions for a uniform and aggregate waste management policy, regardless of waste-type, defining the basic guidelines for its implementation.

The general principles of waste management give priority to waste prevention, encourage re-use, recycling and waste utilization (materials/energy recovery), and promote environmentally safe processes of final disposal.

Given that protection of the environment concerns us all, integrated waste management can be achieved only by the active involvement of consumers. Informed, active citizens are the driving force towards sustainable development.

Stavros El. Kalogiannis · Deputy Minister for the Environment

The profile of MIO-ECSDE

Scope & Objective

The Mediterranean Information Office for Environment, Culture and Sustainable Development, is a federation of Mediterranean non-governmental organisations (NGOs) working in the field of environment, development, or culture. MIO-ECSDE acts as a technical and political platform for the intervention of NGOs in the Mediterranean scene. In co-operation with governments, intergovernmental and international organisations and other socio-economic partners, it plays an active role in the protection of the environment and the promotion of sustainable development. The main objective of MIO-ECSDE is to protect the natural environment (flora and fauna, biotopes, forests, coasts, natural resources) and the cultural heritage (tangible and intangible) having as its ultimate goal the promotion of sustainable development in a peaceful Mediterranean.

Structure

It was established as a network of NGOs in 1990 and expanded to its current NGO Federation status in 1995. The Federation consists of full and corresponding member organisations, which jointly form the MIO-ECSDE General Assembly. The Annual General Meeting (AGM) of the member organisations is the main institution constituting the basis of the Federation. The administrative bodies of MIO-ECSDE are the Executive Bureau, the Chair and Co-Chair. These are supported by the Secretariat which is based in Athens, Greece.

MIO-ECSDE Activities

MIO-ECSDE activities over a wide range of actions including **networking** (ensuring flow of information through electronic (e-bulletins, e-newsletters, web site, etc.) and printed means (leaflets, quarterly newsletter, etc.); **capacity building** (training material, workshops, publications, etc.); **the promotion and drafting of common NGO policies** (seeking consensus among its members and promoting common NGO policies reinforcing the collective voice of the environment and development citizens organisations at international fora and conventions); **international collaborations** with many European, regional and international bodies (i.e. EU, MAP/UNEP, UNESCO, UNECE, UNDP, EEB, RAED, FoE, WWF, RAMSAR Convention, MEDCITIES, MEDWET, IUCN, GWP, etc.) and other schemes of co-operation (MCSD, GWP-Med, EuroMed NG Platform); **Raising public awareness, promoting participation and consensus building** (through campaigns, publications, exhibitions, the coordination of the 'Mediterranean Action Day', etc.); **Research** (SUDECIR project); the **facilitation of Mediterranean networks** (educators [MEdIES], parliamentarians [COMPSUD], and journalists [COMJESD]) etc.

In the field of **Environmental Education (EE) and Education for Sustainable Development (ESD)**, MIO-ECSDE, together with the University of Athens 20 years after Tbilisi, facilitated the secretariat of the international conference 'Environment and Society: Education and Public Awareness for Sustainability', held in Thessaloniki, in 1997, co-organised by UNESCO and the Greek Government. The 1400 participants from 84 countries unanimously adopted the 'Thessaloniki Declaration' and a series of positions is included in the Proceedings of the Conference.

MIO-ECSDE currently coordinates various ESD activities, such as, producing educational material for students and educators (through the MEdIES initiative, see next page), organising conferences and seminars at national and regional level, etc. MIO-ECSDE has contributed substantially to the drafting of the *Strategy on Education for Sustainable Development* adopted by the Ministers of Environment and Education of the UNECE member states and plays a leading role in ensuring the Strategy's implementation in the Mediterranean region, within the framework of the UN Decade for ESD (2005-2014).

Contact details

MIO-ECSDE

✉ 12, Kyrristou str. • 105 56 • Athens - Greece
📞 +30 210 3247490, 3247267 • 📠 +30 210 3317127
info@mio-ecsde.org • www.mio-ecsde.org

The MEdIES Initiative

MEdIES, **the Mediterranean Education Initiative for Environment and Sustainability**, is a Type II Initiative on Environmental Education (EE) and Education for Sustainable Development (ESD) that was launched in Johannesburg during the World Summit on Sustainable Development (Johannesburg, 2002).

Structure

Core Group: MEdIES is supported by the Hellenic Ministry for the Environment, Physical Planning and Public Works and the Italian Ministry for the Environment, Land and Sea. Leading partners of the Initiative are also UNEP/MAP and UNESCO. As of May 2006 MEdIES has been officially certified by the Hellenic Ministry of National Education and Religious Affairs as an International Network on ESD. MIO-ECSDE has been entrusted with the coordination of the Initiative (*Operational Coordinator*). These six entities comprise the Core Group of MEdIES. MEdIES water issues are supported and implemented in close cooperation with GWP-Med and the Mediterranean EU Water Initiative.

Task Group: There are many more confirmed partners, such as governments (through relevant ministries), educational institutions (universities, EE centres, etc.), NGOs and IGOs etc. active in the Mediterranean region. These comprise the MEdIES Task Group (also called the Partners Forum).

e-Network: The basis of this initiative is a network of individual ESD educators in countries around the Mediterranean basin, that implement integrated educational programmes on cross-cutting themes, such as water, waste, etc., as a vehicle to approach sustainable development. The e-Network receives relevant information through regular e-mails and is facilitated by MIO-ECSDE in communicating with each other, and in promoting their work. They have priority in receiving invitations to workshops and seminars on EE, organised in the context of MEdIES.

Goals & Objectives

MEdIES aims to facilitate the educational community to contribute, in a systematic and concrete way, to the implementation of Agenda 21 and the Millennium Development Goals, through the successful application of innovative educational programmes in countries around the Mediterranean basin.

So far, through its wide range of activities the MEdIES initiative has targeted the cross-cutting areas of (i) freshwater resources, (ii) waste and consumption issues, and (iii) linking cultural and biological diversity.

Main Activities

Main activities of MEdIES include:

- **Publications**, such as educational materials: 'Water in the Mediterranean' (produced already in 7 languages), the 'Handbook on Methods used in EE and ESD' (produced in 3 languages), etc.
- **The Webpage** www.medies.net which provides a platform for communication, online material and publications and announcements.
- **Seminars** taking place on a regional or national basis, aiming to support educators through proper teacher training in the field of ESD.

How to get involved with MEdIES

- Any relevant governmental body, institution, NGO, etc. with aims and activities compatible with those of MEdIES at Mediterranean, national and/or local level can join the Task Group by filling an application form and sending an expression of interest to the Coordinator (MIO-ECSDE).
- Any individual formal or non-formal educator may become a member of the MEdIES e-Network, free of charge, by signing on electronically at www.medies.net.

Contact details

MIO-ECSDE
✉ 12, Kyrristou str. • 105 56 • Athens - Greece
☎ +30 210 3247490, 3247267 • 📠 +30 210 3317127
info@mio-ecsde.org • www.mio-ecsde.org

MEdIES Secretariat
info@medies.net • www.medies.net

Contents

Introduction

The Mediterranean within the environmental & educational context

The Mediterranean is an exceptional eco-region not only because of its geographical and historical characteristics, its unique natural and cultural heritage, but also due to the feeling shared by its inhabitants of belonging to 'the Mediterranean world'. At the crossroads of three continents the Mediterranean brings together countries and peoples of different levels of economic and social development, different religions, languages and cultures, that share, however, a common heritage, created throughout centuries old 'exchanges' of all kinds.

According to a recent report, these characteristics render the Mediterranean a perfect illustration of the global situation (Blue Plan, 2005). Having encountered much disruption during the 20th century the Mediterranean faces nowadays a great challenge: Will it be able to collectively find a pattern of development that could bring people together, in an ecquitable and respectful way so that its heritage can be passed on to future generations unscathed? Or, will it follow a short-term pattern that will squander the resources it has inherited and accentuate the differences among its peoples?

Introduced already since the Brundtland report 'Our common future' and widely used after the Rio Earth Summit in 1992, the term *sustainable development* expresses the contents of the abovementioned challenge, embracing all aspects of economic, environmental, social, and, through the latter, of cultural development. For natural resources to be conserved and accessed equally -in terms of time and space- and for the quality of life to be improved, all pillars of sustainable development need to be addressed through a number of tools: More efficient technologies need to be developed; national economic and regulatory policies must promote the switch to a less wasteful, less polluting society; social cohesion

and welfare need to be given priority; the natural environment must be preserved. Scoullos has successfully merged these concepts in a diagram of a double pyramid, illustrated in figure 1 (Scoullos & Malotidi, 2004).

However, beyond novel policies and innovative technologies, sustainable development is more than anything else a value that needs to be integrated in our modern globalised cultures and a way of living, especially through our individual consumption patterns. In this sense, many experts (i.e. Brunner et al., 2001; Beazley, 1993) attribute to individual consumers a strong potential to significantly change patterns towards a more sustainable way of living, through the cumulative effect of their buying power and other green actions. The relevant notions of how individuals perceive the validity and impact of their personal actions are analysed in paragraphs 2.3 and 3.17.

In order to perform such behaviours, however, citizens need reliable information and proper education. Education is a tool that enables us to understand ourselves and others and our links with the wider natural and social environment. Obviously, good quality education is a prerequisite to achieve awareness and sensitise individuals, be they adolescents, or other social groups.

International recognition of the critical role of education *as a sine-qua non* to sustainable deve-

FIGURE 1 The approach of Michael Scoullos of a double pyramid, or so-called "diamond" to schematically depict sustainable development.

lopment is reflected in the unanimous adoption of a *United Nations Decade for Education for Sustainable Development* lasting from 2005 to 2014 (UN Resolution 57/254, adopted in December 2002). Education for Sustainable Development (ESD) is a broad and comprehensive concept encompassing interrelated environmental, economic and social issues. *ESD is fundamentally about values, with respect at the centre: respect for others, including those of present and future generations, for difference and diversity, for the environment, for the resources of the planet we inhabit* (UNESCO, 2005). Along with a sense of justice, responsibility, exploration and dialogue, ESD aims to move us to adopting behaviours and practices that enable all of us to live a full life without being deprived of the basics.

ESD is actually the continuity and broadening of Environmental Education (EE), a well-established discipline, which has traditionally focused on humankind's relationship with the environment, ways to preserve it and properly steward its resources. Obviously, by definition, EE has been articulated and has matured in the framework of environmental concern. ESD encompasses EE, and sets it in a broader context of socio-economic and cultural factors addressing the socio-political issues of equity, poverty, democracy and quality of life (UNECE, 2004; UNESCO, 2005). Scoullos has presented an analytical elaboration on the evolution of concepts from EE to ESD (Scoullos & Malotidi, 2004).

Why focus on wastes

Waste is unavoidable in any form of society, but it is an undisputable fact that today we produce far more waste than ever before. Some consider that the problem is worse in the rich countries of the North than in the South; however with the spread of technology, industrialisation and higher standards of living, the garbage factor is an unwelcome and often unnoticed side effect of 'development' (Rogers, 1995) and globalisation.

Therefore, waste management emerges as a formidable challenge for governments and local authorities around the world, and particularly more so for the poorly planned and managed, densely populated, rapidly expanding cities of the Mediterranean coastline. Recognising that waste can have far reaching and sometimes irreversible consequences on human health and the environment, to adequately address the problem, waste generation rates and proper management should become a critical feature in all future planning exercises: in physical and urban planning, in integrated coastal zone management, in integrated water resource management, even in product design, etc.

This has been recognised by all major strate-

FIGURE 2 The contents of Education for Sustainable Development depicted also as a double pyramid by Michael Scoullos.

The issue of waste offers opportunities to deal in a clear way with each one of the all facets of the content of ESD. Its connection with consumption and production links it directly to economy and society. The substances wasted and the pollution produced clearly places waste in the centre of the environment and through dangers to health and society etc. The ways to address the problem of waste require application of simple or sophisticated technologies, offers fertile ground for new scientific and technological methods and requires good administration and sound, eventually innovative tools (e.g. financial incentives, etc). Finally it requires a less wasteful culture based on based on one hand on traditional knowledge and on the other on new 'alternative' approaches.

gies and political documents concerning the Mediterranean region, e.g. the Mediterranean Strategy for Sustainable Development (MSSD), the European Environmental Strategy, the Environment for Europe (EfE) process, etc.

From an educational point of view, keeping in mind that waste is a complex subject that concerns all individuals, that waste management is a challenge for municipalities and local communities, and that the trade of hazardous waste poses a global threat, it becomes obvious that 'waste management' is a rather thorny, complicated issue that needs, nevertheless, to be addressed at the level of the school and the neighbourhood, at the national and also at the global level. This approach will allow learners to gain insight into other than their own geographical areas.

Furthermore, the incorporation of case studies and data from developed and developing countries of the Mediterranean gives added value to the material, allowing the educators and learners using it to explore and compare Northern and Southern countries in terms of practices followed, management schemes, consumption habits, their own priorities, etc.

Finally, according to international research, waste is classified as a priority issue -from educators, students and citizens- who consider it an important and appropriate subject useful to be explored within the educational system (extended relevant literature can be found in Kokkotas, 2002; Papadopoulos, 2005). In this sense, waste is a useful subject to examine within EE and ESD programmes, especially in the heavily polluted parts of the Mediterranean, either within a formal or non formal educational context.

Students' ideas relating to waste issues

Until fairly recently, many educational settings and materials were largely teacher-centred and students were often viewed as *tabula rasa* onto which knowledge deriving from teachers and textbooks could be added. However, according to cognitive theories of learning, knowledge is acquired and stored in the form of 'concepts' and each individual builds his/her own system of concepts based on:

■ personal experience (including the stimulus from the surrounding environment: family, friends, experiences in natural and built environment, etc.)
■ personality factors (attitudes, skills, etc).

Therefore, students having experienced and thought about the world, enter the formal educational systems using a complex cluster of ideas, beliefs, values and emotions to understand it. Learning is an adaptive process that organizes one's experiences of the world.

Understanding how and what the students already know is of critical importance for educators, in order to plan their teaching and organise activities, in a way so as to build on students' existing ideas and understandings and to assure that they take a more active role in their own learning process (*metacognition*).

Research reveals that students may hold several false ideas or misconceptions around waste management topics. For instance, according to a recent study in Greece on secondary school students, their understanding of waste issues is low, they have limited knowledge level and hold several misconceptions (Papadopoulos, 2005).

Research conducted in the Dutch secondary level (Kortland, 1997) to identify students' ideas on concepts relevant to household waste, showed that they do have a general understanding of waste management; nevertheless, their perceptions of specific points is incomplete or diffuse, thus, possibly negatively influencing the quality of their decision making . Actually the study showed that:

■ Students' perception of the environmental impacts of landfilling and waste incineration are limited to direct ones, such as air, water and soil pollution. Depletion of raw materials was not identified as a negative impact.
■ Students have problems with the distinction between:
  · *Renewable* and *non-renewable* raw materials: some see recyclability as a criterion for renewability, e.g. they stated that: *"Wood is a renewable raw material because paper made out it of is recyclable"*.
  · *Recyclable* and *non-recyclable* materials: some see biodegradability as a criterion for recy-

clability, e.g. they stated that: *"Paper is recyclable because it is biodegradable"*.

• *Reusing* and *recycling*: some base their idea about the possibility for reuse of a package on the recyclability of the material.

■ Students face also problems with the recognition of the limitations of reusing/recycling e.g. the difficulty in recycling laminating material, the impossibility of a fully closed lifecycle of packages and/or packing materials.

Another study conducted in the USA on 15-16 year-old in relation to various environmental topics (not only waste management) (reported in Kokkotas,

2004), showed that many of them considered that:

■ Landfill solid waste doesn't cause pollution.
■ Biodegradable materials are not pollutants.
■ Anything natural doesn't cause pollution.

A general noteworthy result of relevant studies in the field is that students do not use the scientific concepts and ideas they are taught when analysing environmental issues. Moreover, they seem to consider that any environmental action helps to adress environmental problems in general, meaning that they have difficulty to link causes with specific impacts (Kokkotas, 2004).

Part I

*General features
of the educational material
"Waste in our life"*

1.1 *Is it a teaching or a learning material?*

The importance of good quality educational materials to support the work of teachers, especially in the framework of DESD is highlighted as an essential need in various reference documents (e.g UNESCO, 2005; UNECE, 2004). Actually, printed material is rather essential within any educational process, as research shows that i) the teaching process is influenced by the type of materials used; ii) students spend more time interacting with a programme's materials than the educator; and iii) printed materials are the dominant tools of both educators and students, and define more than 70% of their performed activities (Matsaggouras, 2003b).

In general, there are two types of materials in printed form that usually address students: *teaching* and *learning materials*. The majority of the school text books are considered *teaching materials*. These aim at providing learners with scientifically reliable and socially acceptable knowledge and information, basically through texts and pictures. In such materials scientific concepts are described in a simplified way, corresponding to the students' age, while the role of the educator rests mainly in facilitating students to understand these concepts. Therefore, the educator is supported with extra notes to enrich the instruction as well as clarifications on tricky or difficult to grasp scientific concepts.

On the other hand, *learning materials* are based on the notion that people learn by attempting to explain the world around them, in line with the principles of the constructivism theory. To this end, such materials are usually composed of activity sheets, with limited texts, giving students the chance to act themselves in order to build their own knowledge. The educator's notes, in this case, present the possible difficulties of the actual learning context and the didactic methods to address these; the required background of the students in terms of knowledge and skills, as well as the commonly encountered misconceptions and ways to address them.

Currently there is an on going controversy in literature, as to which is most appropriate, the concept-centred *teaching materials* or the student-centred *learning materials* (Matsaggouras, 2003b). Recognising the complementarity and advantages of both, and that depending on the way of use teachers and students may gain from both, the current educational material "Waste in our life" attempts to function both as a teaching and a learning source, bearing the abovementioned characteristics. Being formulated in this way, the material aims to fit the different needs of teachers, and provide opportunities for linkages to the diverse national curricula of the Mediterranean countries.

We note that during the publication, several technical standards were taken into account, in order for the material to be simple and user friendly (e.g. font size, picture size, 4 colour print, use of light colours that photocopy well, etc.).

TABLE 1 The contents of "Waste in our life" categorised as teaching and learning material.

Sections classified as ...	...teaching material	...learning material
Learners' book	theory	activities
Educators' book	info tips	methodology guidelines

1.2 *General pedagogical characteristics*

It is evident and of prior importance that students need to develop an awareness of the world around them as a basis for further study. As they gain more experiences, they may change their perceptions and, hopefully, increase their understanding of their surroundings; of how elements of the natural environment function and interact; how human activities affect and are affected by them.

According to the UNECE Strategy for ESD (2005) learners should be encouraged to apply systematic, critical and creative thinking and reflection, these being considered prerequisites for action for sustainable development, at local or global level. *Critical thinking* is a process that involves digging be-

low the surface and thoroughly analysing an issue. It allows individuals to elaborate information in a logical way and deduct conclusions, using features such as classification, completeness, relevance, etc.

Closely linked, is *creative thinking* which relates to divergent thoughts which -largely based on fantasy and intuition- seek for innovation in approaching reality and revolutionary ways of expression. The skills needed to apply previous knowledge in novel ways also constitute creative thinking.

Educational materials should be developed within a conceptual framework that allows and urges learners to place information within context and to construct new knowledge as a result of their own activities and actions, in other words as a result of applying critical and creative thinking. This is what the theory and activities of the educational material "Waste in our life" aims to provide to learners.

The subject of waste offers many opportunities to link education to the personal experiences of students and their every day lives, a requisite pointed out already since Tbilissi in 1977 and repeatedly underlined in current literature (i.e. Engleson & Yockers, 1994; Kamarinou, 2000; Brunner et al., 2001; Kokkotas, 2002; Matsaggouras, 2003). In fact, some experts claim that when an education programme is not aimed at a *real* environmental problem, students may exhibit resistance to participation and behaviour change (Peace Corps, 1999).

In practical terms, identifying a subject which is locally relevant makes it possible for the class to visit areas of interest, as well as to perform concrete recovery actions at local scale, allowing for experiential learning. Linking to the learners' everyday lives also has the advantage of providing opportunities to extend the proposed activities to their homes and deliver the 'message' to families and the local community.

In this context, in "Waste in our life", emphasis is given on activities that promote action skills and encourage students to use their knowledge, personal skills and assessments of environmental issues as a basis for environmental problem solving and action. Provision was made also to empower students' sense of personal responsibility and self-efficacy -that is, students' confidence in their ability to affect things- through appropriate activities (find out more on self efficacy in paragraphs 2.3 and 3.17).

Brody (1994) further supports that through examining key environmental issues in the lives of the learners a deeper understanding of Science as it relates to the real world may occur. Actually, the subject of waste is a multidisciplinary concept, relating not only to Science but also to disciplines like Mathematics, Sociology, History, Arts, etc. Even the 'surrounding' issues interlinked to waste, such as management, pollution, consumption patterns, etc., are considered subjects of modern society that can offer many multidisciplinary approaches (Matsaggouras, 2003).

Scoullos & Malotidi (2004) present the principle trends for ESD programmes and materials, these being:

- To have learner-centred teaching and learning approaches,
- To be based on the constructivist theory of learning,
- To provide experiential education methods and,
- To have an interdisciplinary character.

It is within this framework that the educational material "Waste in our life" was developed, in line with the student-centred, experiential and constructivism approach, viewing students as active learners who actually 'bring something to the table'. Learners are challenged to build knowledge based on what they already know, through new experiences and active investigation. The material can be applied either as a single subject or programme of EE/ESD (*interdisciplinary* model of implementation) or by integrating parts of it in the various school disciplines (*multidisciplinary* model of implementation).

1.3 *Content & proposed use of the material*

"Waste in our life" is comprised of two parts each in a separate booklet,

a) the learner's book and
b) the educator's book,

The terms 'learner' and 'educator' are used with the wider meaning of the words 'student' and 'teacher' so as to cover both the formal and non-formal systems. These books have a clear and easily understood structure, and their texts are complemented with explanatory tables and pictures.

The **learner's book** contains two sections: theory and activities, both covering topics ranging from daily generation of household waste, hazardous waste, the hierarchy of waste management, policies and their implementation, up to subjects like composting, composite packaging, etc. In line with the constructivist approach, it is proposed that educators begin applying the material based on the daily habits and experiences of students, mainly through activities that can be performed at home and at school. Gradually, they may move to the exploration of more complex themes such as decomposition, packaging, special types of waste (hazardous, electric appliances, etc.) and general waste management issues. Meanwhile, the theoretic section may be used as a resource by students who wish to find more information on a specific issue.

Obviously, the numbering of the activities is indicative and needs not to be followed strictly. Educators who plan EE and ESD activities should bear in mind that the 'logical' sequence of their planned activities may not be so obvious to students, who, in many cases, do not comprehend the successive links between their performed actions (Kamarinou, 2000). It is proposed, therefore, when introducing a new subject, such as waste, to hold extended discussions in class so that the students comprehend the complexity and interlinkages of the issue and participate themselves in drafting their intended activities.

Each activity generally follows the same format, as shown in figure 3.

FIGURE 3 The layout of an activity sheet in the learner's book

Title

Estimated **duration**

Key words and important concepts examined in the activity

Links to theory: Relevant paragraphs of the theoretical section

Reflection: Questions for evaluation and ideas for follow up activities

Objectives of the activity

Basic facts and information on the context of the activity

Materials and necessary equipment

Procedure: Step by step instructions & questions

The present **educator's book** is intended to support the teacher in implementing the learner's book. It includes:

■ some general methodological guidelines for instruction (Part II);

■ some concrete methodological guidelines for activity implementation (Part III); and also

■ useful teacher info and practical tips on some 'difficult' or 'thorny' scientific concepts (Part IV).

In table 2 the total spectrum of activities and educational methods applied (of Part III) is presented. Below is a typical *key* (as found in Part IV) with useful teacher information for each activity . For each activity implemented from the learner's book, educators are advised to read all the relating paragraphs in the educator's book.

STUDENTS' AGE
Suggested age range of students for the implementation of the activity

SUBJECT AREAS
Relevant disciplines of the school curriculum within which the activity could be integrated

ESD TOOLS
Methodology tools and practices that are applied within the activity. Educators are advised to read all relating paragraphs found in Part III before applying the activity in class.

In part IV of the educator's book such an explanatory *key-card* is found for each activity, together with some practical info on how to implement the activity, where appropriate.

Educators are urged to adjust the proposed methodological guidelines according to the age and needs of their class, the local setting, their personality and way of work, and keep in mind that any 'object' may be useful in the educational process. So, when planning and implementing their work educators are advised to make use of pictures, films, worksheets, press clippings, posters, cartoons, literature, graphs, maps, cd-roms, multimedia, games, brochures and any other item which might be helpful for instruction. This will enable educators to form a creative learning environment that may spur their students' interest and eventually lead to meaningful learning.

In this context, 'Waste in our life' is intended to be the starting point for educators to create their own novel practices. In fact, the number of different ways in which the material will be applied will be an indicator of success.

TABLE 2 The total spectrum of activities from the learner's book and the educational methods applied therewith.

METHOD \ ACTIVITY →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	i1	i2
Group work				★			★					★	★	★	★				★	★					★
Discussion techniques			★		★				★								★				★		★		★
Conducting a brainstorming	★	★							★								★							★	
Drawing issue webs	★	★																							
Teaching *through* objects	★	★																							
Constructing concept maps																★				★					
The use of analogies in teaching								★																	
Constructing physical models								★																	
Problem-Solving with an action-oriented approach											★														
General guidelines on surveys					★								★		★	★			★			★	★		
Conducting surveys with questionnaires															★	★									
Conducting surveys through interviews					★										★	★									
Conducting a bibliographic research	★			★		★			★	★	★			★	★										
General guidelines on experiments	★	★	★					★		★	★							★		★	★	★			★
Conducting experiments based on Constructivism											★														
Performing a demonstration																									★
Instruction outside the classroom (field trips)							★					★		★								★			
Using maps							★					★													
Organising debates & panel discussions																									
The role-playing method									★				★												
Values within education																							★	★	
Approaching values within ESD																							★	★	
Sources, effects and academic implications of self-efficacy																									
Reading, writing and presenting...			★	★		★	★					★													
Tips on creating a theatrical play																		★							
Performing citizenship actions						★	★										★	★						★	
Carrying out an awareness campaign						★	★					★		★				★						★	

Part II

General methodological guidelines
for the material
"Waste in our life"

2.1 *Developmental aspects of children & implications for instruction*

Obviously, the more the educators know about learners, their growth parameters and development stages, the better they can adapt their teaching to meet their needs. Apparently, individuals moving from childhood to full-blown adolescence experience major physical, psychological and intellectual changes. In this paragraph some basic characteristics of these changes are presented, specifically those interfering with the learning process. We focus at the age range of 11 to 14 yrs (approximately the target audience of the current educational material) and refer to it as '*middle school learner*' (MSL), as cited in related literature. This term is used to avoid confusion caused by the different grade level configurations and educational systems in the various countries.

To begin with, the tremendous physical and psychological variations associated with the imminent sexual maturation of the emerging adolescence result in a highly volatile and difficult student population to work with. This physical development generates a number of problems for youngsters, ranging from an intense attention to the peer group and interpersonal relationships, to a feeling of inadequacy and self-consciousness often in danger of being diminished by peers, parents, teachers

TABLE 3 Piaget's Stages of Cognitive Development. The subsequent order of stages is identical in all individuals; however the age at which each stage emerges and its duration may vary. Some people may never enter the final stage of cognitive development...

Developmental stage & approx. age	Characteristic Behaviours
Sensory Motor Period (0-24 months)	Infants discover relationships between their bodies and the environment by exhibiting relatively well developed sensory abilities. They rely on seeing, touching, sucking, feeling, and using their senses to learn things about themselves and the world around them. The name "sensory-motor stage" was given because the early manifestations of intelligence appear from sensory perceptions and motor activities.
Pre-Operational Period (2-7 yrs) **Preoperational Phase** (2-4 yrs)	Children make increased use of verbal representation but their speech is egocentric. They begin to apply symbolic rather than simple motor play and transductive reasoning. They are able to think about something by use of speech without the object being present.
Intuitive Phase (4-7 yrs)	Here, speech becomes more social, less egocentric. Children have an intuitive grasp of logical concepts in some areas. However, there is still a tendency to focus attention on one aspect of an object, ignoring others. Concepts formed are crude and irreversible. They easily believe in magical increase, decrease, disappearance. Reality is not firm and perceptions dominate judgment. In a moral-ethical realm, children are not able to show principles underlying best behaviour. Rules of a game do not yet develop, except uses of simple do's and don'ts imposed by authority. By the end of this stage, children begin to have an understanding between reality and fantasy as well as the sex roles in society.
Period of Concrete Operations (7-11 years)	During this stage, children perform multiple classification tasks, begin to reason logically, and organize thoughts coherently. However, they can only think about acute physical objects, they cannot handle abstract reasoning. Thinking becomes less transductive and less egocentric. They have the ability to master most types of conservation experiments, and begin to understand reversibility. This stage is also characterized by the ability to coordinate two dimensions of an object simultaneously, arrange structures in sequence, and transpose differences between items in a series.
Period of Formal Operations (11-15 years)	Thought becomes more abstract, less tied to concrete reality, incorporating the principles of formal logic. The ability to generate abstract propositions, test multiple hypotheses and their possible outcomes is evident. Another characteristic is the ability to reason contrary to fact. That is, if they are given a statement and asked to use it as the basis of an argument they are capable of accomplishing the task. *Some people may never reach this stage of cognitive development.*

TABLE 4 Bruner's distinct cognitive stages. The major age-related changes in behaviour and thinking are largely the result of the acquisition of new, more flexible and more powerful types of 'representation'. For Bruner, cognitive development results from the continuous resolution of conflicts between the 3 modes of representation (Tomic & Kingma, 1996).

Mode of representation & aprox. age of appearance	Description
Enactive Representation by doing Developed immediately after birth	An object or event is understood, known or represented by the actions that are performed with it (i.e. a bicycle is ridden, a ball is played with etc.). Infants experience the world only by acting on objects, otherwise objects do not exist.
Iconic Representation by conception of spatial schema Developed at ~ 18-24 months	Here, objects and events are represented in the form of images and are relatively independent of the actions. Children need concrete objects and activities so as to absorb them perceptually.
Symbolic Representation by means of description in language Developed at 7-8 yrs	Here action and image are transormed to a symbolic system to encode knowledge. Primarily the symbols used are mathematics and language. Children at this stage achieve ability in problem solving and engage in creative thinking.

and the society at large (Marcinkowski et al., 1994).

A major intellectual characteristic of the emerging adolescent is the progression from concrete to abstract ways of thinking, as proposed in the theories of Piaget and Bruner.* In this respect, MSLs are expected to have obtained fully or partially, the capacity of abstract thought. This capacity holds tremendous promise for them and the society in general. At this stage, critical thinking can be taken to considerable lengths by well trained and competent educators, who may set aside factual learning and promote higher order thinking skills such as synthesis and evaluation (Marcinkowski et al., 1994).

Nevertheless, educators should be aware that although some MSLs may be capable of concrete or even operational thinking, others may still be in the pre-operational stage, or in transition between the two stages. A typical middle school classroom contains students who drastically vary in their cognitive abilities and their approaches to thinking (Marcinkowski et al., 1994).

Moving onward to adolescence, another capacity is developed, that is the disposition to examine the logic and consistency of one's beliefs; one's set of explanations of the world; one's assumptions that guide behaviour. As youngsters compare their own beliefs with those of others, they begin to see contradictions and instabilities. Consistency and stability will gradually emerge when individuals realise that there are general principles, extending beyond specific cases. According to

Hungerford (1994b) this process is probably necessary in order for individuals to construct their personal ideology, or set of beliefs and values.

This is somehow related to the individual's recognition of the complexities of human motivation, or intention guiding behaviour. Children of earlier stages cannot conceive 'motivation' as being different from the 'act' itself. At this stage, by reflecting on their experiences and interacting with others, they begin to realise that many factors influence their own decisions, and that other people have complex motivations as well. George & Lawrence (1982) consider techniques which help learners to take the point of view of others, like role plays, dramas, etc., very useful pedagogic tools for middle school level (in Hungerford 1994b).

Students of this age also develop the ability to project extensions of present events or conditions into the future (George & Lawrence, 1982). This helps them realise that the future depends, in some part, on choices made in the present, and consider the consequences and implications of their decisions and choices. It is a good opportunity for educators to mould concepts and attitudes associated with cause and effect in scientific, personal, as well as social dimensions (Hungerford 1994b; Marcinkowski et al., 1994) and cultivate decision making skills.

Another benchmark of this stage is the moving from an ego-centric to a socio-centric perspective. Very young children regard themselves as the centre of the universe; events, objects and people have

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* The successive stages of development, as proposed by Jean Piaget and Jerome Bruner offer useful background for when organising teaching schemes, that is why they are briefly presented in tables 3 & 4 accordingly.

TABLE 5 Developmental characteristics of the middle school learner (MSL) and their instructional implications. [Adapted from the work of Wiles & Bondi (1981), as cited in Marcinkovski et al., (1994)].

Intellectual characteristics	Instructional implications
Emerging adolescents display a wide range of skills and abilities unique to their development patterns.	A variety of materials and approaches in the teaching-learning process should be utilised.
Children of the same age range in development from the concrete-manipulatory stage to being able to deal with abstract concepts. They are intensely curious and growing in mental ability.	Ideally, each student should be treated at his/her own intellectual level providing immediate rather than remote goals. All subjects should be adapted to personality needs and skills of each. Skill grouping should be flexible.
Children prefer active over passive learning activities; prefer interaction with peers during learning activities.	Physical movement should be encouraged with small group discussions, learning centres and creative dramatics ... Educators should provide a programme of learning that is exciting and meaningful.
Students are usually very curious and exhibit a strong willingness to learn things they consider to be useful. They enjoy using skills to solve real-life problems.	Organise curricula around real life concepts ... Provide activities in both formal and in formal situation to improve reasoning powers. Studies of the community environment are particularly relevant to this age group.
Students often display heightened egocentrism and will argue to convince others or to clarify their own thinking. Independent critical thinking emerges.	Organised discussions of ideas & feelings in peer groups can facilitate self understanding. Provide experiences for individuals to express themselves by writing & participating in dramatic productions.

meaning only when in relation to themselves. This egocentrism of preceding stages tends to block important socialising experiences and concepts. Social interaction, especially with peers, appears to be the principal factor liberating individuals from egocentrism. Interaction enables MSLs to learn other points of view, (whether they agree with them or not) and gradually develop a socio-centric perspective, feeling a part of a community. This helps them eventually to sense the role of individuals in so-ciety. Obviously, there is a great opportunity for educators to provise MSLs with meaningful citizenship experiences (Marcinkowski et al., 1994).

MSLs are indeed complex identities. Their developmental characteristics appear to follow similar patterns in individuals; however their rate of development may greatly vary. Their intellectual characteristics and the corresponding instructional implications are summarised in table 5.

2.2 *Overview of prevailing cognitive theories of learning*

Throughout the 20th century many theories developed and a lot of research was carried out aiming to reveal the way people learn. The prevailing theories may differ in their assumptions on the process of learning; yet, all of them may be more or less applicable within today's ESD programmes. In this paragraph, an overview of three classic and influential cognitive theories is presented, namely of Piaget, Bruner and Vygotsky on the premise that the approaches of ESD educators can be enhanced by drawing upon these.

All three theories are based on the constructivism approach, which recognises cognition as the result of mental construction. A thorough analysis of the interconnection of constructivism with EE and ESD is presented in Scoullos & Malotidi (2004). According to constructivism, knowledge is not received from outside, but is mentally constructed by individuals as they reflect on experiences and add new information on what is already known. This way, individuals construct their own understanding of the world. Besides the common principle of constructivism, the most prominent differences of the three theories refer to the role of social interactions in learning.

The well known Swiss biologist-psychologist **Jean Piaget** (1896-1980) never proposed an actual

learning theory. However, as his theory of cognitive development is considered to offer significant insight as per the learning process, it is explained herewith. Piaget conceptualised intelligence and knowledge as biological functions, whose development needs to be (and can be) explained within the ontology of systems (Stahl, 1995).

Piaget adopted the term '*Cognitive Structure*' as a hypothetical mental construct used when managing thinking to interpret experiences. According to his definition, *structure* is an organised totality within which the relationships between elements are clearly defined. To simplify, a structure can be seen as a type of knowledge database that a child uses to interpret the world. A structure that continues for an extended period of time constitutes a *stage* (for the 4 stages of cognitive development refer to table 3).

Piaget supported that the subsequent order of stages is fixed and identical for all individuals. However, the age at which each stage emerges and its duration varies from person to person, as it is influenced by cultural differences, social parameters, intelligence, etc. (Lahiry et al., 1988). When individuals undergo new types of experiences not sufficiently interpreted with their existing structures (or *schema*), they are challenged to modify them in order to interpret adequately the new experiences. Thus, new structures emerge from previous ones and cognitive development is indeed a genesis of structures.

Consequently, there are two different instructional approaches:

(a) Those that *assimilate* in learners, i.e. they are easily interpreted using learner's existing structures. This is done when the educator builds upon previously learned concepts (e.g. present predator-prey relationships in terms of the previously learned consumer concept).

or

(b) Those that are *accommodated* in learners, i.e. they cannot be interpreted; they rather serve as a disturbance and an incentive to modify one's structure in order to interpret adequately. Such events may be encountered i.e. during field trips, or through laboratory or demonstration activities. This is what happens when the educator intentionally provides learners with something they cannot easily explain. Discrepant events stimulate learners' curiosity and eventually lead to the modification of learners' cognitive structures

(Marcinkowski et al., 1994). Learning is in essence identical to acquiring a permanent qualitative change in the cognitive structure. Through the process of learning, existing structures become differentiated and coordinated, evolving to new ones.

According to Piaget's theory an individual does not obtain a new structure by being taught, but rather each person 'invents' his/her structures through his/her own experiences. In this sense, he strongly supports that children construct knowledge through actions on objects. For example, logical mathematical concepts relating to i.e. number, length and area cannot be developed by reading about them, but instead learners must manipulate objects to comprehend these concepts. Similarly, knowledge on social issues cannot be transmitted through words or symbols but it is possible through children's interaction with other people (Lahiry et al., 1988).

Piaget is rather sceptical about the possibility of influencing cognitive development through instruction; he believes that only children who already possess partial knowledge of the concept to be instructed can benefit from it. According to him the determining factors that lead eventually to the development of new cognitive structures are the child's intrinsic activity and motivation (Tomic & Kingma, 1996).

Therefore, Piaget proposes the method of self-discovery as the best approach to learning. In this method the role of the teacher is restricted in the background, offering suitable material as stimuli at the appropriate time and continually asking questions to encourage learners to justify their solutions without giving them any feedback whatsoever (Tomic & Kingma, 1996).

Jerome Bruner (1915-) in his theory emphasises both the internal and the external processes involved in the development of cognitive structures and consideres teaching as an effort to assist growth.

With respect to the recommended instructional approach, Bruner and Piaget largely agree, as they both emphasize on self-discovery. Bruner also considers learning as an active process in which learners construct new ideas or concepts on their existing knowledge. The learner, based on a cognitive structure, selects and transforms information, constructs hypotheses, and makes decisions. Cognitive structure *(schema)* provides meaning and

organisation of experiences allowing the individual to 'go beyond the information given'. In this sense, in disagreement with Piaget who suggests that education should go hand in hand with the child's cognitive level, <u>Bruner believes that education should anticipate the child's cognitive level.</u> He explains that only by presenting the learner with new unfamiliar subjects, will the learner find interest and eventually advance to a higher intellectual level.

Bruner's underlying principle for teaching and learning is that a <u>combination of concrete, pictorial and symbolic activities</u> (refer to table 4) will lead to more effective learning. It is recommended to progress from the simplest to the more complex modes: enactive - to iconic - to symbolic. For this inductive reasoning to be successful the educator should encourage learners to make a mental leap in their thought or *representations* system, in order to achieve viable solutions or correct previous perceptions (Tomic & Kingma, 1996). An example of this approach is an experiment carried out by the teacher (iconic mode), or the learners (enactive mode & iconic mode),followed by a discussion on what they learned from it (symbolic mode).

Another difference between the two is the role of educators in the learning process. According to Bruner, <u>teachers should be in the foreground, active and when necessary guide (or scaffold) the learners</u>' discovery process. They are urged to introduce problematic situations to stimulate interest, and ask questions that excite the learners, enhancing in this way their intrinsic motivation (which is taken for granted in Piaget's Theory). Also, the <u>teacher should provide feedback</u> on the solution or reasoning of learners. The timing of giving this feedback is important and serves either as an encouragement to learners' approach, or as a means to re-direct it.

Another notion introduced by Bruner regarding the learning process is the <u>spiral curriculum</u>. According to this idea, educators should organise instruction in a spiral manner, so that the students continually come back and build upon what they have already learnt. In this context, educators will teach the same content in different ways, depending on the student's developmental level. The school curriculum is ideally organised in a spiral manner to facilitate this process, so that the same topics are redeveloped at succeeding grade levels to progressively reinforce learning (Lahiry et al., 1988; Tomic &Kingma, 1996; Kamarinou, 2000).

Lev Vygotsky (1896-1934) draws from a different perspective, as his theory considers that it is impossible to separate cognitive development and learning from their social context. He argued that cognivists like Piaget had overlooked the essential social nature of language and therefore failed to understand that learning is a collaborative process. According to him, <u>language and culture</u> play essential role both in human intellectual development and in how individuals perceive the world.

Vygotsky argues that the actual developmental level of an individual is determined by *functions* that have already matured; meanwhile those functions that are not yet ripe but in the process of maturation represent the so called '*zone of proximal development*' (ZPD). This zone is actually the area extending between the lower limit (what the child can do independently) and the upper limit (what the child can do with the help of an adult or a more capable peer). Thus, ZPD bridges the gap between what is known and what can be known: Vygotsky claimed that learning occurs in this zone.

Like Brunner and contrary to Piaget, Vygotsky believes that <u>education should anticipate development</u>. According to him, instruction should take place within the ZPD, thereby, helping to bring learners to maturity. The extent to which development can be anticipated is dictated by the cognitive tools already possessed by the learner and the range of his/her ZPD. He emphasises guiding cognitive development through teaching, but recognises also learners' own activity towards this direction, therefore he considers development coming both from within and from outside (Tomic & Kingma, 1996).

Here, <u>the educator's role is to organize dynamic support to help learners complete a task near the upper end of their ZPD</u> and then to systematically withdraw this support as learners extend their current skills and knowledge and move to higher levels of confidence. This is the so called '*scaffolding model*' by which the teacher continually adjusts the instruction in response to the learners' level of performance. The ideal classroom, based on Vygotsky's theory, would provide clustered desks that allow peer interaction and collaboration, through teamwork. The role of peers is very important, as through collaboration the group members have the opportunity to exceed their individual levels of competence (Matsaggouras, 2003a).

2.3 Self-efficacy, self-esteem & locus of control (LoC): some clarifications

Currently, there exist many articles on the notions of 'self-efficacy' and 'locus of control' in the relevant educational and psychology bibliography. They are both considered critical elements eventually affecting human behaviour (including behaviours towards the environment and sustainable development). That is why we shall explain the terms, and provide some key theoretical points and research findings that EE/ESD educators may find useful.

Introduced by Albert Bandura in the late 70s, the notion of perceived **self-efficacy** is defined as "people's beliefs in their capability to organise and execute the course of actions required to manage prospective situations" (Bandura, 1997). Overall, Bandura developed a social cognitive theory that emphasises the role of self-efficacy: What people know, the skills they possess, or what they have previously accomplished are not always good predictors of future attainments, because their beliefs regarding their capabilities powerfully influence the way in which they will behave. Consequently, people's behaviour can sometimes be better predicted by these beliefs than by the results of previous performances. *

There appears to be some confusion in distinguishing between the terms self-efficacy and **self-esteem** (or self-concept). While self-efficacy relates to a person's perception of their ability to reach a goal or perform a task, self-esteem is a personal evaluation of ones' self and relates to his/her sense of self worth. In other words, self-efficacy is a judgement of one's confidence and self-esteem is a judgement of one's value. Because self-esteem involves evaluations of self worth, it is particularly dependent on how a culture or a social structure values the attributes on which the individual bases those feelings of self worth. On the other hand, self-efficacy is specific, dependent on the task at hand, independently of its culturally assigned value (Pajares, 2000). (Example: *The typical self-concept*

item "I am quite good at maths" differs from a self-efficacy statement that begins with "I am confident that I can successfully…").

The notions of self-esteem and self-efficacy do not necessarily correlate with each other. To give an example, some students may feel highly efficacious in a school discipline (e.g. essay writing) but without the corresponding feelings of self worth, in part because they take no pride in accomplishments in this particular discipline. In contrast, other students may readily admit to low self-efficacy in writing, but suffer no loss of self-esteem on that account, in part because they do not invest their self worth in their writing abilities.

A thorough examination of the main sources that shape self-efficacy beliefs and their effects on individuals is presented in paragraph 3.17. The implications of such notions for the ESD practitioners are therewith explored, by proposing specific educational strategies to address efficacy issues in class.

While self-efficacy is the belief of being capable to carry out actions efficiently, the relevant term **locus of control** (LoC), introduced by Julian Rotter in the 60s, refers to how much control over a situation an individual considers him/herself to have. Given the global dimension of numerous environmental issues, and the frequently underlined role of citizen's actions and habits, LoC emerges as a particularly important parameter in the field of ESD. Broadly, the term alludes to an individual's sense that he/she can manifest some degree of control over desired outcomes of a specific activity.

For each individual LoC appears to be comprised of (i) experiential, (ii) affective and (iii) cognitive factors. It is understood as a bipolar continuum, ranging from internal to external (figure 4). Internal refers to the belief of individuals that they themselves exert control over a given situation; while external refers to the belief that outcomes are controlled by outside forces. Since its introduction, however, Rotter's unidimensionality has been chal-

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* This does not mean that people can accomplish tasks beyond their capabilities simply by believing that they can, for competent functioning requires balance between self-beliefs, processed skills and knowledge. Rather, it means that self-perceptions of capability help determine what individuals do with the knowledge and skills they have. More importantly, self-efficacy beliefs are critical determinants of how well knowledge and skills are acquired in the first place (Pajares, 2000).

Internal Locus:
Individual believes that events in his/her life are guided by his/her personal decisions and efforts

External Locus:
Individual believes that events in his/her life are guided by fate, luck, or other external circumstances.

FIGURE 4 Most individuals perceive that an event is affected by both internal and external factors; therefore they would locate themselves somewhere on the continuum of this arrow, other than in one of the two extremes.

lenged, with many authors defending the separation of 'external' into more dimensions (i.e. 'powerful others', chance, fate, etc.).

Educators should restrain from strictly viewing internality as good and externality as bad. Internal LoC needs to be matched by skills and competence so as to act successfully on one's sense of responsibility. Internality without confidence and efficacy in one's abilities can cause anxiety and depression. On the other hand, one positive aspect of external orientation is that it may help a person lead an easy-going relaxed life.

Self-efficacy and locus of control do not necessarily correlate. To explain, although someone may consider that the way some future event turns out is under his/her control, he/she may or may not believe to be capable of behaving in such a way so as to achieve the desired result. For example, a student may believe that studying five hours a day would result in improved grades (internal LoC), but not believe that he/she is capable of studying that hard (low self-efficacy). The opposite is also possible: an individual may hold a strong confidence in his/her skills to do well, but consider that other factors will impede success. For example, a student may believe in his/her capability to motivate peers to modify their daily habits to reduce waste (high self-efficacy) but may not consider that such actions will have meaningful results anyhow, due to lack of efficient municipality services (external LoC).

Moreover, self-efficacy appears to be situation specific (Pajares, 2000; Siegle & Reis, 2000) and depends e.g. on familiarity with the issue, previous experience, etc., whereas LoC is considered a rather general measure of cross-situational beliefs of an individual about control (Siegle & Reis, 2000; Wi-

kipedia). Some writers, however, defend that LoC operates both as a generalised expectancy covering diverse situations, and as a specific expectancy towards a particular issue (Engleson & Yockers, 2001).

Because LoC of students appears to be an important parameter relating to the overall development of environmentally responsible individuals, we provide herewith some research findings that EE/ESD educators may find useful, when planning their activities (adopted from Markinkovski, 1994; Engleson & Yockers, 2001; Wikipedia):

- ■ LoC development is associated with family style and resources, cultural stability and experiences. Parents emphasising effort, education, responsibility and reward encourage internality to their children. Earlier born children in large families tend to be more internal than later borns. External LoC may be associated with low socioeconomic status, because poor people have less control over their lives.
- ■ LoC is relatively consistent when measured* over short durations but it may shift over longer periods. As children grow older they gain skills that give them more control over their environment, therefore they shift to a more internal LoC. Generally, an individual's perceived LoC may change due to new experiences.
- ■ Internal control individuals are more resistant to subtle manipulation, and to coercion and less influenced by high-prestige persons than are external ones.
- ■ People tend to believe that a group can yield more influence than an individual, thus subscribing to the idea of power in numbers, when confronting large complex issues.

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* Several scales developed to measure the perceived LoC of individuals can be found in literature, some of which specifically designed for children.

Based on previous research studies, Marcinkowski (1994) supports that educational interventions focusing on developing the skills needed to investigate, evaluate and then take action can eventually shift LoC of middle level students in a positive internal direction. Meaning, students begin to feel they can have an impact on issues of interest to them once they develop the basic skills to do so.

However, the author warns that students at this age may not be ready to tackle large complex issues. That is why he urges educators to plan their instructions in a gradual way starting from skill development activities, to 'easy to cope with' investigations (where students have a high probability of making an impact), and eventually to more difficult ones. Developing skills and experiencing success build the self-confidence of students, thus contributing also to the development of an internal LoC.

2.4   *When selecting educational method*

Obviously, there is a wide variety in methods and techniques used in any teaching-learning situation. Teaching methods revolve around the teacher, the learner and the curriculum (Lahiry et al., 1988): the teacher is expected to plan and apply the appropriate methods in order for the learner to achieve the objectives of cognitive, affective and psychomotor domains, as set by the curriculum.

However, the peculiarity with ESD (and EE) is that it is very personal, and involves beyond knowledge and understanding, an individual and collective commitment towards what Glascow (1994) calls 'earth care'. In this sense, the author suggests educators to weigh the methods towards those promoting interdisciplinarity, skills of analysis and problem solving, forming opinions and leading to actions, based on attitudes and deeper values of being in harmony with the environment.

The selection of the appropriate method for each particular instruction is critically important and it is determined by a series of factors. Based on existing literature (Lahiry et al., 1988; Glascow, 1994; Peace Corps, 1999; Kamarinou, 2000; Engleson & Yockers, 2001; Scoullos & Malotidi, 2004), these factors are categorised and briefly explained herewith:

The content of the issue and the instructional objectives: The teaching methodology is largely determined by the nature of the content being taught. For example, when teaching about the environment of the past, a field trip to nearby historic places would give learners first hand experiences and could motivate them to seek for more information from the elderly and other sources.

Method selection is influenced also by the objectives to be achieved through teaching. An educator may wish to convey knowledge, to influence the way of thinking, or promote certain types of behaviour. These different objectives require different working methods. For example, if the objective of a particular instruction is to explore value-related attributes, the educator may select from a series of *value clarification strategies* (i.e. a discussion method, a role play etc., refer to paragraph 3.16).

The characteristics of the learners, including age, stage of development, academic background, inclination, etc. Generally speaking, different strategies may be needed for different audiences and settings i.e. school children, students in a camp, women, etc. (Peace Corps, 1999).

With regard to formal schemes, many authors highlight the importance of being aware of the knowledge background of learners (i.e. Kamarinou, 2000; Engleson & Yockers, 2001), and urge for educators to ensure that the new concepts 'fit' with existing cognitive schemes. In this context, educators should also be aware of the stages of development and the proper way to 'instruct' children in each stage. To do that they may chose from a spectrum ranging from concrete educational experiences, involving physical activity on behalf of the learners (i.e. hands-on activities), to more abstract ones, with very little or no physical activity (i.e. using verbal symbols – speech) (Engleson & Yockers, 2001).

People have different ways and styles of learning and working together, set different priorities and prefer different teaching methods (Council of Europe, 2002). Lahiry (1988) claims that within the same group, people do not undergo the same process and degree of learning. Some learn fast and others slower; some are keen readers, others learn by doing (experimenting). Peace Corps (1999) add to these categories those who learn by feeling (experiencing, exchanging feedback); others by wat-

ching and listening (observing); and others by thinking (analysing rationally). Obviously, each person learns in a unique way. Effective teaching recognises the different learning preferences or styles and adjusts to address them.

Resources & administrative issues: The decision whether to apply a teaching method largely depends on economic and administrative parameters such as resources availability, time and space restrictions, etc. For example, the success of a field study approach could depend on the quantity of items like compasses, thermometers, hygrometers, etc. in proportion to the number of learners. Similarly, extended group discussions and debates are time-demanding, therefore difficult to insert in a 'loaded' school programme.

The characteristics of the educator, in terms of scientific and pedagogic adequacy, personality and teaching style. Educators' mastery of subject matter, their awareness of the methodology, familiarity and confidence to practice it are all important considerations. Applying a method appropriately presumes overcoming administrative and educational constraints and adapting themselves to the conditions in which the method is practiced, each time.

In any case, recognising that one and only teaching method may not be sufficient to address the desired objectives, and that learners may not learn from it equally, educators are advised to use a combination of methods that would best promote learning in their students. Actually, Matsaggouras, (2003a) goes beyond that to state that school has the *duty* to exploit the variety of teaching methods and techniques to maximise effectiveness of learning.

In line with this principle, the educational material "Waste in our life" presents a number of educational activities, based on a wide range of educational methods including experiments, research studies, role plays, visits, field work, surveys, etc. This variety in methods is intended to maximise learner participation, provide them with wide and diverse input and enable them to apply their gained experiences to similar or different situations. In Part III of the current publication, the advantages and limitations of each one of these methods are analytically presented.

2.5 *Issues' instruction*

The subject of waste is characterised by many EE and ESD experts (i.e. Hungerford et al., 1994a & 1994b; Engleson & Yockers, 1994; Kamarinou, 2000, etc.) as an 'environmental issue', rather than an 'environmental problem', meaning a subject around which different (and possibly contradicting) socio-political views arise, in terms of beliefs and values. Environmental issues extend beyond *factual* questions, even approach *ethical* questions; and in this sense their investigation through the process of teaching gives added value to education schemes in any free society.

> "The 'environmental issue' represents the interface of social change itself and relates to the conflict between the positive and negative consequences involved in that change process. Thus the 'issue' itself subsumes the human, technological, environmental and economic dimensions associated with sustainable development."
>
> (Hungerford et al., 1994b)

The controversy around issues -environmental or other- is not only pervasive, but is highly valued in any society that allows for different ideas and interests to compete (Peace Corps, 1999). In this context, education is called for to provide students with opportunities to confront alternative points of view, to weigh them rationally, to determine their own position on issues and to decide on their own the courses of actions they will follow in attempting to resolve these issues.

Dealing with issues in class presupposes providing an open atmosphere for intelligent confrontation to occur. This way, educational experiences may merge to the realities of citizenship and especially decision making. Educators are not to indoctrinate but instead help their students to analyse the merits of the different opinions around the given issue. They should also be familiar with all sides of the issue and stand firm for the right of each position to be heard. Nevertheless, this does not mean they should restrain from sharing their opinion in class. This is impossible to avoid, because by

example -even unintentionally- they constantly convey messages about their personal convictions (Titus, 1994; Halstead, 1996; Kamarinou, 2002, etc.). Peace Corps (1999) advise educators to express their views only after the issue has been thoroughly examined and students have had the opportunities to support their personal positions.

More information on educational methods appropriate for approaching issues can be found in paragraph 3.14 for debates and paragraphs 3.16 and 3.17 for addressing values.

2.6 *Educational objectives within the material "Waste in our life"*

Setting the goals and objectives of an EE/ESD programme, a curriculum, a text book etc., is of primary importance, as these provide the framework that guides all decisions and courses of action within the programme. Formulating the desired outcomes of a project may prove to be rather difficult for educators. Therefore they need to have a clear idea of what constitutes goals and objectives in order to be able to formulate comprehensive and achievable ones themselves (Council of Europe, 2002).

Goals are the general broad statements about what is to be achieved by the programme. Major reference texts and declarations such as the Tbilisi Declaration, the UN General Assembly Resolution that adopted the Decade for ESD (2005-2014), the UNECE Strategy for ESD, etc. may be useful for goal development (Hungerford & Peyton, 1994). Being long-term and general, these goals can hardly be used for instruction preparation. However, they provide a framework and guide educators to identify the desired learning outcomes of their programme (Marcinkowski et al., 1994).

While general goals provide the overall vision of a programme, the **Educational objectives** can be considered as the intermediate steps that need to be achieved in order to meet those goals. These are statements that capture in specific terms the intended or anticipated results of a planned educational experience. In literature they can be found as '*learning outcomes*', '*learner objectives*' or even '*performance objectives*', for in many cases they clearly identify what the learner should be able to do (perform) after exposure to a segment of instruction.

In turn, educational objectives serve also as a guide for developing learner activities, selecting the methodology to apply and also for developing evaluation measures. They constitute a common point of reference for interactions between all the relevant actors within a programme -programme designers, educators and learners (Kamarinou, 2000).

The North American Association for EE proposes a set of criteria in writing meaningful objectives, summarized by the acronym SMART (NAAEE, 2004). A SMART objective is:

Specific - Describes an action, behaviour, outcome, or achievement of the audience that is observable,

Measurable - Details quantifiable indicator(s) of progress towards meeting the goal (e.g. 70% of participants..., five or more ...)

Audience - Names the audience (e.g. workshop participants, community members);

Relevant - Is meaningful, realistic and ambitious; the audience (given the appropriate tools, know-

TABLE 6 Examples of educational goals and objectives within an ESD programme on waste.

Educational Goal	Educational Objective
To help learners gain a greater appreciation for the environment	After the end of the activity learners will identify the composition of household wastes.
To foster positive recycling habits	Given separate containers in class (for paper, aluminium, glass), students shall separate their waste and every time they have something to discard they place it in the appropriate container.

ledge, authority, etc.) can accomplish the task or make the specified impact;

Time-bound - Delineates a specific time frame.

For ESD programmes in particular, the UNECE Strategy for ESD (UNECE, 2005) urges for educational objectives to include knowledge, skills, understanding, attitudes and values, while UNESCO's Plan of Implementation (UNESCO, 2005) adds that ESD learning should lead to active participation. In line with these reference texts, the four domains of the educational objectives of the material "Waste in our life" are the following:

(i) Cognitive, referring to awareness & knowledge,
(ii) Affective, referring to behaviours, attitudes and values,
(iii) Psychomotor, referring to physical skills, social and communication skills,
(iv) Participation and involvement in creative action.

This classification is in accordance with ESD literature. On the one hand, it is based on Benjamin Bloom's work, who developed a taxonomy of educational objectives, as a means of expressing qualitatively different kinds of thinking back in the 60's. Since then attempts have been made to review the original taxonomy and adapt it for classroom use, * but it is still one of the most universally applied models. The undeniable value of Bloom's work rests in that it was the first attempt to classify learning behaviours and provide concrete measures for identifying different levels of learning.

Bloom's taxonomy refers to three domains: the cognitive, affective and psychomotor -sometimes overlapping with each other. The classification suggests a hierarchy in levels (categories) highlighting that each level should be mastered before progressing to the next. Tables 7-11 describe the levels of increasing difficulty in the cognitive, affective and psychomotor domain.

The classification of educational objectives in "Waste in our life" is however, also based on the work of Hungerford and others that follwed him. A common feature in these is that they call for a shift from an awareness-based towards a problem solving and action-based outline (i.e. Benett, 1984; Hungerford & Peyton, 1994; Engleson & Yockers, 1994; Flogaiti, 1998; Brunner et al., 2001; Scoullos & Malotidi, 2004).

The *cognitive domain* (☙) refers to knowledge and awareness objectives. These usually relate to particular gains in theory and scientific insights for the learners to master. They may refer also to acquiring awareness of the entirety of environmental and allied socio-economic issues, such as environmental degradation, wasteful consumption, poverty, gender inequality, violation of human rights, etc. These objectives relate also to developing, in the long run, students' cognitive skills of 'learning to know' in order to recognise the challenges of the modern world in the environmental, social and economic sectors.

Bloom's subsequent levels (categories) of cognitive objectives are listed in table 7, which includes also a selection of action verbs to be used when writing such objectives as well as possible activities that can be carried out in class. Some researchers consider the more advanced categories of analysis, synthesis, and evaluation as 'problem solving' skills. In any case these categories certainly entail higher order thinking abilities.

The *affective* (🌿) is the domain of behaviours, attitudes and values. Here, educational objectives are designed to help students gain a variety of experiences, feelings and motivation, acquire and strengthen values of concern for the environment at large.

Of course, changes in attitudes and values are slow and rather complex processes that are determined by many personal and social-deriving factors (Papadimitriou, 1998; Brunner et al., 2001). Recognising that these evolve gradually and progressively over time, Engleson & Yockers (1994) suggest they need continual stimulation and reinforcement. And as far as behaviour and habits are concerned, Hungerford admits that changes in behaviour are difficult to occur even for those who show some degree of environmental sensitivity (Hungerford et al., 1994a).

The assessment of any objectives referring to emotions and attitudes is very difficult to carry out, much less with tools designed for the cognitive domain, like tests, questionnaires, etc. (Lahiry et al., 1988). By means of observation, changes may be depicted in students' behaviours at school and at home, during or after an EE/ESD programme. In the long run, students may eventually adopt atti-

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* During the 90s' Lorin Anderson, former student of Bloom, led a team of experts in revisiting the taxonomy and resulted in a number of proposed improvements. These can be found in Anderson & Krathwohl (2001).

tudes and behaviours towards life patterns compatible with the principles of sustainability. Bloom's taxonomy, found in table 8, lists five levels starting from the simplest behaviour resulting to the most complex, giving examples for each one.

Find more information on the three prevailing behaviour change models as Annex.

The *psychomotor domain* (⚒) originally referred to the development of skills relating to manual tasks and physical movement, in other words actions which demonstrate the fine motor skills, i.e. the use of precision instruments or tools. However, today the psychomotor domain is considered to cover also the area of new technologies, social and communication skills, such as ability to use computers and internet, fluency during public speaking, etc. (Alan Chapman webpage).

Various experts have built on the work of Bloom within this domain, because he originally identified it in a broad sense, but did not fully explore it. The three commonly referred versions of the psychomotor domain are those of Dave, Simpson and Harrow. Since all three taxonomies are suitable and may be used by EE/ESD, we present a short description of all three of them in tables 9, 10 and 11. Dave's model is considered simple and easy to apply when training adults while Harrow's and Elizabeth Simpson's models are more relevant for children and youth, or for developing skills in adults that take people out of their comfort zones. This is because the latter models offer different emotional perspectives and advantages, which are useful for certain learning situations and which do not appear so obviously in Dave's structure.

Finally, the objectives of *participation and citizenship action* (⚴) are those relevant to the learners' active involvement at all levels. One of the ultimate goals of EE & ESD is to develop a human being who can become an effective citizen in the world community and who can contribute to the solution of environmental issues. Therefore, this set of objectives refers to the individual or collective actions to address issues of one's local surroundings, or of global scale. A thorough examination of the educational methodology for addressing participation and citizenship action skills of students is presented in PART III of the current publication (paragraph 3.20).

The educational objectives of the material "Waste in our life", classified in the four domains (Cogni-

tive – Affective – Psychomotor – Action) are given in each activity sheet. Educators are advised to present them in advance so that learners are aware of the desired learning outcomes of their activities (Marcinkowski et al., 1994; Council of Europe, 2002; Matsaggouras, 2003a). Without a clear understanding of the aims of an activity, learners are likely to become disorientated and waste time trying to discover what it is the teacher wishes them to achieve or learn (Ramsden, 1992).

Depending on the experience of learners they may be encouraged to take part in forming the objectives. In some cases it is more appropriate not to present any pre-determined objectives, but to design them from scratch together with the learners. Kamarinou (2000) stresses on the importance of allowing learners to express their own expectations and desires from the implementation of an EE/ESD programme particularly at its early stages. Even though the objectives of each activity are subject to re-formulation they should always be in consistency with the general goals of the programme and the principles of EE and ESD. Generally, it would be desired to have a balanced incorporation of the four abovementioned domains (Gavrilakis, 2005).

On the other hand, when writing objectives, educators should pay attention not only to the tasks that the students are expected to do after the completion of an activity, but also to the type and quality of learning processes they will have experienced during this activity. Such results, referring for example to the level of group collaboration, or cultivation of self-confidence of weak students, are in principle difficult to assess. That is why it is essential to include quantitative as well as qualitative methods for assessing the achievement of the objectives of a programme or activity.

In closing it should be reminded that the application of the model of objectives classification in the four abovementioned domains (Cognitive – Affective – Psychomotor – Action) should be viewed as a tool. Since tools are most useful when the user controls them –not vice-versa– educators are urged to exploit the proposed taxonomy within their own context. In any case, the objectives of each activity are not set and definite but may be subject to re-formulation and adjustments.

A list of examples of objectives from the four domains is given in table 13, as taken from the learners' book of the material "Waste in our life".

TABLE 7 Bloom's taxonomy of cognitive objectives (adapted from Bloom et al., 1956). Last column was adapted from the website of 'The oz-TeacherNet'.

Category	Description	Verbs	Examples	Examples
Knowledge	Ability to recall previously learned concepts.	Define, identify, list, name, recall, recognize, record, relate, repeat, underline	• Make a time line of events in a story. • Draw a facts chart / concept map/ list of keywords.	• Make a list of the story protagonists. • Recite a poem, or part of it.
Comprehension	Ability to grasp meaning, explain (in one's own words), restate ideas.	Choose, give examples, demonstrate use of, describe, determine, discuss, differentiate between, explain, identify, indicate, interpret, locate, pick, report, restate, review, recognize, select, translate, respond, practice, simulate	• Cut out, or draw pictures to show a particular event. • Illustrate what you think the main idea may have been. • Make a cartoon strip showing the sequence of events in a story.	• Retell the story in your own words. • Outline the main points of the story. • Write a summary report of the event. • Write and perform a play based on a story.
Application	Ability to use learned material in new situations.	Apply, demonstrate, dramatize, employ, generalize, illustrate, interpret, operate, practice, relate, schedule, shop, solve, use, utilize	• Make a diorama to illustrate an event. • Make a collage about the areas of study. • Construct a model (from paper, clay, etc.) to demonstrate how something looks or works. • Prepare invitations for a character's birthday party.	• Write a textbook about the story for others. • Take a collection of photographs to demonstrate a particular point. • Make up a puzzle or game about the topic. • Continue a given story.
Analysis	Ability to separate concepts into component parts and show relationships between parts.	Analyze, appraise, calculate, compare, categorize, correlate-contrast, criticize, deduce, debate, detect, determine, diagram, differentiate, distinguish, estimate, evaluate, examine, identify, experiment, inspect, predict, question, relate, solve, test, diagnose	• Design a questionnaire to gather information. • Survey classmates to find out what they think of a particular topic. • Construct a graph to illustrate selected information. • Classify the actions of the characters of a book.	• Make a flow chart to show the critical stages. • Make a family tree showing relationships. • Devise a role-play about the study area. • Write a biography of a person studied. • Review a work of art in terms of form, colour and texture.
Synthesis	Ability to put together the separate ideas to form a new whole, establish new relationships.	Arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, modify, organize, plan, prepare, produce, propose, predict, reconstruct, set-up, synthesize, systematize, devise	• Invent a machine to do a specific task. • Create a new product. Give it a name and plan a marketing campaign. • Write a TV show, play, puppet show, role play, song or pantomime about …	• Design a record, book or magazine cover for… • Develop a menu for a new restaurant using a variety of healthy foods.
Evaluation	Ability to judge the worth of material against stated criteria.	Appraise, assess, choose, compare, critique, defend, estimate, evaluate, judge, rate, revise, score, select, validate, value, test	• Form a panel to discuss view points. • Make a booklet about five rules you see as important. • Convince others. • Prepare a list of criteria to judge … • Write a letter to … advising on changes needed.	• Write a persuasive speech arguing for / against… • Write an extended project report. • Prepare a case to present your view about … • Write about your feelings in relation to…

TABLE 8 Bloom's taxonomy of the affective domain objectives (adapted from Krathwohl et al., 1973).

Level	Definition	Examples	Verbs
Receiving	Being aware of or attending to something relevant to a key issue.	• *Individual reads an article or a book about the threats posed by water shortage in his/her country.* • *Individual listens to others with respect.*	Accept, attend, develop, recognize
Responding	Reacting to a particular phenomenon, or showing some new behaviours as a result of experience.	• *Individual seeks more relevant articles or contacts municipalities or environmental NGOs to find relevant information on a subject of interest.* • *Individual participates actively in group discussion (or activity) on a subject of interest.*	complete, comply, cooperate, discuss, examine, obey, respond
Valuing	Attaching worth or value to a particular object, phenomenon, or behaviour. This ranges from simple acceptance to the more complex state of commitment.	• *Individual changes his/her daily water consumption habits, or voluntarily attends a local "water conservation campaign".* • *Individual is sensitive towards individual and cultural differences (value diversity)*	Accept, defend, devote, pursue, seek
Organization	Prioritising new values after weighing and contrasting these and integrating them within one's own unique value system.	• *Individual devotes his/her limited free time to get involved in the set up of a campaign to sensitize citizens of his/her city.* • *Individual recognizes the need for balance between freedom and responsible behaviour.*	Codify, discriminate, display, order, organize, systematize, weigh
Characterization by Value	Internalizing values and acting consistently with them. The behaviour is therefore predictable and characteristic of the individual.	• *The individual is firmly committed to water conservation and behaves accordingly.* • *The individual uses an objective approach in problem solving.*	Internalize, verify, act, modify, authenticate, defend, habituate, verify

TABLE 9 Dave's model of the psychomotor domain objectives (adapted from Alan Chapman webpage; original reference: Dave R., "Developing and Writing Behavioral Objectives", Tucson AZ, Educational Innovators Press, 1970).

Level	Definition	Examples	Verbs
Imitation	Copy action of another; observe and replicate	*Watch teacher or trainer and repeat action, process or activity.*	copy, follow, replicate, repeat, adhere
Manipulation	Reproduce activity from instruction or memory	*Carry out task from written or verbal instruction.*	re-create, build, perform, execute, implement
Precision	Execute skill reliably, independent of help	*Perform a task or activity with expertise to a high standard without assistance or instruction; able to demonstrate an activity to other learners.*	demonstrate, complete, show, perfect, calibrate, control
Articulation	Adapt and integrate expertise to satisfy a non-standard objective	*Relate and combine associated activities to develop methods to meet varying, novel requirements.*	construct, solve, combine, coordinate, integrate, adapt, develop, formulate, modify, master
Naturalization	Automated, unconscious mastery of activity and related skills at strategic level	*Define aim, approach and strategy for use of activities to meet strategic need.*	design, specify, manage, invent, project-manage

TABLE 10 Elizabeth Simpson's model of the psychomotor domain objectives (adapted from Alan Chapman webpage; original reference Simpson E., "The classification of educational objectives in the Psychomotor domain", Vol 3., Washington DC, Gryphon House, 1972).

Level	Examples: *The individual...*	Verbs
Perception: ability to use sensory cues to guide motor activity	...estimates where a ball will fall after it is thrown and moves to the correct location to catch it).	hear, feel, touch, notice, recognise, distinguish
Set: readiness to act (Mentally, physically and emotionally)	...knows and acts upon a sequence of steps in a manufacturing process. ...Recognises one's abilities and limitations.	arrange, prepare, get set
Guided Response: the early stages in learning a complex skill that includes initiation and trial & error	...follows instructions to build a model. ...performs a mathematical equation as demonstrated.	imitate, copy, follow, try
Mechanism: the intermediate stages in learning a complex skill (basic proficiency)	...competently responds to stimulus for action. ...uses a personal computer. ...drives a car ...repairs a leaking faucet.	Assemble calibrate, measure, mend, perform, shape, complete
Complex Overt Response: skilful performance of motor acts that involve complex movement patterns (expert proficiency)	...operates a computer quickly and accurately. ...manoeuvres a car in a tight parking spot. ...displays competence while playing the piano.	coordinate, fix, demonstrate
Adaptation: skills are well developed and the individual can modify movement patterns to fit special requirements (adaptable proficiency)	...responds effectively to unexpected experiences. ...modifies instruction to meet the needs of the learners. ...alters response to reliably meet varying challenges.	adjust, adapt, alter, integrate, reorganise, solve
Origination: creating new movement patterns to fit a particular situation or specific problem. Being creative based upon highly developed skills (creative proficiency)	... develops and executes new integrated activities. ...constructs a new theory. ...designs a new comprehensive training programme.	build, design, formulate, modify, re-design, trouble-shoot

TABLE 11 Harrow's model of the psychomotor domain objectives (adapted from Alan Chapman webpage; original reference: Harrow A., "A taxonomy of the psychomotor domain: A guide for developing behavioral objectives", New York, David McKay Co, 1972).

Level	Examples: *The individual...*	Verbs
Reflex movement: Involuntary reaction	...responds physically instinctively.	react, respond
Basic fundamental movements	...alters position, moves, performs simple action.	grasp, walk, stand, throw
Perceptual abilities: Basic response	...uses more than one ability in response to different sensory perceptions.	catch, write, explore, distinguish using senses
Physical abilities: Fitness	...develops strength, endurance, agility, control.	endure, maintain, repeat, increase, improve, exceed
Skilled movements: Complex operations	...executes & adapts advanced, integrated movements.	drive, build, juggle, play a musical instrument, craft
Non-discursive communication: Meaningfully expressive activity or output	...performs activity that expresses meaningful interpretation.	express and convey feeling and meaning through movement and actions

TABLE 12 Proposed verbs to be used within the forth action domain of educational objectives.

Verbs	Examples
Persuade, boycott, debate, testify, operate, lobby, monitor, calibrate	*Within a school presentation, the students will be able to persuasively argue the point of view of the class as determined by a survey, before and after the debate.*
	Following a programme on environmental action, students will be able to write a suitable definition for consumer action and name at least two issues that may be influenced by that kind of action.
	Following a programme on environmental action, students will be able to describe the dangers of persuasive actions based only on emotions.

TABLE 13 Examples of learners' objectives found in the educational material "Waste in our life".

Cognitive	Affective	Psychomotor	Participation & Action
To identify the composition of household waste.	To be motivated to consume less.	To practise in working in the field.	To cooperate and work in groups effectively.
To name the various types of household waste e.g. recyclable and non, organic, toxic, biodegradable, etc.	To be positive towards purchasing environmentally friendly products.	To conduct simple experiments.	To be involved in the set up of reuse-recycling schemes in the school premises.
To list the environmental impacts resulting from the improper disposal of hazardous household and municipal waste.	To be encouraged to purchase products supplied in a recycled or recyclable packaging.	To analyse given information and elaborate research data (classify, differentiate, correlate) in order to draw conclusions.	To raise awareness of the local community to reduce waste generated.
To compare the various waste management practices in terms of policies and legislation in the various Mediterranean countries.	To be encouraged to reuse and recycle the waste one produces.	To develop communication skills such as: expressing opinions based on arguments, making presentations and reports, writing letters to officials, etc.	To practice communication skills such as: expressing opinions based on arguments, making presentations, writing letters to officials, etc. in an attempt to solve an environmental issue
To estimate the contribution of mass media to raising public awareness on environmental issues.	To habituate against littering.	To be able to organise events such as exhibitions, competitions etc.	To volunteer in organising events such as exhibitions, competitions etc. in an attempt to address an environmental issue
To interpret warning labels on packaging of products.	To make efforts to reduce the volume of waste one produces.	To be able to convince others to reduce the volume of waste they produce.	To systematically engage in efforts to convince others to reduce the volume of waste they produce.
To evaluate the degree of "environmental friendliness" of the various materials.	To recognise that producing less waste actually means consuming less.		
To recognise the various types of packaging and identify methods for management of packaging waste.			

2.7 *Evaluation*

The broad term 'evaluation' refers to the appraisal of the value of any subject/system. Lahiry et al. (1988), give a more technical definition of the term, referring to the process assessing the relevance of input and efficiency of a system through the measurement of output, and explain that this feedback helps to make needed changes in the planning and execution of an activity.

Evaluation is certainly a significant component in any teaching and learning context. It may refer to several aspects of an educational programme, such as its design and planning; the methods and the material utilised within; the realisation of its set objectives; the instructor's effectiveness; the learner's interactions and relationships; the programme's results through the learner's performance, etc. Benett (1984), referring specifically to evaluating EE programmes, uses the terms *effectiveness* and *efficiency*; the former referring to products, ends or outcomes and the latter to the process, the means, and the appropriateness of the teaching method.

Depending on the context of an EE/ESD programme, evaluation can be carried out in any stage. A commonly applied pattern is that of using evaluation instruments for pre- and post-testing. However, in order to be meaningful, it is recommended that evaluation takes place throughout the whole programme being an integral part of day-to-day learning experiences (Lahiry at al., 1988; Stimpson, 1997; Council of Europe, 2002; Kamarinou, 2002).

In EE and ESD bibliography there appear to be two distinctive schools of thought determining the character of evaluation of programmes (Benett, 1984; Lahiry et al., 1988; Kamarinou, 2002):

According to the prevailing goal-oriented school of thought, evaluation is directed toward measurement of achievement of previously identified instruction objectives. This process refers mainly to learners' achievements of the objectives -and to a lesser extent to parameters like the content of the programme, the quality of the material used, etc. It is carried out through appropriate tools and may have formative or summative character (during or at the end of a programme), both providing feedback for the possible amelioration of the overall project. Linking evaluation to specific objectives may prove rather difficult (Hungerford, 1994a), highly depending on the exact wording of each objec-

tive (for verbs used in writing objectives refer to paragraph 2.6).

The second school of thought refuses the uniform linear model of objectives-to-outcomes, acknowledging the educational process as highly complex, involving many inter-dependent and frequently unforeseen factors (such as classroom conditions, institutional context, learners' and educators' characteristics). In this context, no matter how well-drawn in advance, there is always a differentiation between the planning and the actual implementation of any programme. In this case, a goal-free evaluation model may be applied, assessing in an unbiased way what is being achieved in a programme, without considering what was intended to be achieved.

The tools for evaluation are determined by the nature of what is to be evaluated. It can be done orally (i.e. through interviews), in writing (i.e. through questionnaires, multiple choice and completion questions, essays, etc.), or by means of observation (free or using check lists and rating scales). In general, academic achievement is measured in writing, while skills, attitudes and behaviours of learners can be assessed through observation tools, or by examining recorded work i.e. delivered stories, posters, portofolios, etc. However, the time and effort demanding methods of direct observation that may even entail extra costs (i.e. external evaluator) may discourage educators from applying them.

In any case, in order to evaluate an EE/ESD programme sufficiently, a combination of complementary techniques would be most appropriate. Innovative methods like creative games, etc. may prove good evaluation tools as well. The process of self evaluation is of utmost importance, this being done e.g. by diaries, self reports, etc., not excluding discussions, where each participant, including the educator, values their own level of activity and explains factors that hindered them from getting involved.

Action Research is another EE/ESD method that can, in a way, be considered as a tool of continuous evaluation. Action Research is a process in which educators themselves examine their educational practice systematically and carefully, using the techniques of research. It is a reflective investigation of an educator with the intent that the research will reform and change his/her practices in the future. This

research is carried out in real time environment (i.e. class) on questions that deal with tangible educational matters. Often, action research is a collaborative activity among colleagues searching for solutions to everyday, real problems experienced in schools, or looking for ways to improve instruction and increase student achievement.

In line with the above, assessment tests have not been included in the educational material "Waste in our life" to evaluate the work of learners. However, at the end of each activity sheet, a set of questions is often incorporated aiming to stimulate self-reflection, follow up discussion, etc. Students' reflection is important for them to realise *what they have done, why,* as well as *what were the outcomes of their work*, and *in which way they will use them*. The educator is advised to incorporate such metacognitive processes that help students gradually gain active control over their own process of thinking, increase their self-consciousness as well as their potential for self-regulating learning (Matsaggouras, 2003a).

Part III

*Specific methodological guidelines
on the implementation of the activities*

3.1 *Group Work*

In most activities of the material 'Wastes in our life' group work is recommended, a method that encourages students to take part, to share and to interact. One should not forget that participation, communication and cooperation are integral parts in any scheme addressing sustainability, much less an ESD programme. Actually, literature based on Vygotsky and Piaget supports that although learning and development are individual's own achievement, these are 'constructed' in a collective framework (Matsaggouras, 2003; Kokkotas, 2002).

The advantages of applying the method are plentiful. It has been found that working in groups encourages learners to share understandings. Group members continuously reform their ideas by being constantly exposed to opinions and challenges of other members. The method draws out meaning, on which learners can build and in most cases they reach options that would have never evolved through individual work. Also, group work encourages greater confidence in learners' abilities (read more on self-efficacy in paragraphs 2.3 and 3.17); contributes to achieving consensus on decisions; and reinforces the sense of ownership of solutions (Matsaggouras, 2000). Overall, within groups the processes of learning, feeling and eventually acting are interrelated in a natural, authentic way.

Nevertheless, ill-planned or sporadically planned group work may give poor results in terms of collaboration or final products (Smith, 1998; Kamarinou, 2000). The necessary planning and preparation by the educator and the potential little participation of some members can be considered as the method's drawbacks (Glascow, 1994).

Forming groups successfully entails certain criteria, the principal of which is *diversity*: parameters to be taken into account include age, sex, nationality, number and roles of members in a group, maximising the contribution of each student's skills and competences, their willingness to share knowledge, etc. (Kokkotas, 2002; Jaques, 2004). By predetermining group composition, the educator can encounter the natural tendency that most people have to group with those they are more familiar with (Smith, 1998). Various roles can be assigned within a group such as the recorders, the reporters, the time keepers, etc.

When forming student groups, educators should bear in mind that groups will reach higher levels of efficiency when obtaining the following characteristics (based on the recommendations of Smith, 1998; Seebach, 2001; Kokkotas, 2002; Matsaggouras, 2003a; Jaques, 2004; Scoullos & Malotidi, 2004):

a. Task objectives and member responsibilities should be clarified both at individual and at group level. Especially for inexperienced classes, it may be necessary to jointly pre-decide on clear guidelines to facilitate work i.e. discussion rules, etc.

b. Group members should feel a commitment to commonly established objectives and a sense of ownership for their commonly decided work.

c. All members can contribute their personal resources, qualities and competences for successful results. Creating participative and interactive teamwork and decision-making does not mean that every member contributes in the same way: but it does mean that everyone can contribute to their full potential.

d. A climate of trust and encouragement to express ideas, disagreements, feelings and questions should prevail, where members make efforts to understand each others' points of view. In this framework conflict would be considered as a normal aspect of interaction and as opportunity for creativity and improvement. Members should interact even when undertaking individual sub-tasks.

There is no rule on the size and synthesis of a group, as this depends on the task and desired objectives, each time. In general, big groups are slower, having a more complex system of communication with low level of individual participation. On the other hand, as the group size decreases, so does the quantity and quality of ideas expressed. The size of 4 members per student group is considered a golden mean by many experts. In this case, mixing a highly competent, two average and one weak student is recommended in some cases, as this synthesis allows some tutoring to take place from the most competent student towards the other three (Matsaggouras, 2003a; Jaques, 2004).

It is a common phenomenon that within a group a student acquires a *leading* status, making the rest of the members less active. However, decentrali-

zation and limitation of hierarchy should be pursued, in line with cooperative learning theory. So, depending on the assigned tasks, it is advised to re-form the groups every 5-6 weeks. This shift allows the rotation of roles within groups and halts inclinations towards hierarchical forms, by simply changing the group dynamics (Matsaggouras, 2003a; Jaques, 2004). On the other hand, 5-6 weeks is a period long enough to secure the tightening of bonds among members and the development of the collaborative skills needed to perform demanding, complex tasks (Seebach, 2001).

In order to obtain meaningful results, regular consultations among groups may be necessary (Matsaggouras, 2003a; Scoullos & Malotidi, 2004). During such consultations, groups update each other on issues like how they approach their tasks, the challenges faced, their working relationships, etc. This is an opportunity for the whole class to reflect on each group's contribution to the objectives of the overall project, and if necessary, commonly decide on modifications. This process, among others, enables learning groups to focus on group main-

tenance and helps students to practice collaborative skills consistently. Of course, a climate of cooperation rather than competition among groups should be cultivated.

In general, the function and work of a group should be examined and evaluated in two distinct, equally important levels: The level of the performed task and the level of the performed communication within members (Kamarinou, 2000; Matsaggouras, 2003a; Jaques, 2004). The level and quality of intra-communication of members should not be underestimated. Actually, Kamarinou (2000) supports that the main force driving adolescents to participate in groups is this need of peer interaction.

Educators should bear in mind that because working in groups is a skill that is cultivated, they should be patient to let their class improve over time. A good starting point to apply the method is through simple, short group discussions (see relevant paragraph 3.2), and later, as students become more efficient, the time and complexity of the tasks demanded may increase.

3.2 *Discussion techniques*

Discussions in class may take a variety of forms ranging from the traditional teacher centred lecturing, through less formal group discussions, to brainstorming techniques, student led debates, etc. The virtues of a well planned discussion are numerous: it sharpens the use of language; it requires thinking ideas through to clarify opinions; it helps to learn to listen to the iseas of others, it allows for the sharing of information, the logical progression and pooling of ideas; and eventually fosters the formulation of solutions (Scoullos & Malotidi, 2004).

Whatever form the discussion takes, free or formal, Glascow (1994) supports that there should always be someone in control and that the success of the technique rests heavily with the moderator (may that be the teacher or a competent student). Many authors underline the important facilitator skills needed such as interacting successfully with the participants; dealing with any controversy that may rise; guiding participants back to discussion when deviating; visualising the expected outcome, etc. (Lahiry et al., 1988; Georgopoulos & Tsaliki, 1998; Kamarinou, 2000).

But how can the teacher really divert the weight of a class discussion from him/herself to the students? Based on the work of Georgopoulos & Tsaliki (1998), Kamarinou (2000) and Brunner et al. (2001), some practical advice are given, to help in achieving student-centred discussions:

- The starting point of any discussion should be something the students have experienced. Gradually, discussion may move from the specific to the general.
- Students' participation can be enhanced, for example, by drawing from the highly advanced knowledge and experience they have in certain issues (e.g. computers); by stressing that often there is no single objective view to an issue, but rather many subjective ones; by asking them to state their queries, etc.
- In many cases educators should use simple open-ended questions, asking for an opinion, rather than knowledge on an issue (e.g. '*What do you think about …?*' instead of '*What do you know about …?*').
- Allowing enough time for a student to answer a

question is an important aspect, often forgotten.

- In the case of a wrong reply the student should certainly not be condemned and the educator should rather build on the reply by giving more clues for the student to re-think, or, when appropriate, engage the whole class in an open dialogue to test the accuracy of the initial reply, and help to 'correct' it.
- Children's questions are a great opportunity to exploit their curiosity, interest and sense of exploration. Instead of simply answering students' spontaneous questions, it is better to convert these into meaningful learning activities (or questions), so that they find the answer themselves (Example: '*Let's see what we can do to understand more about ...*'). Of course, unless educators train themselves to formulate questions through research and experimentation, they cannot expect students to ask exploratory and meaningful queries.
- Objects, articles, pictures, etc., may all be used as stimuli. Naturally, variety of input is crucial in stimulating questions, creativity and inventiveness.
- Non-verbal communication techniques may also promote student participation. Educators should keep eye contact with the student they talk to, address them by their names, attend to their feelings and avoid standing still in class. They may use facial expressions to show their satisfaction about a correct reply, but should avoid expressing strong feelings of rejection on a wrong reply.
- Whatever discussion method used, it should have clear, meaningful results. The clarification process can be supported by the educator who should undertake to summarise the main discussion points and draw conclusions at the end.

We present here two techniques that can be applied during instruction in any discipline, the *tell each other* technique and the *group discussion*, proposed also by Scoullos & Malotidi (2004). The more elaborated methods of *debates* and *panel discussions*, which require preparation on behalf of the student, are presented in paragraph 3.14).

The **'tell each other'** discussion technique is especially recommended for science classes, as it gives the opportunity to involve all students (Ross et al., 2000). In this method, instead of stating a question and waiting for hands to go up, the educator requests students to say their ideas to each other,

in pairs, in a set time (e.g. half a minute, or longer for complex issues). Then the educator re-states the question to the class, chooses some students to respond and after hearing each response checks who agrees by raising hands, he/she may ask for alternative ideas. This does not take much longer than the usual class questioning. Its value lies in allowing all students to express and rehearse their ideas verbally before answering to the whole class.

In the **small group discussion** method, group members may reflect and exchange opinions, arguments or feelings on a topic introduced by the educator. Of primary importance is to give students explicit instructions as to the goals of the discussion. This helps them focus on a clear task rather than drifting around the topic (Smith, 1998). (Example: *Instead of simply asking groups to discuss on an article about incineration it is better to ask them to detect in the article two advantages and disadvantages of the method*). The technique is ideal for students who are otherwise less likely to contribute in a plenary. Also, because students have less anonymity in small groups, they are somehow urged to provide input. When groups are expected to report back to the class the discussions become more productive, because this increases each student's responsibility and adds a sense of purpose to the discussion (Smith, 1998). For this reason, one group member may be assigned the role of reporter (*rapporteur*), who records the ideas expressed and expresses the group's collective position on the issue. By the end of the activity the educator -facilitated by the *rapporteurs*- may summarise the main points of the groups and conclude.

Overall, the method promotes group dynamics, as the awareness and familiarity that is cultivated through discussion aids in holding other forms of group work (i.e. projects, problem solving, etc.). The method is very suitable for discussions on values and attitudes (UNESCO etc. No 35, 1993; Georgopoulos & Tsaliki, 1998). On the other hand, if the method is used far too often and without a particular purpose, it may be tiring for students (Smith, 1998).

3.2.A *Conducting a brainstorming*

Brainstorming is a widely applied method, used to explore individuals' spontaneous thoughts and ideas about a central theme. It is based on the assumption that during a discussion one idea can trig-

ger off a host of others. The technique is frequently used at the beginning of a lesson or programme as a brief diagnostic assessment to assess strengths and weaknesses (Lahiry et al., 1988); in some cases for tracing attitudes (Gavrilakis, 2005); or eventually for identifying solutions during a problem solving process (Glasgow, 1994; Jaques, 2000). Because responses are elicited quickly -in the form of a 'storm'- the method is particularly useful when time margins are pressing.

The main principle during a brainstorming is that no single idea is rejected: even when responses seem irrelevant to the class, or not up to the educator's expectations, they should be welcome without criticism, as there is no 'wrong' or 'excluded' idea (UNESCO etc. No 15, 1985; Lahiry et al., 1988; Jaques, 2000; Kamarinou, 2000). Logically, the more ideas heard, the easier it is to reach a really creative and novel one.

Brainstorming demands a rather skilled moderator (in most cases the educator), able to keep the balance between the vigilance and fast tempo necessary for the technique and a friendly atmosphere in the group. The moderator should ensure that the rules of the technique are obeyed: that is free association of ideas, fast responses, paying attention to the speaker, equal chance for all to express, etc. Another task for the moderator is to urge learners to build on the ideas of others, and to reformulate when necessary any vague ideas, in order to clarify the underlying concepts.

At the beginning of the brainstorming the moderator should present and clarify the issue to be examined to the participants, the process and if necessary remind them of the rules. He/she can use an object to stimulate interest or introduce a really provocative idea, in order to guide the participants' thoughts out of cotemporary paths, to more unusual and obscure ideas. Depending on the complexity of the issue, participants may be given a few minutes to think/note their arguments before the actual 'storm' begins. During the discussion, it is better for participants to have eye contact. The moderator notes on a flip chart the key words and phrases arising, when necessary in a scale of hierarchy (Scoullos & Malotidi, 2004), or by drawing an issue web (see paragraph 3.3). The last step is reflection on the ideas noted and discussion on which ones may eventually be appropriate and applicable.

Overall, brainstorming is a simple, non-demanding and lively method that generates interest and may be used in a variety of contexts. It may be good practice for students to concisely elaborate and present their views on a subject, even if they don't know much about it, teaching them to avoid hasty, reckless expressions and helping them to feel comfortable with taking part in group discussions (Gavrilakis, 2005). According to Jaques (2004), the best results are obtained when participants have a general idea about the issue, without knowing it in detail, and when they have varying background and personality traits. On the other hand, the method is not effective when applied in a superficial way, neither when participants cannot freely function within the process.

3.3 *Drawing issue webs*

Key words and ideas arising from a brainstorming or discussion session can be arranged in a form of a 'web' (Matsaggouras, 2003a), called also 'issue web', which may be considered as a preliminary form of a concept map (see paragraph 3.5). The issue web is simply a cognitive-mapping technique which ties multiple concepts together in a manner so as to demonstrate the enormous number of interrelationships of issues.

To make a web, a central word or phrase is written on a board and as brainstorming takes place, a series of 10-15 secondary key-words (or 'satellites') arising from the class gradually radiate around it in a meaningful manner. Being brief and using single words is the key to a good web, but sometimes it is necessary to add brief explanatory sentences. Depending on the theme, the satellites may be grouped, after common agreement, or interconnected with lines. Actually, solid, dotted or coloured lines may be used to depict the various types of relationships identified (Hungerford et al., 1994a).

An example of a rather advanced web on environmental problems and solutions relating to solid waste management is illustrated in figure 5.

If the group of students is inexperienced the teacher should lead the class by drawing webs after

ENVIRONMENTAL PROBLEMS   HUMAN HEALTH PROBLEMS

HOUSEHOLD
INDUSTRIAL
ROADSIDE
ON-SITE
AIR POLLUTION
SEWAGE
INCINERATION
LITTER
SURFACE AND
GROUNDWATER
POLLUTION
REFUSE
LANDFILLS
LOSS OF LAND

SOLID WASTE
MANAGEMENT
ISSUES

LANDFILL MANAGEMENT

REFUSE REDUCTION
REUSE
RECYCLING
LITTER REDUCTION
RETURNABLES
SEWAGE DISPOSAL
PREVENTION   CLEAN-UP
SEWAGE TREATMENT
CHEMICAL   BIOLOGICAL

ENVIRONMENTAL SOLUTIONS   HUMAN HEALTH SOLUTIONS

FIGURE 5 Issue web or 'mind gap', taken from: Hungerford et al., 1994a. In this approach, the authors advise the educator to introduce the issue of solid wastes management by exposing students to a partially completed web, and then conduct two brainstorming sessions (i) to add or modify the completed left side and (ii) to fill the empty right side.
This activity can be extended if the class is split in four groups, each of them assigned one quadrant of the web with the task to review secondary source materials which provide information about their quadrant, and report their findings back in plenary.

making appropriate questions. The educator may chose to present students with a partially completed issue web, showing only the central issue and one or two satellites, asking them to complete it individually or in small groups. Another way of work is supplying students with all the satellites and asking them to draw the web by making the proper interconnections.

With practice, students soon develop the ability to make webs themselves. The educator may present experienced students only with the focus issue asking them to draw the web by working in groups. Having each group do its own and then report back to the class on their completed webs can be a powerful learning tool. The following discussion on the interrelationships and the diversity of the webs -and viewpoints- helps the students think through what they have begun to conceptualize (Rosenberg, 2005).

In any case, when the task is completed the students should evaluate their work by reflecting both on the process as well as the results of their efforts (Hungerford et al., 1994a). Overall, webs can prove rather useful tools that young people use to represent and analyse various issues and problems in terms of causes, solutions, interrelatedness, etc. (Seebach, 2001; Rosenberg, 2005). They can be used from as early as the kindergarten level, where words are replaced by children's drawings, etc. (Bia, 2005).

3.4 *Teaching through objects*

The importance of the process of learning through objects is widely recognised and well documented in literature. Such processes are largely applied i.e. in museums, the places where, *par excellence*, objects are collected and exposed. Given the potential learning value of everyday objects -including of course objects we throw away- it is recommended that students undertake the gathering of such items to form class collections and explore these in various ways (Kamarinou, 2000).

Kindergarten up to late secondary classrooms can all benefit from the use of such techniques that may be combined with most subject areas like history, language, math, science, etc. and of course ESD. Actually, these techniques create a direct sensory connection between learners and objects that results in new levels of interest and attention. This way, educators can succeed in engaging everybody, especially those students who don't respond to written materials, as well as in connecting students with their own environment and culture (Sieber, 2001).

There is wide discussion in literature on how to efficiently teach through objects. A distillation of these, based on the work of Kamarinou (2000) and Sieber (2001), would include the following steps:

a. **Description:** The skill exercised here is observation, based on one's senses. Actually, objects provide an excellent opportunity to enhance students' *sensory literacy*, since they may compile evidence through sight, touch, hearing, smell and, why not, taste. Identifying the raw materials used to create it is a vital component of an object's description. For instance, posing the question *'Are the materials natural or man made?'* opens up a wide discussion of how people and cultures relate to their natural environment. Other topics to be explored at this stage, especially when dealing with waste items include use, method of manufacture, date and place of origin, design and packaging, disposal method, durability, possibility of being recycled, etc.

b. **Classification:** The ability to compare and contrast is the central skill practiced here. Such comparative analysis can be accomplished at a very basic level by youngsters and refined to much more detailed levels by older students. Important critical thinking skills are developed by examining the classification itself, because students have the opportunity to assess many different options and decide from among them. For instance, if the students are examining the

TABLE 14 Warm-up games and activities that can be used at an introductory stage when planning to teach with objects.

Name of game	Exercises the skills of...	Description of game
The tangle	...description	From a collection of objects students secretly select one and write 1 paragraph describing it. Then, in turn, they read out their texts and the rest try to guess the object described.
30 questions on an object	...description	Students are asked to state 30 questions on a simple everyday object such as a paper clip or a beverage tin. This activity demonstrates how much information we can draw even from an insignificant object, depending on the viewpoints we examine it through.
Guess the object	...description	Students in pairs sit back to back. Student A holds an object which student B tries to guess by asking only 10 "yes/no" questions (depending on the object the number of questions ranges). After the game students draw conclusions on the importance of classification and sequence of questions.
The museum	...classification	Students (alone or in groups), are asked to classify a wide collection of objects in as many ways as possible, as if they were to exhibit them in a Museums' show-case. Naturally, for each classification, they need to explain their criteria.

waste found in the class dustbin, they can start by sorting these objects in different ways, such as by colour, size, weight, material of origin, use, price, possibility of recycling, etc., and then reflect on the value of each classification by asking questions like: *'What issues can we address by sorting objects by weight or size, compared to sorting them by recyclability?'* This way, students may weigh the various classification factors and gradually determine their own classification criteria, according to the objectives of their project.

c. **Interpretation:** Any one object has both a pragmatic and a symbolic side, conveying many more *messages* than the information gathered by mere observation (step a). The most important concept in order to interpret an object is its setting, meaning its cultural, environmental and social context. After awaking the curiosity of students with a waste item, discovering these contexts is itself a rewarding activity for them. It is also a good opportunity for educators to in-

troduce them to higher level investigation skills needed e.g. to conduct a survey.

Asking the proper questions (*what, who, where, when, how and most importantly why*) is a prerequisite to de-codify the 'messages' of objects and given the lack of experience of most students in such inquiries, the role of the educator is critical at this step. Coming back to the example of the class dustbin, focusing on a typical object found there, the plastic food wrapping, questions that build on interpretation might be: *'Why is it made of the particular material?', 'Why is it used in this way?', 'Why is it disposed in this way?', 'When will it decompose once buried?', 'What could be the eating habits of the students who dumped it?', 'How could we have prevented its presence in the dustbin?'* etc. As the word *interpretation* implies, answers to these questions are not always absolute: Different students interpret objects differently. This provides opportunity for presenting and defending positions, developing listening skills, and cultivating respect of diverse views.

3.5 *Constructing concept maps*

Concept maps are schematic diagrams (representations) that show the relationships among a set of associated concepts. Figure 6 shows the typical structure of a concept map. As shown in the figure, arrowheads may be put on the lines to show cause and effect relationships. In general, concept maps, which may be considered as elaborated forms of webs (see paragraph 3.3), are widely used for curricular, pre-assessment, instructional as well as for evaluation purposes (Marcinkowski et al., 1994).

Actually, the philosophy behind the development of concept maps has its roots in the constructivist theory of learning and the cognitive operation of the human mind (cognitive psychology), according to which the basic elements of thinking are concepts, built on the perceptual images of individuals (Novac & Gowin, 1984).

References and research findings relevant to concept maps from UNESCO etc. No 35, 1993; Marcinkowski et al., 1994; Vasilopoulou, 2001; Scoullos & Malotidi, 2004, indicate the following:

⬎ The more the links around a concept, the more important the concept is in the individual's thinking.

⬎ It is recommended for MSLs to construct

concept maps in small groups (4-5 members). The exchange and reflection occurring often serves to correct faulty ideas and promotes meaningful learning.

⬎ An indicatively appropriate number of concepts to be exploited through a concept map constructed in an environmental science instruction would be 7-9 concepts.

⬎ Concept maps can be very useful for identification and evaluation of students' misconceptions.

⬎ While collective mapping does not provide insight into the conceptual scheme of each student, it does allow for extended discussion around the central concept.

⬎ Concept mapping is a powerful tool for ESD, as it demonstrates interaction of ecological, economic and social systems.

The general steps for constructing a concept map with students (adapted from Scoullos & Malotidi, 2004) are:

Identification of concepts around the central concept: The educator may start by brainstorming for key-words around the central concept to be stu-

died, sometimes after providing boost (e.g. article, text, image, etc). The educator notes these words in a form of a list or a diagram. Next, the students are encouraged to discuss which of these words they consider more general, significant and comprehensive.

Ranking of concepts in different levels – map construction – links: Starting from the central concept, students then propose the 2-4 most relevant concepts to be placed just underneath it: these constitute the 1st level of the map. Depending on the theme, a subsequent second and third level of concepts might evolve. The concepts should be linked with conjunctions, verbs or small sen-

tences in order to make sense.

Cross-links: An indication of a successful map construction, however an advanced task for students, is to indicate intra-relations between different parts of the map, and link these too, as above.

Map re-construction: Following a map construction, students may re-construct it in small groups on the basis of the same theme or of relevant topics. They should then present them in class and reflect on the way each group has perceived the basic idea, what the 'philosophy' behind their map is, and eventually, comment on the similarities and differences between the designed maps.

FIGURE 6 TOP: the general outline of a concept map; BOTTOM: an example of a concept map.

3.6 *The use of analogies in teaching*

During instructions analogies are frequently utilised, intentionally or not, every time teachers give explanations using phrases such as '*It's just like...*', '*Think of it as...*', etc. Constructing effective analogies can help students activate, transfer and apply existing to new knowledge. They are not only useful but sometimes necessary to achieve the objectives of a given instruction. However, unless analogies are used in a systematic, well designed way, they might cause confusion or misconceptions to students (AAAS, 1990; Glynn, 1994; Kokkotas, 2002; Scoullos & Malotidi, 2004).

An analogy is drawn by identifying similarities between two -seemingly irrelevant- concepts. In this way, ideas are transferred from the familiar concept (*analog*) to the unknown one (*target*) by sharing similar *features*. Of course, the more the interrelating features, the more successful the analogy. An example of a well known analogy between a bookcase and Bohr's representation of an atom is shown in the following text box.

Analogies should be built through constant dialogue, questions and clarifications on behalf of the educator. The successive steps for such a process, as proposed by Glynn (1994), are the following:*
1. Introduce the novel *target concept.*
2. Ask appropriately to recall the known *analog concept.*
3. Identify the corresponding *features* between the target and the analog.
4. Map similarities between the target and the analog.
5. Indicate where the analogy breaks down or where it may lead to misconceptions.
6. Draw conclusions.

Obviously, no analog matches the target perfectly (AAAS, 1990; Glynn, 1994; Kokkotas, 2002). Every analog has its limits and no analogs are alike: each analog has corresponding and non corresponding features, and for specific purposes some will be better than others. That is why educators should work with several analogs on the same theme, when possible. (Example: *Following on the 'bookcase' analog, if the purpose is to examine how an atom emits and absorbs light, a 'staircase' analog is mo-*

Bookcase (analog)		Bohr's atom (target)
f e a t u r e s		
books	↔	electrons
number of books per shelf	↔	number of electrons per level
shelves	↔	energy levels
number of shelves	↔	number of energy levels
distances between shelves	↔	distances between levels
floor	↔	nucleolus

An example of an analogy in chemistry: While such a word mapping of features is sometimes sufficient to draw an analogy, additional mappings (i.e. pictorial) are desirable to activate the cognitive progress of forming mental images, which helps students form better representations of the analogy (Glynn, 1994).

re appropriate). When presented with several analogs, students are less likely to equate these with the target, as they focus on the target from many perspectives and they can reach a more complete understanding. Depending on the circumstances, the additional analogs need not be so detailed as the primary one (Glynn, 1994).

When introducing an analogy, educators should take some time to ensure that the analog, as well as the features they are about to use, are familiar to the students. In this sense, it is recommended to find analogies between concepts covered earlier in the course and those currently examined. Such analogies have added value because there is some assurance that the previously examined concept is familiar to students (Glynn, 1994; Kokkotas, 2002).

The great advantage of teaching with analogies is that it capitalizes students' existing knowledge. Learning involves finding relations -rather than memorising- a process intrinsically motivating. Analogical thinking can help students understand new phenomena and even predict some aspects of their function. However, educators should be cautious, because if students over-generalise and map non-corresponding features between the target and the analog, misconceptions will arise (Glynn, 1994; Kokkotas, 2002). That is why proper guidance is nee-

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* The same steps can be applied during model construction (paragraph 3.7).

ded during the whole analogy building process, and especially in steps 5 and 6 referring to its limitations.

The importance of the analogies which the students constructed by the students themselves should be underlined. Through this process they undoubtedly scaffold on their own relevant know-ledge, and meaningful instruction is ensured. In addition, students who construct their own analogies become more independent in their learning. They can tackle new concepts on their own, by practicing in applying analogical reasoning.

3.7 Constructing physical models

A model of a system is its hypothetical representation with simplified imitations that help us understand it better, based usually on a series of analogies. A model may be a device, a plan, a drawing, an equation, a computer program, or even just a mental image. Whether models are physical, mathematical or conceptual, their value lies in explaining how things function (AAAS, 1990).

The most familiar types of models are the *physical* ones: actual devices or processes that behave reasonably well in approximation to the physical phenomenon or natural system being modelled. A physical model can be scaled in time, in size or in materials and is therefore easier to work with, than with what it represents. Through experimentation the *variables* of a model may be controlled and if it is successfully constructed, its response would be close to that of a full scale system or phenomenon. (AAAS, 1990).

Just like no *analog* can match the *target* perfectly, neither can the behaviour of a physical model ever be expected to represent the full scale phenomenon with absolute accuracy: Often divergencies occur even for the limited set of characteristics selected to be studied by the model. However they could be the basis on which the model can be improved (AAAS, 1990). Models may be misleading, when missing basic components or sugges-

Mini landfill		Sanitary landfill
a n a l o g i e s		
plastic garbage can	↔	
soil	↔	
buried wastes	↔	
compressing the layers	↔	
bottom of container	↔	
faucet	↔	
distilled water	↔	
drainage liquids	↔	

The analogies between a sanitary landfill and its model (as constructed in activity 8) to be completed by the learners.

ting characteristics that do not relate to the real phenomenon.

Physical models offer a hands-on experience to young children, so they are excellent in introducing the idea of models in general. However, it is suggested that educators should increase the sophistication of the models used with students of 12-14 yrs or older (AAAS, 1993). By this age, students may be asked to discover limitations and make suggestions to improve their models and make them function better (Vazeou, 2002). Engelson & Yockers (1994) consider models as useful self-teaching tools and as a means to demonstrate learners understanding of the modelled phenomenon, especially when they construct them themselves.

3.8 Problem-solving with an action-oriented approach

It is widely recognised that the "problem-solving" approach is used to engage students in becoming aware and active in their own learning process. Engaging people in working on real-life problems is also linked to the transition from a traditional educator/school-centred teaching approach to a more learner/society-centred one. Group work is the typical means of applying the method.

Problem-solving with an action orientation facilitates learners (Resenberg, 2005) to:
- handle information and knowledge in a meaningful context and broaden their understanding of concepts;
- become creative;

◗ develop problem-solving skills;
◗ enhance self- empowerment and self confidence;
◗ develop the skill of cooperation and cooperative work; and,
◗ understand and control their own learning process and come up with innovative ideas.

The following paragraphs develop as a general framework for a problem-solving activity with orientation towards action. It includes the steps of:

(1) Investigating the problematic situation: Students search for and collect information about the problem and the 'affected' area. They discuss and explore all possible causes and eventual impacts of the problematic situation. Questions that could support the discussion may be the following:

• *What is the problem (its nature, its size, its history)?*
• *What causes the problem?*
• *What are the consequences of the problem (environmental, economical, social)?*
• *Who is involved / responsible?*
• *At the expense of whom?*
• *In what ways is this connected to other problems?*

Depending on the case, a recommended option is to investigate causes and impacts throughout a longer period of time. By means of a survey students can collect primary or secondary data (through e.g. questionnaires or bibliographic research, respectively), in order to examine what caused the situation in the past and what causes it nowadays, as well as what its impact was in the past compared to today.

(2) Identifying possible solutions: Any possible actions to deal with the problematic situation are proposed and discussed within groups, taking into account the advantages and disadvantages of each. Depending on the level and experience of the students and the objectives of the instruction, the optional action strategies (paragraph 3.20) might be explained to the class.
Questions to be answered by the groups at this step may be:

• *What can be done to address the impacts of the problem?*
• *What can be done to address the roots of the problem?*
• *By whom?*
• *In which way?*
• *At what economic and social cost? (e.g. by instal-*

ling clean up equipment, or by closing down a polluting factory)
• *What will be needed for these actions?*
• *What would be their impact in the short, medium and long-term?*

(3) Assessing the possible actions: The actions proposed by the groups of students are presented e.g. on a flip chart. Students should decide jointly which one (or ones) they would follow and make their final action plan. To this end, they should assess all alternative options, considering the importance, feasibility, advantages and disadvantages, involvement of various stakeholders, etc.

Hungerford et al. (1994a) propose a series of action analysis criteria to be considered by students at this step:

A ... validity of evidence
B ... effectiveness of the selected action
C ... legal consequences
D ... social consequences
E ... economic consequences
F ... ecological consequences
G ... consistency with personal values
H ... understanding of beliefs and values of others
I ... understanding of necessary procedures
J ... courage needed to take the action
K ... time needed to take the action
L ... other resources needed to take the action.

Obviously, depending on the context and the objectives of the instruction, the abovementioned criteria can be adapted or enriched. By the end of this step students should co-decide their detailed action plan which will describe all activities to be undertaken in order to successfully implement the plan.

(4) Acting: The students act upon their action plan trying to stimulate the participation of all relevant stakeholders (families, friends, other schools, local authorities, experts, etc.).

According to Brunner et al. (2001) an educator's role during the problem-solving process is to:
■ ensure that students acquire valid and updated information on their own initiative and facilitate them in finding appropriate sources,
■ encourage students' initiatives and facilitate group-work,
■ assist in the implementation of the various activities,
■ create a positive and open group atmosphere,
■ explore his/her own practice on how to organize educational experiences, enabling a problem-solving approach.

3.9 *General guidelines on surveys*

The survey method is a student-centred, issue investigation process, which involves data collection, analysis and interpretation, and reaches conclusions and recommendations. The main instruments to implement a survey are questionnaires and interviews, aiming to elicit information on opinions, feelings or attitudes of a particular target population towards a specific issue.

Surveys move the class outside the classroom, allowing students to gain first hand experience with phenomena, materials, social realities and environmental problems of the real world. Overall, the method is an excellent avenue for the sharpening of all the investigative, diagnostic and decision making skills, such as observing, measuring, hypothesising, analysing, synthesising, recognising signs, trends and patterns, prioritising, comparing, evaluating, etc. (Glascow, 1994). In fact, as we shall see here, it can be considered as an umbrella ESD method interlinking many others.

An overview of the successive steps of a survey is given in the flowchart of figure 7, adapted form Hungerford et al. (1994b) and Scoullos & Malotidi (2004). This chart is provided here for the edu-cators, but it may be distributed to students, if considered appropriate.

According to this flowchart, the students begin by selecting their main research question on the issue they wish to investigate and decide on their specific objectives. The use of brainstorming, issue-web or a concept map can help them identify the main parameters (variables) of the issue under investigation. This initial step is critical for the rest of the process. (Example: For the main research question: '*How is the mobile phone used by teenagers?*' the variables that can be investigated include: *time spent talking daily; number of calls made for pleasure, business or other reasons; number of calls that could be avoided; ratio of using headphones; ratio of applying other facilities of the device, like music, internet etc., the frequency of device renewal, etc.*).

The main research question and the characteristics of the target population will determine the data collection strategy. Students should then formulate their instrument: questionnaire or interview sheet. Consulting experts might be considered necessary prior to this stage, as well as conducting a

FIGURE 7 Flowchart depicting the successive steps of a survey.

The survey method

- Review the status of the surveyed issue & generate the main research question about the issue.
- If necessary contact experts or conduct a bibliographic research for additional information.
- Develop a data collection strategy: Identify the target group, the sample and data collection instrument.
- Develop the instrument. If necessary test the instrument before finalising it.
- Collect the data.
- Interpret the data: Draw conclusions & make recommendations.

bibliographic research on past surveys. Designing instruments is a rather difficult task, especially for younger children, so the help from the educator is critical at this phase.

Group work is recommended for when collecting the data, especially in the case of large samples or large amounts of requested data. Depending on the theme and target population, it might be required to obtain permission from competent authorities to conduct the survey.

Data elaboration usually involves categorising the answers, sorting them in tables and presenting them in diagrams, e.g. pie charts, histograms, etc. More sophisticated data analysis may be carried out by older students. Based on their findings, students draw conclusions and make recommendations.

In many cases, the outcomes of the survey act as stimuli for further decision making and planning for future actions (Lahiry et al., 1988; Gavrilakis, 2005). For instance, students may decide to deliver their outcomes to the rest of the school, the local community or public authorities. This can be done in a number of ways i.e. by preparing a report or a brochure, organising a public hearing or exhibition, etc.

What exactly will be investigated?

There are several types of variables that may be examined within a survey. A proposed categorisation is presented in table 15.

TABLE 15 The categories of variables that may be investigated through a survey, based on Hungerford et al. taxonomy (1994b), with some examples referring to the particular issue of wastes management.

Category of variables associated with...	Examples
...**factual[1] information** related to the issue	▪ The number of articles referring to waste management in the local / national press over a selected period. ▪ The amount and types of waste found daily in the dustbins of a school. ▪ The amount and types of litter within a four block radius around a given fast food store. ▪ The number of empty classrooms in which lights (or other electric appliances) have been left on during school hours in a particular school.
...individuals' **knowledge** related to the issue	▪ The knowledge of the elderly population of the recycling centres operating in their city. ▪ The knowledge of housewives about electric and electronic waste collection services provided by the municipality.
...individuals' **perceived knowledge (opinions) & beliefs** related to the issue	▪ The perceived knowledge of adults on the implications of the waste management methods. ▪ The perceived knowledge of youth on the health risks of using mobile phones. ▪ The perceived knowledge of highschool students on the implications of each of the alternatives of e-waste disposal.
...individuals' **values** about the issue	▪ The reaction of students, the unemployed, the local authorities, and of the farmers to the construction of a chemical factory in their area. ▪ Prioritisation of the critical features when selecting a new electric/electronic appliance: ... safety ... durability ... affordability ... design ... energy consumption ... fashion ... place of origin (in terms of child labour, etc,)
...individuals' **attitudes** about the issue	▪ The attitudes of residents towards the construction of a small scale sanitary landfill in their region. ▪ The attitudes of residents towards a newly proposed strict law on factories' effluents. ▪ The attitudes of teenagers towards renewing their mobile every year.
...individuals' **behaviours** related to the issue[2]	▪ The (non)recycling practices of the residents in a given neighbourhood. ▪ The (non)littering practices of students in a given highschool. ▪ The renewal rate of en electronic device (e.g. computer) in youth aged 20-25.

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1 The definitions of the terms *facts*, *beliefs*, *attitudes* and *values*, together with examples can be found in paragraph 3.16.

2 The most appropriate means for recording behaviours and habits of individuals is through observation. When questionnaires are used, we basically record individuals' *self-reports* on their exhibited behaviour. This may differ from their actual behaviour, since people tend to declare that they behave in the 'politically correct' or the 'socially accepted' norm, even if they don't. Further references on this distinction can be found in Alampei (2002).

 A few notes on sampling

The *target population* (or *target group*) of a survey is primarily dependent on the latter's objectives and main research question. *Population* represents the total number of human beings who are somehow associated with the issue surveyed. These could be the residents of a particular area, people of a certain age group, etc. If the population is small enough (e.g. the students of a particular school), the survey can be conducted on its totality; however this is rarely the case. Usually, a small part of the population is selected to conduct the survey and this fraction is called a *sample*.

The size of a sample may vary; typically it should exceed 70 individuals to ensure scientifically accurate information (Hungerford et al., 1994b). Selecting the sample is crucial, as it must be representative of the total population. Ideally, sampling should be done randomly, so that all view points can have an equal chance of being represented in the sample, without bias or research prejudice. Sometimes, however, due to lack of time or funds, samples of convenience are taken instead, i.e. a group of people that the researcher can easily contact. Such samples are not truly representative.

3.9ᴀ *Conducting surveys with questionnaires*

A survey is commonly carried out by means of a questionnaire, that is, a carefully written set of questions about a particular subject that is given to a carefully selected sample of individuals (Hungerford et al., 1994b). The questions (items) included are typically either open or close-ended; although other types of mixed questions may be found as well.

Open ended questions call for a free response, short or extended, depending on the subject and the target population. Such items may be a good starting point for a survey, giving respondents the opportunity to answer in their own words. Overall, open ended questions are rather useful for qualitative investigation. (Example: *What do you consider the most serious environmental problem of your area and why? What do you think is the greatest implication of abandoned old cars and why?*).

Close ended questions have a finite set of answers from which the respondent chooses. Such questions may be put forth as:

• A *disjunctive option*, with two possible replies e.g. yes or no, true or false, agree or disagree, etc. (Example: *Do you purchase beverages that are in glass containers? Do you consider the removal of the old car the responsibility of the owner? YES / NO*).

• A *multiple choice*, which have more than one alternative replies, from which the respondent is expected to select the 'best' choice. One of the choices can be 'other', and the respondent in this case may specify. (Example: *What types of heating systems are found in your neighbourhood? - natural gas - bottled gas - oil - electric - coal - wood*).

• A *rating scale*, in which the replies are rated between two opposite ends. Such questions are commonly used to assess a person's feelings about something. (Example: *How willing are you to use public transport instead of your car to move around the city? Rate from 7 (Very much) to 1 (not at all)).*

Based on the recommendations of Hungerford et al. (1994b), Kamarinou (2000) and Gavrilakis (2005), we note herewith a few points that students should bear in mind when designing a questionnaire:

❯ All items of a questionnaire must be closely linked with the main research question and the overall survey objectives. To achieve this, for each item introduced, students must ask themselves questions like *'Why am I introducing this item?'* or *'How is this item linked with the survey's objectives?',* etc.

❯ The type and wording of the items should correspond to the characteristics of the target population (age, needs, interests, etc.). It is preferable that the wording used derives from the everyday vocabulary of the target population and this can be determined by holding interviews, beforehand. The questionnaire, overall, should be comprehensible and pleasant to the respondents.

❯ For multiple choice questions all logical and possible replies must be included in the given items, and not implied under the choice 'other'; otherwise they might not be recalled by the respondents and valuable data might be lost. Bibliographic research on relevant surveys and preliminary interviews can prevent such incidents.

❯ Items that contain two or more ideas are confusing and should be avoided. (Example: *Are you in favour of building new nuclear plants to have enough electricity to satisfy our country's needs, or against building more nuclear plants, even*

though this would result in less electricity?). Furthermore, long items exceeding 20 words may be rather difficult to grasp.

❯ Words that do not have the same meaning for all respondents should be avoided. (Such words may be i.e. *usually, commonly, youth, everybody, none,* etc.). Proverbs and mottos should also be avoided for the same reason.

❯ Clear instructions should be included, explaining how to fill in the questionnaire.

❯ In order to limit the tendency towards misleading 'politically correct' or 'socially accepted' responses, it should be underlined to respondents to reply precisely and honestly. For this reason, it is better to use anonymous questionnaires and clarify that the responses will be treated as confidential.

❯ The order of questions is particularly important since people tend to respond to an item being affected by its neighbouring ones. This is especially the case for questions on attitudes.

❯ Leading questions that either guide to a response, or reveal the point of view of the writer of the questionnaire should be avoided. (Example: *Most people today believe in equality. Do you apply it in the relationships within your family?*)

❯ Loaded questions inclining to a strong feeling of acceptance or rejection should be avoided. (Example: phrases *hinting political ideologies, religious and other beliefs*).

❯ Embarrassing or threatening questions such as the ones examining socially non acceptable behaviours, taboo issues, etc. should be stated with caution. (Example: *issues dealing with race discrimination, drugs, violence, etc.*)

❯ When aiming to check the accuracy of a statement (i.e. when exploring attitudes), additional items of the same content can be used, stated in different ways, far from one another.

❯ Testing the questionnaire through pilot implementation is always helpful, to omit or change any confusing or problematic items.

❯ Overall, the shorter and simpler a questionnaire, the better. Overlapping questions must be avoided, but at the same time it should be ensured that over-limitation and oversimplification of the instrument will not hinder useful data collection.

❯ Before giving out a questionnaire, students should decide beforehand how they will 'grade'

it, meaning how they will de-codify their results and what kind of analysis they will carry out.

3.9ʙ *Conducting Surveys through Interviews*

In many cases students decide to carry out a survey through interviews, which is really about getting the desired information from someone by talking to him/her. Good interviewing is about good communication, which is a valuable skill for students (Seebach, 2001).

The types of interviews range from strictly structured to non-structured. Structured interviews are planned in detail with predetermined content and sequence of questions, while the non-structured ones resemble free discussion. In the intermediate type of semi-structured interviews, the interviewer sets up a general backbone of the main themes to be addressed, leaving the detailed questions to be worked out during the actual interview.

In any case, the information collected through interviews is quite different from that of filled questionnaires. Interviews allow for thorough investigation revealing rich, detailed data appropriate for recording knowledge, as well as attitudes and feelings. The method is especially recommended for approaching experts. Through a well designed interview with an expert, students may elicit all the important information, from someone really knowledgeable about the issue (Hungerford et al., 1994b). Drawbacks of the method is that it is time-consuming; requires higher communication skills and experience; and that sometimes it gives an enormous amount of data which is difficult to analyse (Gavrilakis, 2005).

Based on the recommendations of Doverborg & Pramling (1993), Hungerford et al. (1994b), Stokking et al. (1999), Kamarinou (2000), Seebach (2001), Gavrilakis (2005), and the presentation of Makeli & Karagiannis (2005), we note herewith a few key points for students to bear in mind when conducting interviews:

BEFORE THE INTERVIEW:
▮ The interviewers must know very well what they want to find out. They should have in mind the overall aim and content of the survey, within which the interview is conducted.
▮ Depending on the issue investigated a list of po-

tential respondents should be compiled and a round of interviews scheduled.

- When designing their instrument (interview sheet) interviewers should take note of the relevant points raised in paragraph 3.9.A applying to questionnaire design.
- While preparing their questions interviewers should ensure a coherence and logical sequence of questions that will allow a flowing discussion.
- It is recommended that the interviewers rehearse with their fellow students to familiarise themselves with the questions.
- Applying more elaborated simulation methods for rehearsal (i.e. role plays), will allow students to experience the relevant roles (interviewer, interviewee, observer, tape recorder operator, etc.) and also to get accustomed with valuable interviewing practices, such as appropriate facing the speaker; being close enough to hear; exhibiting *active listening*, etc.
- Interview duration should be estimated in advance and communicated to the respondents beforehand, together with a rough description of the interview's aim and content.
- A quiet setting should be preferred for the interview with no people coming in and out continually, in order for the interviewee to concentrate better and not lose interest.

DURING THE INTERVIEW:
- Interviewers should briefly introduce themselves and the institution (school) carrying out the research, the purpose of the research, how interviewees were selected and how data will be used, guaranteeing anonymity if desired.
- A number of respondents will have a story of their own to share. It would be sensible to allow them to 'unload' these at the beginning and then proceed with the interview according to plan.
- It is recommended to start with the more general 'easy' questions that may be answered promptly and make the respondents feel at ease.
- The interviewer should avoid reading out the questions 'word by word' but strive for a naturally flowing conversation; while remaining as close as possible to the aims of the questions.
- Some changes in the sequence of questions might be considered appropriate. In any case, the different clusters of questions should be introduced and put in a framework that the re-

spondent understands.
- If needed, the interviewer should not hesitate to insist by asking follow up questions, to clarify some complex points.
- The good atmosphere of the interview is very important in order for the interviewee to feel comfortable and certainly not interrogated. Interviewers should be polite and hold the conversation in an informal but polite manner. They should not interrupt, especially to correct mistakes and they should never judge the replies of the interviewee.
- A process rather important in interviews is the so called *active listening*, which refers to the verbal and non verbal behaviour of the listener that marks his/her full attention to the speaker. Verbal aspects include using phrases referring to previous statements of the respondent, adjusting to his/her vocabulary, summing up, etc. Equally important are non verbal modes such as smiles, exclamations, nods of agreement, etc.
- Interviewers should keep in mind that people communicate not only by speaking but also through face and body expression. The voice, the speech flow, the hand movements, the look and the posture are all modes of expression that deliver important 'messages' from both.
- Interviewers should remember the key words for asking questions: *what, when, where, why* and *how*.
- There are three ways to record interview data: By taking notes, by filling summary data sheets prepared beforehand, and by using a tape recorder or video. A combination of these is rather useful; however pre-consent of the interviewee is absolutely obligatory for the use of video.
- While interviewing, it is best to keep only brief notes: The attention of the interviewer should be on the person being interviewed and not on the notes. These notes may be completed immediately after the interview.
- In the case when interviews are carried out by a group of students, it should be ensured that the questions are not posed only by the same students, but that everybody has the chance to speak and that everyone interprets the questions in the same way. Attention should be paid not to repeat questions previously posed by another student.

- Depending on the objectives of the survey, questions referring to attitudes and behaviours may be stated either at the very beginning of the interview or at the end as concluding remarks. The first option ensures that the respondents are not pre-disposed and are less likely to give 'socially accepted' responses; the second, with the factual questions having preceded, gives the opportunity to the respondent to state a more complete and holistic view.
- The interview may close by asking the respondents if they have anything more to add, briefly going over the main points, and thanking them for their cooperation.

AFTER THE INTERVIEW:
- The interviewer is advised to read through and complete the notes taken immediately after the interview. This way the minimum amount of information will be lost.
- After all interviews have been carried out an elaboration of the input and synthesis work is necessary to reach conclusions and suggestions.

*Things to be **avoided** in **interviews**:*

- failing to listen attentively
- repeating questions
- being impolite
- interrupting the replies
- asking questions where answers are obvious or impossible
- insisting to have the last word

3.10 *Conducting a bibliographic research*

Bibliographic research is an educational method that may be applied independently or in combination with other methods, such as surveys, field research, projects, etc. The method contributes to the development of cognitive skills such as elaboration of collected information in terms of categorisation, analysis and synthesis, language and presentation skills, etc. We take note herewith of several issues that need to be addressed before implementing the method.

The difficulties reported when students conduct a bibliographic research are usually related to lack of experience, support and incentives in their family, social, or cultural environment. This is particularly the case for rural areas and small villages, where the absence of libraries deprives students of the chance to familiarise themselves with the use of journals, books, etc. To recompense this it is suggested that the educator brings to class all necessary material. Other problems that may be encountered concern the students' lack of critical thinking when reading a reference and their unwillingness to cross-check information. In any case, the educator should ensure that the sources collected include sufficient data on the research theme, because students when given insufficient information tend to make up the missing data and arbitrarily fill in their work (Kamarinou, 2000).

In our days, the notion of the term 'bibliography' has extended beyond books and journals to include various audiovisual sources of information such as videos, transparencies, photographs, CD ROMs and, of course, the internet. Some educators are sceptical about the reliability and educational value of such sources and materials. However, if such information is clear and legible to students, they can be considered useful didactic tools (Kamarinou, 2000). Especially for the use of internet, despite its drawbacks, it contributes to familiarising students and teachers to Information and Communication Technologies (ICTs), a significant component of cotenmporary society at the dawn of the 21st century (Scoullos & Malotidi, 2004). A warm-up exercise for text analysis that can be carried out prior to conducting an extended bibliographic research is given in figure 9.

TABLE 16 Suggestions for learners and educators on how to conduct a bibliographic research based Scoullos & Malotidi (2004) and Kamarinou (2000).

The educator should ...	The students should ...
clarify from the very beginning, the theme and the objectives of the research and make sure they are well understood by all students, so they are not disoriented.	**focus** on the research questions and objectives.
indicate the appropriate sources of information, depending on the theme, such as school and public libraries, as well as relevant research institutions e.g. statistical services, press archives, universities, environmental or social/humanistic NGOs, etc.	**brainstorm** on possible sources of information.
explain to students how a library is organised and how books and journals are filed.	**ask** the librarian further information on the classification system.
explain to students how they can use the index of a book, journal, etc.	**create** the "ID" (reference) of every piece of information (article, extract, etc.) used, which will include the title, author, date of publication, publisher, etc. (figure 8).
assist students in tracing key words and main concepts in a text, etc.	**record** in the "ID" the basic elements of every piece of information (subject, key-words & main points, findings & conclusions, etc.). This will help them to index sources and facilitate the elaboration of the information collected.
discuss with students the type of sources and reliability of the information they collect in order to mobilize them towards cross-checking it.	**cross-check** information deriving from different sources, when possible.
systematically **guide** students throughout the process.	**elaborate & synthesise** the information collected and present it by means of reports, tables, diagrams, etc.

Article ID (Identity Document)

title: .... date: ....

writer: .... journal: ....

extract / main point:

- The educator starts with giving students a few texts, e.g. on hazardous waste transfer.
- Students read the texts thoroughly, highlight the key-concepts, note any unknown words and clarify these with the help of their fellow students and the teacher.
- The educator then gives out a set of specific questions to be answered through text analysis. (Example: Who are the protagonists in this text and what are their viewpoints? — What are the beliefs implied behind each person´s viewpoint? — What values are hinted behind each person´s viewpoint (aesthetical, economical, environmental, etc.)?).
- At a more advanced stage students may be asked to reflect on the author him/herself (Example: Where did the writer find this information? What is the personal viewpoint/intention of the writer?).

FIGURE 8 One way of recording the main information of articles is through preparing individual "ID"s.

FIGURE 9 Warm-up exercise intended to familiarise students with *text analysis*, a process widely applied in bibliographic research.

3.11 *General Guidelines on experiments*

In an experiment, a certain situation is investigated under controlled conditions which help to test and establish a hypothesis or discover some factor of a natural phenomenon. Through this method the complexity of a process or phenomenon is appreciated. An important consideration is that the situation examined should be relevant to the interests of the class, and be manageable considering their age and level (Glasgow, 1994).

A good staring point prior to any experiment is for students to examine various environmental (or social) problems in their surroundings, a process during which, the help from experts and/or indigenous people might be needed. After identifying the problem they will focus on, students may propose a solution and test it by conducting an experiment in a laboratory, or in open space.

The experiment may have the form of a mini Environmental Impact Assessment (EIA). For instance, in activity 10 on composting students test the use of a particular fertiliser *vs* the use of their produced compost in the same plants. Of course, caution, care and safety aspects of dealing with chemicals and delicate equipment should be stressed when undertaking such experiments (Glasgow, 1994).

In any experiment the controlled conditions are essential to allow the effect of different variables to be addressed. This means that students need to identify and understand all relevant variables and test each one of them separately, while keeping the rest unchanged (Georgopoulos & Tsaliki, 1998; Gavrilakis, 2005). This is the best way to practise applying the scientific method; however it is not always possible due to time, space or material constrains. For instance, in the same activity 10 only few determining parameters are tested by the students, the rest being described only.

During an experiment students work either individually or in groups and may make suggestions to improve it. The same experiment may be carried out by many groups simultaneously, in order to test its repeatability, meaning whether the same results are obtained every time it is conducted, under the same conditions. In any case, students should always carefully record the method they used, register in detail their results and draw conclusions. If appropriate, these conclusions could be diffused in the school or local community at a later stage.

Overall, experiments and investigations allow for the wide use of a range of intellectual and manipulative skills. The process of experimentation, in terms of methodology, is equally important to its final results. That means that even if an experiment/ investigation does not lead to the desired outcomes, the benefits for the students who undertake it can be significant. Naturally, in such cases, they should be encouraged to look into the reasons for the failure of the experiment and suggest ways to improve their performed investigation process (Kokkotas, 2002).

3.11.A *Conducting experiments based on Constructivism*

The meaning of words and ideas develops as children get older or as science progresses over cultural and historical time. As our minds constantly try to make sense of our everyday experiences we build up mental models which begin to fit with incoming sensory data. The 'core' of the constructivism teaching and learning approach is that pupils need to have time, appropriate assistance and enabling learning environments to construct their own meanings. Constructivism has as main principle the building of knowledge by the learners and thus, their active involvement in the teaching and learning process.

A teaching model for conducting experiments based on constructivism includes five phases, namely (a) motivation; (b) elicitation of students' ideas; (c) reformulation of students' ideas; (d) implementation; and, (e) taking feedback.

The experiment described in the following text box aims for students to identify the biogas produced by the decomposition of organic matter, by conducting a combustion test of the produced gas. A constructivism approach to this experiment is given below (suggested to be conducted by older students due to its advanced knowledge prerequisites in Chemistry).

A. Motivation of students
In this phase students are introduced to the topic trying at the same time to challenge their interest and motivation. To this end, the educator could start e.g. with presenting photos of fruits in decay or pic-

Experiment suggested to be carried out with the Constructivism approach

1. Fill 1/3 of a 1.5L plastic bottle with fruit and garden residues cut into small pieces. Add some soil.
2. Fill half of the bottle with water.
3. Screw the bottle shut and place it in a warm place.
4. From time to time shake it and make observations. Test if you can squeeze the bottle easily.
5. After some 10 days, wrap the spatula's edge with cotton and dip it into white spirit.
6. Unscrew the bottle's cap and light the cotton with the lighter.
7. Place the lit cotton above the bottle's neck squeezing the bottle with your hand. What is happening? Why?

tures of microorganisms taken microscopically. Ideally, students should use the microscope themselves.

A brainstorming session could start on:

- The reasons why the fruit, food, etc. decay.
- Whether microorganisms are in any way related to the phenomenon.
- What the impacts of decay are e.g. if somebody eats the fruit.
- How important or useful this process is to the environment.

B. Elicitation of students' ideas

Using the above mentioned questions or other relevant ones students' ideas about the phenomenon of biodegradation are revealed. They should be stimulated to give their thoughts on the nature of this phenomenon, the ways it takes place, by what means, what kind of material is susceptible to this procedure and what its resulting products are.

To this end, students -depending on their age- may be asked to work in small groups or in pairs, and answer in writing to a set of questions; or, to write down five sentences using the key-words e.g. *decomposition* or *biodegradation* or *biogas*; or to construct an issue web or a concept map.

In this way what students think about the topic becomes clearer.

C. Reformulation of students' ideas

A discussion should follow based on the students'

answers. The educator may announce the objectives of the activity that will be implemented, and hand out worksheets with key questions to spark discussion and, possibly, reshape initial ideas.

It would be useful if students at this point work in groups to carry out the first phase of the experiment (steps 1-4) and leave it for as many days as required. Their worksheet should include step by step instructions and space for observations. They should not neglect to write down their hypothesis beforehand. *(In the particular experiment students should first make a hypothesis on what they expect to happen at the end of the experiment or during the various steps).*

D. Implementation

After some days during which the groups have the chance to fill in their worksheets with observations on what is happening in the bottle, they carry on with the experiment. But first, a recapitulation is needed, which may have the form of an open discussion, based on students' observations so far.

At the end of the activity the educator asks students whether all or some of their hypotheses were verified and why *(do you still believe that...)* and helps them draw conclusions.

(In the particular experiment students should explain that when approaching the burning cotton the flame fades out because of the CO_2 produced. The oxygen in the bottle was consumed during the decomposition of the organic matter. However, if the CH_4 which is coproduced is sufficient, students may see for a moment the flame increasing).

E. Making use of the new ideas

At this step students apply their insights and 'knowledge' in real life situations e.g. they could discuss landfill biogas as a source of energy, etc.

3.11.ʙ *Performing a demonstration*

Demonstration is the process whereby the educator performs an operation or skill for the learners who attain the role of observers, in some cases however students may take part also. The method is based on the assumption that in order to acquire a skill one needs to see it practiced (UNESCO etc. No 15, 1985) and it is frequently used (UNESCO etc. No 35; Glascow, 1994) in cases when it is desired to:

- introduce a procedure or technique which is

new to the students,
- present an activity with high risk practical aspects, or
- exhibit a process which requires skilful manipulation of delicate equipment.

The main reasons why the method is widely applied, especially in science classes is that it saves time, keeps cost low and offers the possibility of using highly sophisticated equipment. Yet, students' passive participation is considered a major drawback. This problem can be overcome if the educator has planned the instruction in a way so as to hold a constant discussion with students as the demonstration progresses.

In fact, the educator needs to be alert and play different roles simultaneously during the actual demonstration: He/she may ask for explanations, help in clarification of details, provide technical expertise, repeat a certain action, request students to give their personal experience, invite them to look again, encourage them to make hypotheses, ask them to reflect on the procedure follwed, etc. Maintaining this constant interchange between tasks and thought is the main objective of experimental demonstration activities (UNESCO etc. No 15, 1985).

In order to maximise students' involvement and increase their feeling of ownership towards the process, the educator, may also:
- Ask some students to perform certain tasks of the activity. This can be the case particularly for the non-demanding parts, such as reading out the instructions of an experiment, collecting the necessary materials, etc. Although this action might increase competitiveness, it makes it possible to turn the class from a 'passive' to a 'facilitating' group, whose ideas and criticisms help every member to progress.
- Ask each student (or group of students) to formulate a study or research, as a follow up of the process already collectively initiated during the demonstration.

Finally, with regard to the technical aspects of performing demonstrations, we note here two important points:
→ Demonstrations should always be rehearsed beforehand.
→ Good visibility from the observers should be ensured. This can be done by making proper seating arrangements and by using equipment like overhead projectors when possible.

3.12 *Moving outside the classroom*

Activities performed beyond the classroom or, so called, 'in the field' include a wide range of tasks to be carried out outside classroom walls.* Of course, the term 'field' embraces all kinds of natural, cultural and community environments; therefore, outdoor activities can take place in the neighbourhood, national parks, EE centres, agricultural, industrial or historical sites, etc. Such activities offer many opportunities for direct experience and help in understanding relationships in nature, environmental principles, and social problems. Studying phenomena in their 'own' environment helps students to conceptually consolidate, or contextualise the information they read in books, articles, etc. (Lahiry et al., 1988). That is why it is rather important for field trips and field studies to be incorporated in ESD or EE programmes (Vandenbosch, 2007).

In order to be effective, a field trip should be task oriented; otherwise a simple 'excursion' can be a total waste of time. The assigned tasks -depending on students' age and interests, the characteristics of the visited area and the programme's objectives-may range from simple observations for younger students, up to more inquiry oriented activities su-

"That which can best be taught inside the schoolrooms should there be taught, and that which can best be learned through experience dealing directly with native materials and life situations outside the school should there be learned".

Sharp L.B. (1943), Outside the classroom, the educational Forum 7(4), p. 363

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* In this paragraph we do not refer to the adventure or recreation activities organised in camps, parks, etc., that aim merely to provide fun, relaxation or adventure. Obviously our focus is on outdoor activities which have a concrete educational content.

ch as answering in depth important questions/ hypotheses, using a data collection instrument etc. The important criterion is that the tasks are meaningful to the students and permit them to interact with the source both mentally and physically. In most cases, the purpose, content and assigned tasks should is clarified to all from the very beginning (Hungerford et al., 1994b; Millan, 1995).

Field trips are appropriate for secondary, primary, as well as for kindergarten level and educators should take advantage of students' characteristics in each age group. For primary school children who are very curious, enthusiastic and carry unbiased opinions, visits aiming to cultivate interest in their immediate environment may be organised, based more on the use of their senses. Students of secondary level are expected to have developed manipulative, experimental and interpretive abilities and skills to carry out more elaborated field investigations (Lahiry et al., 1988).

For example, a field trip on '*the impact of waste on living and non-living components of the immedia-* *te environment*', can be planned both for primary and secondary level, but should incorporate different types of activities, in each case. Activities for primary level may target at developing skills of observation, data collection, classification and drawing. Activities for high school students may entail sample collection, qualitative and quantitative surveys, laboratory analysis, interpretation of the existing socioeconomic backgrounds, needs assessments, etc.

The timing of a field trip within several other learning activities planned depends on the educators' objectives: Early in a programme, moving outside the classroom for basic information gathering can increase motivation; at the end of a programme a field trip can be helpful in bringing a number of 'distant' themes together. Practically, of course, the timing of a filed trip depends also on a series of operational, bureaucratic or other factors such as syllabus constrains, permissions to visit the site, weather conditions, etc. When a series of trips is planned sequence is important, especially for the case of younger children (Bia, 2005), in order for them

TABLE 17 The advantages and the constraints of field trips have been clustered based on existing literature (Lahiry et al., 1988; Glasgow, 1994; Hungerford et al., 1994b; Millan, 1995; Georgopoulos & Tsaliki 1998; Kamarinou, 2000; UNESCO, 2002; Scoullos & Malotidi, 2004). The drawbacks may cause educators to show reluctance in undertaking outdoor activities.

advantages	constraints
☺ Field trips may address a wide range of objectives from the cognitive (knowledge & understanding), the psychomotor (skills) and the affective domain (attitudes, values, feelings) and also offer opportunities for actions.	☹ Field trips require careful planning in order to achieve efficient use of time and accomplish the educational objectives.
☺ Field trips are ideal grounds for promoting interdisciplinarity and help create holistic approaches to the issue examined.	☹ Field trips require several preparatory administrative and organisational tasks, such as travel to and from the site, obtaining school permission and parents' consent, financial issues, etc.
☺ Students may practice investigation skills such as observation, taking measurements, data collection, experimentation, etc.	
☺ Students may practice problem solving and decision making skills such as information analysis, drawing conclusions, proposing solutions, etc.	☹ During the visit, health and safety risks might be faced.
☺ Field trips allow for the elevation of the various talents and inclinations of students (e.g. knowledge of local environment, organisational skills, etc.)	☹ Field trips involve several costs (transport, entrance fees, accommodation etc.).
☺ Field trips promote the interest of students who tend to develop high awareness and senstitisation levels towards environmental issues, etc.	☹ The scheduled lessons of the day are skipped and alterations have to be made to the timetable and organisation of the syllabus.
☺ Field trips can help students develop a greater sense of their own responsibilities towards each other and their assigned tasks.	
☺ Field trips provide opportunities for teachers and students to get acquainted with each other better through interacting outside classroom structures.	

to gradually develop understanding of difficult concepts (e.g. ecosystems, urban greening, etc).

3.12.ᴀ *Organising a field trip*

In terms of execution, there are three major stages in any field trip: before; during; and after the trip. The key in planning is for the educator to identify the specific tasks that need to be carried out in each one of these stages of the learning process. Based on experience and literature (Lahiry et al., 1988; Glasgow, 1994; Hungerford et al., 1994b; Georgopoulos & Tsaliki 1998; Kamarinou, 2000; UNESCO, 2002), we provide herewith a list of tasks intended to be performed in all three stages. However, this list is neither compulsory nor exhaustive and exclusive; alterations and adjustments could be made, depending on the nature and focus of each field trip.

(a) Prior to the field trip: Taking students outside the class involves a wide range of preparatory actions to cover administrative, safety and legal responsibilities besides the educational ones.

Within a typical EE/ESD programme the decision to conduct a field trip may either be sparked by the identification of a hot issue as a result of class work, or it may originate entirely from the educator. Beyond ESD, within disciplines such as geography, science, history, etc., the educator is advised to begin with a syllabus survey to trace the types of issues (environmental, social, etc.) that will be dealt during the school year and thereafter plan the visit(s) appropriately. In either case, three important factors need to be taken into account: (i) the interests of students, (ii) their previous experiences and abilities, and (iii) the added value of a local visit, linked to their everyday life.

After deciding the place of the field trip the educator should visit the site him/herself, in order to check its potentialities and limitations and plan in context the activities for students. Considerations that need to be addressed during the preparatory visit include site accessibility, services provided (water, food and toilet facilities, etc.), identification of possible risks and ways to deal with them, and, if necessary, contacts with field experts and personnel.

At this stage the educator should contact all authorities whose permission is needed for the field trip. That entails legal permissions to enter the site; ensuring parents' consent; etc. Also, the costing of the various phases of the field trip and any insurance issues need to be settled in advance.

Having formulated the educational objectives of the activity, the educator should hold a discussion in class to present the theme and purpose of the visit, and if necessary, adjust the objectives based on students' feedback. If they have no acquaintance with the issue, slides, photos and articles may be used to attract interest and inspire questions. In some cases students formulate a question or hypothesis that needs to be checked during the field trip. (Example: *Does the existing sanitary landfill influence the flora and fauna of the close by stream?*).

Task assignment to individuals or groups, should also be (co)decided beforehand. The visit should build on students' previous learning experiences. Sometimes they carry out preparatory activities such as a survey in the press, a study of area maps, etc. Especially if during the upcoming visit they intend to practice skills in which they have no experience (i.e. use of instruments to take measurements, use of a questionnaire, etc.), it is preferable to practice in these skills beforehand.

Prior to the visit the educator should prepare a list of all the materials and equipment needed for the visit e.g. worksheets, plastic bags, binoculars, etc. When students exhibit a high degree of involvement in the planning process they can prepare this list themselves and show it to the teacher for comments.

The worksheet is always desirable even in cases

THEMES TO INCLUDE IN A WORKSHEET

If the site of the visit is a human construction (e.g. factories, industrial plants, etc.) the questions of the worksheet might refer to the processes that are implemented in the plant, the purposes, the implications and demands of the function of the plant, etc.

In the case of a visit to a natural environment site (e.g. forest, wetland, beach, etc.) the questions could be relevant to its fauna and flora, the particular characteristics of the landscape, its condition, eventual problems that occur (pollution, erosion, etc.), the relation between the particular site and the local community, etc.

(Scoullos & Malotidi, 2004)

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of simple visits lacking strong 'enquiry' content. It should contain specific questions that help students focus their attention and restrain from distraction. This tool also facilitates the process of synthesis of the collected information, when the students get back to class.

Based on the estimated appropriate student/adult ratio, other teachers and parents may be invited to assist with supervision. If the educator wishes to broaden the scope of the visit, the class should be accompanied by teachers with relevant expertise/academic backgrounds. Involving those teachers from the early stages of planning, and sharing expertise with them will result in greater interdisciplinary correlations. For very specialized issues external experts may be invited also (e.g. forester, land planner, historian, sociologist, etc.). Sometimes it is easier to identify such experts among parents or relatives of students.

Students' deportment in the field must be discussed and commonly agreed in advance. Visiting a natural site is a good opportunity for the educator to assess attitudes of caring for the environment. Particularly in the case when students are to apply sampling techniques, they must be informed beforehand on the consequences of their behaviour (Example: *What will happen if we remove a rare plant as a sample, or if we step on it?*). Naturally, the behaviour code varies from place to place: students are expected to exhibit different patterns of behaviour in a archaeological site, a forest and a factory. In any case, the discussion and agreement on the 'rules of behaviour' has an added pedagogical value, enhancing students' sense of responsibility. With some groups it is a good idea to come to an agreement by means of a pre-agreed contract.

Last but not least, the contents of the backpack of students need to be stressed to them, preferably one day before the departure. This includes necessary clothing and food requirements and other details (e.g. hats, rainwear, types of shoes, snacks, sunscreen, etc.).

(b) During the field trip: Along the way the educator may use practical exercises and games to make the walk or driving more interesting (Example: *ask young students to collect something green/ round/hidden on the way to the forest; ask older students to observe the landscape/odour/traffic etc. while approaching a landfill*).

When actually 'in the field' the students work alone or in groups, depending on their pre-determined tasks. They may make direct observations, apply mapping or sampling techniques, use specific instruments to take measurements, collect and record information on their worksheets. When appropriate, they may interview the people they meet in the field (workers, inhabitants, etc.). At this stage they are encouraged to collect as much data as possible. In some cases they can already start making a preliminary analysis and interpretation.

The educator has the general supervision, provides assistance and coordination when required and encourages students to be analytical by raising questions such as *why* and *how*.

By the end of the field trip it is better to give students the opportunity to express what they experienced (orally or through a proper reflection activity).

When in the field, find a comfortable picnic spot and enjoy your lunch. After everyone has eaten, ask each student to check what remains in their backpack as food leftovers and packaging. Gather all these in a pile and carry out a discussion on what is going to happen to each item, what is biodegradable, what is disposable, what is reusable and what can be recycled, etc., performing various sorting exercises. Last question could be "what will the content of your backpack be next time?"

Proposed game to be carried out in the field aiming to review one's consumption habits.

(c) Follow up of the field trip: When students return to class they should organise their collected information, analyse and interpret their results. If they work in groups they need to report to class and check their findings with the other groups. They could elaborate further their collected information by compiling graphs, posters, etc. At this stage they draw conclusions, make generalisations and propose solutions to problems encountered. Students may wish to further research unanswered questions, and in this case the educator should direct them to other appropriate sources. Their final report should compile individual and group work as well as follow up discussions.

If considered appropriate, the class may display the materials collected and their findings in order to motivate and create interest to others. This can be done by a number of methods for raising public awareness public such as an exhibition, an article for the school newspaper; a leaflet, etc.

3.13 *Using maps*

Adolescents regularly come across maps as they are often challenged to read, interpret or draw cartographic representations, be it a street map, a metro line, a ground plan of the school premises, a weather chart, etc. The acquisition of skills to use maps is typically addressed in geography curricula; however, such skills can be of relevance throughout the total curriculum and may appeal to teachers of various domains (i.e. history, social studies, science, language art, mathematics and naturally, EE and ESD), who seek new ways to invigorate their instruction (Sobel, 1998; Grassos, 2005).

Obviously, maps have a varying complexity depending on the amount and type of information they depict. Grassos (2005) explains the two main categories of maps:
- the topographical (or general): These depict the natural environment (geomorphologic maps) or man-made environment (political maps) of an area.
- the thematic (or specific): These maps present the distribution of a certain characteristic in an area, such as population density, language, etc.

There is some research evidence that children from quite an early age demonstrate the ability to conceptualise information from maps. Findings show that children as young as 3-4 yrs old successfully use large-scale plans during a 'treasure-hunt' game, or find their way through a maze, and even recognise aerial panoramic photographs (Wiegang, 1999; Harwood & Usher, 1999; Bia, 2005). Such assumptions indicate that children might be able to conceptualise abstract concepts embedded in maps by applying higher skills of analysis and synthesis, not as would have been expected by the Piagetian school of thought (Wiegang, 1999; Harwood & Usher, 1999; Kamarinou, 2000).

However, Harwood & Usher (1999) differentiate between the ability to read a map, that is obviously obtained earlier, and the ability to draw a map, which requires higher order skills in terms of perspective, spatial arrangement, proportion, etc.

Van der Schee & van Dijk (1999), in their research on the cognitive process involved when secondary level students apply map reading skills suggest the following subsequent levels:
1. **Map reading** involves identifying and naming the phenomena on a map (Example: *Students locate the waste dumping site the class is about to visit and the nearby surface water bodies*).
2. **Map analysis** entails:
   (a) the classification of phenomena on the map.

TABLE 18 Based on previous literature, Harwood & Usher (1999) propose five criteria to assess children's map drawing abilities for 8-9 yr olds, which could be applied also for older students. Their study revealed modest improvements after a short term intervention, suggesting, in accord with the Piagetian research, that map-drawing is still a difficult task for primary level. Spatial arrangement and scale were the skills found the most difficult to master. However, statistically, significant improvements were reported for the skills of perspective and symbolisation.

indicator	range
A **Accuracy of spatial arrangements**, referring to the linear order of features of the map, e.g. buildings, streets, etc.	from entirely random not recognisable arrangement to totally accurate arrangement
B **Representation of scale and proportion**	from absence of recognisable features, to putting all elements in correct scale and proportion
C **Perspective**, referring to the angle of perspective	from absence of recognisable perspective; to front view or mixed forms of perspective; up to totally plan view panoramic perspective
D **Abstraction and symbolisation** referring to the presence of abstract symbols to represent elements of a map, instead of pictorial ones	from use of pictorial forms only; to use of mixed pictorial and abstract features; up to representing everything by abstract symbols
E **Amount of linear content on a route map***, referring to the number of included features previously discussed with the teacher, or other additional	from absence of recognisable content; to only pre-named features; to few additional features; to many additional features

* Criterion E can be used for the case of a single route map (e.g. the route from my home to school) or a wider area (e.g. my neighbourhood).

(Example: *Given a population distribution map of the Mediterranean, students try to look for common characteristics in neighbouring countries*).

(b) discovering relationships between groups of phenomena on a map. (Example: *The relation between the population distribution and the occurring landfills in a country; or between the waste generation points and the routes of the trucks transporting this waste to landfills or recycling plants in an area*).

3. **Map interpretation** includes making statements or predictions of spatial phenomena using the spatial relationships found in a map. This may require the use of other sources of information and previous knowledge. (Example: *predicting how city expansion will make a remote landfill gradually surrounded by settlements*).

The authors report of an increased percentage of students facing difficulties when asked to recognise relations (step 2b). That is why they advice (geography) educators to systematically train students to master the underlying map skills of identification (step 1) and classification (step 2a), before engaging them in the acquisition of the higher skills needed to interrelate data. In any case, their sti-

mulating finding is that quite complex map skills can be obtained rather quickly (via short term interventions) by the majority of students, already from the first phase of secondary education.

Moving further, the ability of drawing maps is more elaborate, considering the higher subtractive and synthetic skills required for someone to reconstruct his/her view of the landscape. Consequently, difficulties of children commonly reported in literature deal with concepts such as the view-plan, the scaling, the spatial arrangement, etc. (Harwood & Usher, 1999; Kamarinou, 2000). Of course, the final form a map takes depends primarily upon its theme and purpose. It is often the case that students are more interested in interpreting a landscape's features, rather than depicting these with accuracy (Kamarinou, 2000).

Based on Piaget's theory, as children grow, their maps are expected to progress from an egocentric view (side-on, or pictorial/iconic), to a decentred one depicting abstract symbolic representations of reality (top-down or plan-view). Map drawing ability apparently depends not only on the child's development stage, but also on their social and cultural environment (Harwood & Usher, 1999; Kamarinou, 2000) and this notion gives added value to the role of educators in teaching map skills. Table 18 pre-

● Ask students to draw a map after a walk on the banks of the nearby river. During the walk put emphasis on the division of tasks, the questions and discussions held, and the sharing of information, rather than the scale and the artistic detail of the maps. Challenge students to incorporate in their maps, all the things they discover in their walk that they consider worthwhile to inform their peers about. These maps could be used as an introductory or an evaluation tool in an ESD programme on wastes.

Ideas for activities for exploiting maps.

(based on ideas of Seebach, 2001)

● Ask students to draw their own representation of their village or city, without looking from one another. The resulting maps focus in diverse themes e.g. on the football grounds (interests), the cafeterias (free time activities), the nearby seaside (emotions, preferences), etc. underlining how subjective the perception of space is. In a sense, students depict features of their personality and their life, that is why, this would be considered a good introductory activity for an ESD programme on any issue. One step further, educators may elaborate on the map drawing skills by asking students to add elements so as to make their maps 'readable' for a visitor. This way, they can introduce map features such as index of symbols, orientation, street naming etc.

(based on ideas of Kamarinou, 2000)

sents a proposed classification of map drawing skills.

The degree, to which an EE/ESD educator will choose to incorporate map interpretation or map drawing techniques, depends on the programme's objectives, students interest, maps' relevance to the other methodological tools used. Topographical maps can be incorporated in several ways (Examples: *drafting the travel plan to visit a dumpsite; drawing an educational trail to the nearest re-* *cycling station, adapting the popular game of a 'treasure hunt' to create a 'waste hunt' in the neighbourhood*). Thematic maps are useful especially when exploring geographical distribution issues (Examples: *the distribution of a rare bird threatened by the construction of a new landfill; distribution of waste management methods within a country etc; distribution of illegal dumpsites in a region*).

3.14 *Organising debates & panel discussions*

Research shows that there is a lack of pedagogical expertise among teachers, especially those teaching science, in organising activities where students are given a voice. Also, most secondary level students seem to have little experience in discourse and limited abilities in forming arguments (Walker & Zeidler, 2003). Organising debates and panel discussions within ESD programmes provides an excellent opportunity to address these deficiencies. These tools constitute elaborated forms of discussions, where controversial issues are presented by individuals or small groups, usually in front of an audience. In debates there are two opposite viewpoints, while panel discussions entail more positions defended by a corresponding number of 'major players'.

In a sense, such methods are noticeably similar to other socio-drama simulations (role plays and dramas). However, they differ in terms of the roles assigned, their content and structure. This means that such discussions are more loose and open to all kinds of arguments, not necessarily limiting students to the views of the specific 'players' they represent, i.e. in a role play (Marcinkowski et al., 1994).

Panel discussions and debates may well be applied to students of late middle class or older. They can involve 2-10 students directly in active discussion and the entire class, indirectly. Their theme may be chosen by the students or the educator (advised in cases when he/she plans a series of such activities), but should in any case be appealing to students. Usually in a debate the main statement is posed in an affirmative close ended manner, while in panels the issue statement is stated in question form. (Example: *FOR DEBATE: Municipal taxes should include a specific charge based on the amount of waste produced per household. Agree /Disagree. FOR PANEL: To whom should the \po-* *luter pays principle apply? -homemakers, factories, farmers, shop owners, hospital managers, etc.*).

The preparation phase is essential not only for the panellists, but for the entire class who will evaluate the points raised during the debate. Naturally, no sound decision can be drawn on complex issues, i.e. the site of a new landfill, unless in-depth preparation has preceded. It may take from several days to weeks, for students to sufficiently cover the background material (articles, researches, internet, videos, etc.). Even if this material is provided by the educator, students should be encouraged to seek additional input useful for the discussion. It is suggested that each student prepare themselves on the issue holistically, covering all contradicting positions, prior to being assigned specific roles (Marcinkowski et al., 1994; Smith, 1998; Kamarinou, 2000).

After the preparation phase students are divided in two or more groups (according to the number of major players) and either select or be assigned their roles. Group members collaborate further to synthesise the presentation of their positions. As in real life, these positions may make use of several types of statements, such as factual assertions, value-oriented appeals and policy recommendations (Marcinkowski et al., 1994). Educators are advised to spend some time to instruct students on how to form valid arguments, i.e. what is the claim, on what grounds, justification, and backing (Walker & Zeidler, 2003).

The next step is the actual debate or panel discussion. A moderator ensures equal opportunity and time to speakers and keeps the discussion 'on track'. Because this role demands advanced facilitation skills, it is usually undertaken by the educator (Glascow, 1994). Whether moderating or not, when necessary, the educator should not hesitate

to introduce some arguments that may have escaped the students (Smith, 1998).

During a debate: Each group, in turn, gives its overall position (general statement), and procedes, within a set time limit, to present their arguments. The groups do not engage in a free dialogue, but they are allowed to argue back in as many rounds as needed. The rest of the class (audience) may ask for clarifications from a speaker if a point is not clear. During the final round, each group sums up its main points.

During a panel discussion: A similar procedure is followed:
a. Presentation of positions: The purpose is to provide the audience with the general introduction to the issue and the main arguments of each group (major players) in the form of clear and complete statements.
b. Clarification of positions: This is a question and answer phase, where groups clarify their own and the other players' positions. Customarily, this step is rather short, as only clarification questions are permitted, excluding rebuttal discussion.
c. Discussion: This is the major, lengther step, where points, counterpoints, rebuttals and general discussion are all. Each group can have many spokepersons, however the moderator must ensure no one speaks at the same time and that everyone respects their time limit. Panellists should focus on the main points of agreement and disagreement.
d. Audience participation: In this step the rest of the class may pose questions to the panel, preferably addressed to individual panellists having made a specific comment, rather than to the entire group. This way the panel members are encouraged by the audience to participate equally.

In both cases the final phase may develop into a free dialogue that will involve the whole class. Kamarinou (2000) underlines the importance of avoiding ending these processes with confrontation, but rather seeking alternative solutions to the issue examined -a compromise that will serve the interests of all players involved. Students will, therefo-

re, realise that only through the cooperation of social groups with different -sometimes conflicting-interests will they reach a commonly accepted solution.

When the exercise ends the entire class should evaluate the quality of presentations and arguments (content) as well as the debate itself (process). The arguments can be categorised and rated, in terms of number of claims, justification, data presented, etc. As students' skills in debating improve over time, they may wish to move to a more integrated assessment approach of the quality, strengths and weaknesses of the positions defended (Walker & Zeidler, 2003).

The overall process helps in developing skills related to i.e. thought organisation; precise presentation based on logical thought; main points' extraction; distinguishing relevant from irrelevant information; determining the factual accuracy of a statement and credibility of a source; identifying ambiguous claims, etc. Also, it develops those skills needed for the identification of underlying values and attitudes, detecting bias in others, etc. (Lahiry et al., 1988; Smith, 1998; Walker & Zeidler, 2003). Of course, when adolescents evaluate the various positions, they have the opportunity to compare these with their personal views and values (Marcinkowski et al., 1994) and in some cases re-shape them accordingly (Georgopoulos & Tsaliki, 1998).

In any case, panels and debates are tools that increase student participation. That is why they are particularly suitable either for fostering students' involvement in a newly introduced issue, or in cases when the educators are experiencing 'course fatigue' within an EE/ESD programme and need to change pace (Crone, 1997).

The debate activity can be organised in the form of a TV show, where the host journalist (moderator) will follow the rules applied in TV conversation. Students are familiar with this type of conversations and are usually excited to follow such a procedure. The rest of the class can participate either as the audience in the studio, or through making phone calls to state their questions /opinions 'on air'.

Overall, they constitute excellent tools that permit students to present conflicting viewpoints on various issues and to evaluate the relative merits of differing beliefs and values. However, the fact that these methods are time consuming and that some students may avoid involvement are considered their drawbacks (Glascow, 1994).

3.15 *The role playing method*

Simulation exercises in general provide excellent strategies for promoting the understanding of the options which have to be considered in taking a decision on any issue, environmental or other. The qualitative, quantitative, past, present and future parameters come into play, these being rather useful for reinforcing the focus on humans as part of the environment (Glascow, 1994). Such experiences may then function as a stimulus for more traditional teaching methods, such as writing and discussion.

Roleplaying is a simulation method that allows learners to 'get inside' and 'experience' an issue through the viewpoints of the relevant stakeholders (actors or players). The method is based on asking participants to portray certain well–defined characters (e.g. local authority officers, farmers, ecologists, consumers, etc.) in the context of a given situation with conflicting interests, seeking for a resolution. Sometimes, especially in cases of younger pupils, the characters to be portrayed could even be animals in the food chain, legendary / mythical creatures, etc. (Scoullos & Malotidi, 2004).

Important parameters to be taken into account in role plays are the following:

Introduction & preparation
In practice, the theme of the role play is, at large, selected by the educator, preferably after consensus with the class. In order for the role play to be successful the issue examined should be realistic, and closely linked to the lives of learners. The more disputable the issue, the better dynamic the role play will have.

Students should not engage in the role play unless having been adequately prepared for it, in terms of both *content* and *process*. To this end, relevant information, statistics, articles, students' findings from previous projects, etc. should be studied in advance. Class discussions will familiarise students with the issue, identify the social groups affected by it, etc. This will help them to start raising argu-

ments for each player, a process that, in practice, may be rather difficult (Kamarinou, 2000).

On the other hand, role playing is an improvisational technique, thereby requiring a feeling of safety on behalf of the players. This is particularly important for inexperienced students or in cases where the players are not familiar with each other. The sense of safety may be cultivated by warm-up exercises (i.e. kinetic, drama techniques, etc.) in which participants get to know each other in a more trusting fashion and start to get involved with the theme of the role play. Educators should empower all learners to enjoy such primal vehicles of self-discovery and self-expression without having to be concerned whether they are 'good enough'.

The objectives
The main goal of such an educational method is to jointly reach a decision after the various players have defended their roles. The educator may present in class the objectives of the activity, which could be:
- To explore the variety of positions and interests of stakeholders on the main issue.
- To investigate the motives and values behind human attitudes and behaviour.
- To evaluate alternative options and seek solutions.
- To practise communicative skills and develop empathy (putting oneself in someone else's position).

The scenario & the roles
After the preparation phase the educator presents and discusses with the students a brief scenario to describe the issue, aiming to act as a staring point for the role play. Including real time data and conflicts is preferable.

The students are then assigned their roles, usually in small groups representing the major players. In each group cards may be handed out, describing the players' main characteristics and their prio-

rities and goals during the subsequent role play. The number and synthesis of each group should be carefully planned so as to be fair and well-balanced, also in terms of group dynamics. Usually groups are expected to conduct a background research in order to develop their positions upon accurate and up-to-date information. It is important that all group members have some input in the role play, even if the presentation and debating will directly involve only one or two students (Smith, 1998).

In order to prepare the players, the teacher, as dramatic producer, may interview them 'in role', to draw out their thoughts about associated aspects of their roles, and gently involve them in the situation. Another technique appropriate for this stage is role reversal, meaning the exchange of roles of players so they can begin to empathize with the others' points of view, even if they don't agree. Enacting various roles helps individuals become more conscious of existing ambivalence. Such sociodramatic techniques facilitate the degrees of self-expression and reflection and thereby deepen the insight obtained by both players and audience (if any).

Rules & role playing process

The time and place (and 'scenery', if needed) of the role playing activity should be set. Some guidelines and rules may be necessary to be co-decided in advance, in order to secure to all players equal time and opportunity to express themselves. It should also be clarified that any confrontations that may rise are part of the roles and should not be taken personally.

The activity can be conducted by large or small groups. The first option has the advantage of full involvement of most, if not all class members. In the second case most of the class participates by observing the role play performed by a small group of students. This audience may be eager to discuss the postures and decisions of the role play (normally in the reflection stage), even if they lack confidence to expose themselves as players. Through observation and follow up discussion their experience and confidence grows, eventually making them receptive to participation in similar activities in the future (Marcinkowski et al., 1994).

During the role play the educator should remain in the background, giving students the possibility to take control of the entire process. In this sense, an effective role for the educator would be to: (Marcinkowski et al., 1994)

* constantly move around the class ;
* be ready to remain silent for quite a while;
* act as the 'devil's advocate', if needed, in order to push students to explore their role, their deeper motives and decisions;
* restrain from revealing his/her thoughts and from judging values and opinions that students express.

Depending on the objectives and the issue examined, proposing solutions and reaching meaningful decisions are important parameters of such simulation exercises (Smith, 1998; Kamarinou, 2000). Actually, the entire role play may evolve around a 'proposed' solution presented already in the scenario, with the players stating their views on it. Of course, to reach meaningful decisions and appropriate solutions, players need to hold a holistic view on the relating factors and show willingness to engage in collaborative schemes, since compromise from all sides is often necessary. It is advised that students seek a range of alternatives already from the preparation phase, and reach their final decisions during the role play. When they cannot reach a joint decision there is the option of voting (Scoullos & Malotidi, 2004).

Reflection

A debriefing activity that relieves the tension of the role play and smoothly moves the players 'out of role' is necessary in such simulation methods. This can take the form of discussion, writing (e.g. a letter), drawing, etc.; however always in relevance to the activity's set objectives.

Questions to be raised at this point may be (Scoullos & Malotidi, 2004):

What were the basic characteristics and behaviour traits of the roles enacted?

How did you feel and what do you think you gained from such an experience?

In the case of repeating the role playing game what would you change?

In case you confronted a similar but real situation in the future, would you behave in a different way and why?

3.16 *Values within education*

Even if the definition of the term 'sustainable development' is still debated among scientists, sociologists, technocrats etc., no one can disagree that the concept is essentially about links people develop with their overall environment, human, natural, manmade and cultural. Although it entails also natural processes, economies and policies, **sustainable development is primarily a matter of culture and ethics: It concerns the attitudes and the values people cherish, and the way they perceive their relations In this sense, the key factor in sustainable development are human beings and the relationships they develop**, be they based, on the one end, on self-interest, greed, envy, disregard of future availability of natural resources, etc. (unsustainable practices); or, contrarily, relationships characterised by respect, tolerance, solidarity, promoting equity, democracy and justice (sustainable practices).

The term *environmental ethic*, introduced already since the Belgrade Conference (1975), is commonly found in EE/ESD major texts. Currently, the 'UNECE Strategy for ESD' (UNECE, 2005) supports that the *ethical dimension* -that includes equity, solidarity, interdependence, responsibility within the present generation, between generations, and also between humans and nature- should be addressed through ESD. UNESCO's 'Draft Implementation Scheme for the Decade on ESD' (UNESCO, 2005) recognises that alongside positive spiritual motivations, education is our best chance to promote and root the values and behaviours of sustainable development.

But how could this ethical dimension of SD and ESD be described really? According to Engleson & Yockers (1994), an ethic is a sense of what is fundamentally right or wrong; a self-imposed moral code that helps the individual determine relative values, make choices based on them and accept responsibility for those choices. The personal ethic gradually develops as a person experiences and learns from making moral decisions.

Values, attitudes and beliefs

Values are complex entities through which people show preferences for certain ways of living and conditions of existence. Notwithstanding the significant number of surveys on *values* in the last decades, there still seems to be much disagreement on the definition and use of the term itself (Halstead, 1996). In order to avoid confusion in terminology, for the purposes of the current publication, an explanation of the relevant concepts together with examples is provided in table 19.

Values start being 'implanted' in individuals, from very early stages, by their family, and their social and religious environment. As individuals grow, the peer group, the media, and undoubtedly the school are a strong influence to their value system development (Glascow, 1994; Halstead, 1996; Knapp, 1999). Values appear to develop over a long period of time and are dynamic throughout one's life (Caduto, 1985). Therefore they may be accepted, amended, or rejected at some point, after critical thinking on one's value system.

Values are the standards guiding social, political and religious behaviour; influencing the ways in which people present, evaluate, and compare themselves to others and rationalise their performed be-

"We need nothing short of a new global ethic - an ethic which espouses attitudes and behaviour for individuals and societies which are consonant with humanity's place within the biosphere; which recognizes and sensitively responds to the complex and ever-changing relationships between humanity and nature and between people"

(The Belgrade Charter, 1975).

[One objective of EE is to] "help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvements and protection" and [one of the guiding principles is to] "promote the value and necessity of local, national, and international cooperation in the prevention and solution of environmental problems"

(The Tbilisi Declaration, 1977).

haviour. However, the degree of self consciousness of one's value system, and of the way it correlates with one's actions varies from person to person (Knapp, 1999). Meaning, people may be very conscious of the rational basis on which they behave (i.e. consume), or barely conscious of the underlying reasons for their actions.

Several types of classifications of the humans value system have been developed, starting from the work of Rokeach back in 1973 (who categorised values in instrumental and terminal ones); Thomas Lickona (who separated them in moral and non-moral); Hungerford (who developed a list of value descriptors), etc. Thorough examination of these classifications and lists goes beyond the scope of the present publication, as our focus is rather to explore their relation to education and learning.

The role of school and ESD

Due to the importance placed on cultural, societal and personal values there is ambiguity in literature concerning the role school -and consequently educators- should or could play in addressing these. Any examination of values through the prism of education brings to light two critical questions:

- ■ Are there any values and behaviours commonly regarded as globally acceptable, or right?
- ■ Are schools and educators legitimate to interfere with the value system of students? And if yes, in what way?

Some writers defend that there are a set of universally accepted values that may include freedom, equality, peace, respect (to the others and to the environment), justice, responsibility, tolerance, etc. (Engleson & Yockers, 1994; Halstead, 1996). However, being at large *social constructions*, forged by features relating to history, culture, religion, governance, demography and even climate (UNESCO et al. No 15, 1985), values may greatly vary within different communities. So, it appears that the minimum basis of common universal values may be a rather *thin* one (Halstead, 1996), or at least not always clear.

At country level, the importance placed on values education is reflected in the national curricula, the majority of which recognise that formal education is not and certainly should not be value free.

TABLE 19 Definitions with examples showing the relationship between facts, beliefs, attitudes and values (Based on the definitions given in Caduto, 1985 Engleson & Yockers, 1994; Hungerford et al., 1994b; Knapp, 1999; UNESCO, 2002)

Description of terms	Examples
Facts are pieces of information that have objective reality. A person may claim something is factual, but the truth of the statement can be tested to determine its accuracy.	- *The burning of fossil fuels releases CO_2.* - *Apples are red. (This is a fact but apples could also be green or yellow...)*
Beliefs are convictions of the reality of some phenomenon, usually based on the examination of facts. Beliefs can be challenged, depending on the accuracy or comprehensiveness of the facts considered.	- *(I consider...) incineration is a more environmentally friendly method than landfilling.* - *(I am of the view that...) population growth is the root cause of environmental problems in certain developing countries.* - *(I believe that...) the consumption and production pattern of the western world is a far more determinant factor to resource depletion, than population growth in the developing world.*
Attitudes predispose people to respond in some manner (positively or negatively) to something. Attitudes may or may not be reflected in a person's behaviour. They are not so deeply felt as values and they may change as a result of experience.	- *I dislike big cities because there is so much noise.* - *I am in favour of recycling glass and aluminium because it's good for the environment.* - *I feel overwhelmed by the rate consumer products multiply in our days.*
Values refer to what individuals consider really worthy to them, may that be an object, an action or an idea. They provide the criteria by which we judge something preferable over something else, on a personal or social basis. Values also describe certain character traits that have long been considered worthwhile (virtues). In being more central to the personality, values may guide attitudes and certainly influence behaviour.	- *I deeply appreciate a quiet environment.* - *I deeply respect life and therefore all living things.* - *I value honesty as the most important thing in human relations.* - *I would like to become famous and be recognised wherever I go.* - *Being useful to others makes me feel good.*

Although values are inherent practically in any discipline, they are strongly embedded in subjects like literature, social science and history (Titus, 1994). Especially with regard to ESD, in a report of the 15 EU Member States, several countries stated they expect from EE and ESD to inculcate in students a set of values to serve as reference for environmental protection and management actions (Giolitto et al., 1997), restraining, however, from any kind of ideological indoctrination approach.

In practice, in many cases, values' education approaches are left out of instruction, for reasons even beyond the ethical questions raised above. Such reasons, reported in research, may be: either because values are hard to analyse, being deeply embedded in teachers' taken-for-granted worldview; or due to lack of appropriate training to address them (Halstead, 1996); or because of the belief of some teachers that values, alongside other personality parameters have already been shaped in children from a very young age (Titus, 1994); or because they consider them too subjective to be taught; or eventually, because they feel that values will evolve in students from the increased knowledge alone (based on the long-disputed linear relationship values → attitudes → behaviour) (Caduto, 1985). Read more on the three behaviour change models prevailing today in literature in the Annex.

The fact is that valuing is unavoidable, implicit in all forms of interaction between educators and learners, as the teaching profession is, by nature, value laden. Educators' values are reflected in their daily behaviour: in the way they interact with students, in their selection and approach of subject matter, in the learning environment they create, even in the seating arrangements in their classroom, etc. (Titus, 1994; Halstead, 1996; Kamarinou, 2002). Papadimitriou (1998) further argues that even those educators who support the *laissez faire* policy, meaning deliberately avoiding any value education approach, they themselves, by doing so, promote a value: that of 'academic distance' and neutrality. In such cases, it is possible that children incorporate values *par hazard*, and thus eventually develop, within school, a different value system than what the school itself would intend (Halstead, 1996; Papadimitriou, 1998).

Based on the above, considering that the educator's behaviour unavoidably influences students it would be more honest for any educator to convey his/her view, highlighting its subjectivity, especially when being asked to. This notion has been supported by many authors who view the educator as a *role model* to students (e.g. Glascow, 1994; Papadimitriou, 1998; Knapp, 1999). It is advisable to do this *after* the students have had the opportunity to freely express their views (Peace Corps Guide, 1999; Kamarinou, 2002).

Especially in ESD, it is unthinkable for an educator to approach the idea of sustainable development in a 'neutral' way! For example, it is contradicting to examine the consumption and production patterns, keeping a distance from the emerging values when analysing the crisis caused by unsustainable consumption. The very notion of differentiating sustainable from unsustainable is value laden. This notion is further enhanced within the reality of our modern globalised societies, with their growing cultural (and therefore values') diversity. From that point on, the challenge for the educators is certainly to develop principles for dealing with such issues, in a professional and ethical way (UNESCO, 2002).

The entire approach to values education should be one of caution at all times. Educators' focus can certainly not entail any form of indoctrination, but instead the development of independent thinkers, capable to consider the world they live in and humans relationship to it, and also capable to critically analyse values and motives behind human activities. Besides their own feelings, when dealing with controversial issues, teachers should assess the school policies on the issue and if possible, the parental and community attitudes towards values education (Caduto, 1985; Titus, 1994; Corder, 1999; Knapp, 1999). Anyway, they are advised to treat any materials on values education that they decide to use in a critical, thoughtful manner.

We should not forget that the very purpose of EE and ESD, stated already since Tbilisi, is not just to make students aware of environmental and other issues, but to encourage a particular sensitivity and attitude towards these issues. Therefore, trying to develop a positive ethic for caring for the environment, throughout our educational programmes, is not only recommended but the core essence and vision of EE and ESD. Certainly educators should not get disappointed in terms of progress made through their values education programmes. Firstly, because education is not the only tool to inculcate values (UNESCO, 2005). Secondly, because value shifts among people may be imperceptible during our lifetime, so, values education actually

builds for the long term future, not just the present generation (Caduto, 1985).

When and how should educators address values?

The appropriate students' age to implement values education approaches is a matter widely discussed in literature. Recognising that *moral development* occurs in stages, the theories of Kohlberg and Piaget support that learners should be helped in this process by being exposed to moral conflict situations, as well as to other individuals who function at a higher level of moral reasoning. Dilemmas that require the use of moral reasoning beyond learners' present functioning, create an internal dissatisfaction that eventually stimulates moral growth (Caduto, 1985; Hungerford et al, 1994b).

The transition from moral dependency to autonomy is estimated to occur at the middle school le-

vel, roughly at the age of 11-12 yrs, with a 'grey' area of varying width. Prior to that age, children have not yet developed higher powers of cognitive and moral reasoning; they may not be able to recognise the complexities of human motivations within issues; and they usually lack a personal environmental ethic (Caduto, 1985; Hungerford et al, 1994b; Engleson & Yockers, 1994).

Obviously, younger students (primary and elementary level) should not be excluded from values education; however the approaches to cultivate an environmental ethic in them obviously differ. The educational methods for the young morally dependent students should focus <u>on the development of an ethic of *love*</u> (Caduto, 1985; Engleson & Yockers, 1994). Appropriate activities for these ages include, for example, visits to natural areas that emphasise on developing learners' emotional, intuitive and aesthetic appreciation for the envi-

TABLE 20 Values education activities directed towards the development of an environmental ethic, in primary and secondary level, as proposed in the curriculum for EE of Engleson &Yockers (1994).

Grade	Method	Description
Primary	Visits to natural areas	The aim of such activities is for children to discover nature basically through their senses. They will play games that involve touching, smelling, hearing and looking at objects within nature. They may take samples (when appropriate) and record their experiences by means of drawings, sound recordings and writings. Negative things (e.g. littering, etc.) should be discussed, and follow-up activities (collages, letters, bulletin boards, etc.) may be planned. Such activities may help children to value natural areas, such as the ones visited and develop positive attitudes regarding their protection.
Upper elementary	Games that spark discussion	Environmental issues, such as human population problems, water pollution, desertification, urbanisation, etc. may be addressed, using a game to start discussion. *Example for earth resources & population*: the teacher splits the class in groups of different sizes representing the relative populations of various countries. One group may have 2 persons, other 3, another 14, etc. The teacher then gives out baskets with apples representing the relative amounts of resources, especially food, available to these countries. As small baskets are given to large groups and big baskets to small groups, students' reactions range from satisfaction to strong dissatisfaction, and loud protest about the inequality of distribution. The discussion that can follow may touch upon concepts like global geography, economics, the heavy depletion of resources from developing nations in order to survive, etc.
Middle school & High school	Case studies, simulations (role plays, etc.) group investigations	Properly selected case studies enable students to learn tow to define an issue; identify the stakeholders involved in it; determine the stakeholders' beliefs and values; analyse the potential environmental economic and social impacts of each proposed solution. Simulations, where students role-play the people involved in an issue, rather than just reading, encourage students to defend positions they might not otherwise consider seriously. Through group investigation on an environmental issue students learn how to collect information from primary sources (questionnaires, opinionnaires, etc.) as well as secondary ones (authorities, press, etc.); how to analyse these data; how to determine their own position on the issue; and, if they decide so, how to develop and implement an action plan to resolve the issue. Such activities help students examine the value positions of others, identify their own, and compare these value positions to those most beneficial to social and environmental welfare.

ronment (Caduto, 1985); instructional strategies to engage children in democratic decision making processes in their every day school life and cultivate in them the sense of responsibility (Andrews, 1994), etc. An additional reason for including such programmes from that early on is that some personality parameters are formed at a very young age, even before students go to school, and these values become rather resistant to change, as individuals mature (Titus, 1994).

At the middle school level children begin to examine the logic and consistency of their beliefs and compare them to others'. Often through contradiction, learners realise that there are general principles extending beyond specific cases, and in this way begin to construct their personal ideology, or set of beliefs and values. That is why this level is critical to apply those educational approaches that concentrate more on enhancing self-awareness of values, and how to apply these in a caring way that is most beneficial to environment and society (Caduto, 1985; Hungerford et al., 1994b).

In line with the above, the authors of this book are of the opinion that there are no forbidden issues for any age of children; however our pedagogical approaches should always be appropriate and relevant, with respect to their evolving personality. Depending on the age and maturity of learners, their cultural context, and the objectives of instruction, a carefully designed approach to the issues to be dealt with is advised. In any case, the proposed target group of the educational material 'Waste in our life' is the MSL, a level which is considered ideal to address value laden issues that promote moral development.

3.16ᴀ   *Approaching values within ESD*

Fernandes (1999) claims that there are three types of approaches of values in education, namely the *direct* approach, referring to deliberate and systematic instruction on values, the *indirect* approach using curricular and co-curricular activities to develop values and the *incidental* approach, during which some value instruction or advice is passed on only when a situation demands it.

In literature, there are several education strategies that propose how to address values. Caduto (1985) reports of eight strategies, namely: the *laissez faire* approach, inculcation, moral development, values analysis, values clarification, action learning, confluent education and behaviour modification. In practice, within a time-limited ESD programme it may prove difficult for the educator even to unveil students' values and attitudes, much less alter these. In this case maybe, the best option is to make students think about and systematically engage themselves with their own value system. By being exposed to the others' values towards an issue and comparing these to their own, students gain a more holistic approach to the issue (Kamarinou, 2002).

For the purposes of the current publication we shall focus on the two most widely used strategies, *values clarification* and *values analysis*, which are also considered the least biased.

The values clarification strategy
This is an internal process which refers to how individuals designate their own values, having as focus the process, rather than the content. It is intended to help students become emotionally aware of their value system by examining their feelings and way of thinking (Fernandes 1999; UNESCO, 2002). Students are encouraged to express themselves and freely choose to act within various hypothetical contexts. The ultimate goal of the strategy is to enhance self awareness, self respect and self definition of individuals within the unified globalised mass cultures (Papadimitriou, 1998).

The values clarification strategy was extensively developed in the 60s and 70s, particularly in the work of Raths and Simon.* Raths proposed to develop activities that allow the student *(1) to choose freely (2) from alternatives, (3) after consideration of the consequences of each, (4) to cherish, be happy with the choice, (5) to publicly affirm, (6) and act (7) repeatedly on the choice (value).* These subsequent steps may be presented in the form of a values grid, (proposed by Glascow, 1994, UNESCO, 2002; Scoullos & Malotidi, 2004), in order to help students clarify their degree of concern towards different issues, using the seven scale rank of commitment. An example of such a grid is given in table 21. Other appropriate methodologies include role playing games,

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* Further references: (1) Raths I., Harmin, M. & Simon S., "Values and Teaching: Working with Values in the Classroom", Columbus, OH, Charles E. Merrill, 1966; (2) Simon, S., Howe L., Kirschenbaum H., "Values Clarification: A Handbook of Practical Strategies for Teachers and Students", New York, Hart, 1972.

	Description	Examples
A. rating	Rating exercises present a question with several alternatives and pupils rate them accordingly. The steps in the method are: **1.** The rating list (1 or more questions with alternatives) is passed out, or written in blackboard. **2.** Each student individually rates ALL the alternatives. **3.** Students form groups (of 4 to 5) and every group member, in turn explains his/her rating and justifies his/her priorities. The group members then discuss similarities and differences in their rating. **4.** Each group briefly describes to the class the process having been followed. A class discussion may develop to reflect a general view on the topic.	*Which of these is the most efficient way to deal with household waste?* ▌ *Legislation* ▌ *Charge penalty fees to those homes that fail to sort waste* ▌ *Information and more sorting bins* ▌ *If you were responsible for investing in environmental improvements in your country, prioritise the following areas you would focus on:* - *Cleaner air* - *Pesticide free food and agriculture* - *Healthy forests and seas* - *Waste management*
B. stand on the line	This is a kinetic game for students to find out where they stand between two opposites. It also gives them the confidence needed to physically demonstrate their position in front of their fellow students. Therefore the educator should point out from the beginning that they should place themselves based on their own opinions, unaffected by where their classmates stand. The extremes may be numbered on a long floor board (i.e. from -5 to +5 or 1 to 7). The steps in the method are: **1.** The educator states the issue and presents the two extreme opposites on it. **2.** Students are given a few minutes to think and then they stand on the number that corresponds to their opinions. **3.** Students are grouped according to their chosen number. Within groups each member, in turn, explains why they chose to stand there. **4.** One student from each group justifies to the class the group's position. **5.** A class discussion may be sparked from the opinions heard, and the game may be repeated after that, to check if any student wishes to change position. An alternative option for the game, when anonymity is desired, is to ask students to justify their positions by writing 1-2 sentences and hang these between the two extremes using clothes pins on a long rope.	*What do you think of direct mail advertising?* *Extreme 1: It is unnecessary waste* *Extreme 6: It is valuable information*
C. values grid	By means of a brainstorm students make a list of issues that are of concern to them. Then they rate their own viewpoint and degree of commitment towards these issues, according to the 7 scale hierarchy of Raths: **1.** I have chosen my position freely, **2.** from alternatives, **3.** after thoughtful consideration of each argument, **4.** I am proud of and cherish my position, **5.** I publicly affirm my position, **6.** I act, **7.** I repeatedly act with consistence on the value. Next, they compare their viewpoints, either in groups or through a class discussion.	*a. All people should have access to adequate quantity of good quality drinking water* *b. Our planet's flora and fauna should be protected* *c. Girls should have equal opportunities to boys.* |	1	2	3	4	5	6	7 | issue a issue b issue c
D. unfinished sentences	Teacher writes on the blackboard one or more value statements around an issue. Students rate their own viewpoint and degree of commitment, according to the 7 scale hierarchy of Raths: **1.** I have chosen my position freely, **2.** from alternatives, **3.** after thoughtful consideration of each argument, **4.** I am proud of and cherish my position, **5.** I publicly affirm my position, **6.** I act, **7.** I repeatedly act with consistence on the value. Following, they compare their viewpoints, either in groups or through a class discussion.	*a. All people should have access to adequate quantity of good quality drinking water* *b. Our planet's flora and fauna should be protected*
E. Text analysis	**1.** Educator introduces to students carefully selected texts (i.e. press articles). **2.** Students read the texts and begin with identifying the main players in the given texts. **3.** They are asked to trace the exact phrases/statements in the text which indicate the opinions or positions of the players. **4.** Students should then detect the players' values implied in these phrases. **5.** Students are asked to examine the values of the writer him/herself.	*a. Give out two texts describing the homes of two teenagers living in different countries. It is extraordinary how many values of the owners may be hinted in the description of the architecture and decoration of their house, referring, i.e., to the role of tradition and modernity, the consumption habits, the personal cleanliness, the family and the social relations, the privacy, etc.* *b. Distribute a college brochure and use the brainstorm and the web construction techniques to identify and categorise the values embedded in the colleges' objectives.*

TABLE 21 (Previous page) Examples of specific value exercises (techniques) that can be used in various contexts in class (A, B, D adapted from Brunner et al., 2001; C adapted from Scoullos & Malotidi, 2004, E adapted from Hungerford et al. (1994a & b) and Kamarinou, 2002. These do not have simple right or wrong answers, but rather call for students' insights by posing questions like 'Where do I stand?'; 'Why do I support that?', etc.

in depth self analysis exercises, out of class activities and small group discussions.

The overall values clarification approach is actually based on two assumptions: (i) that children will care more about values they have thought through and made their own than about those simply passed down by adults; and (ii) that being totally relevant to culture and personal preference (therefore neither 'right' nor 'wrong'), any attempt to teach a certain set of values would be considered as indoctrination, and would be highly inappropriate for our modern pluralistic societies. The teacher's role is certainly not to make substantive statements, but to pose questions, and to keep issues open than seek consensus.

Criticism on the values clarification strategy is actually based on the same assumptions: The neutrality of the teacher, who is non-judgemental of the values students arrive at, may cause failure to differentiate between personal preference and values; between moral and immoral, between right and wrong (Caduto, 1985; Titus, 1994; Papadimitriou, 1998). That is why this method is considered more appropriate for morally autonomous learners, older than the age of 11-12 yrs (Caduto, 1985).

The values analysis strategy
The values analysis strategy involves applying rational, logical and scientific thinking to resolve issues that may entail many stakeholders and viewpoints. Its ultimate goal is to help individuals apply this type of deductive reasoning to values exploration and decision making in their own lives (Caduto, 1985).

Commonly applied methodologies of the strategy include moral dilemmas that evoke a value question, role plays (Caduto, 1985), as well as text analysis (Hungerford et al., 1994a; Fernandes, 1999; Kamarinou 2002). The educator's role is to try to push learners' values forward while examining an issue and to function as a non-evaluative and active listener to the discourse. Through a well conducted exercise students may develop a sense of empathy placing themselves in someone else's 'shoes') in situations where there is a value conflict.

In the case of *moral dilemmas*, students are presented with a dilemma and through discussion they are helped to discover the inadequacies of their own moral thinking and move to a higher level (Caduto, 1985; Halstead, 1996; Papadimitriou, 1998). The approach is based on the theories of Piaget and Kohlberg, which defend that humans gradually develop their abilities to make complex moral judgements. However, in order for dilemmas to be real and personal they need to be closely related to learners' lives and experiences (UNESCO etc., No 15, 1985; Andrews, 1994; Fernandes, 1999, Brunner et al., 2001).

Within these processes the importance of practicing in *decision making* is stressed by many authors (i.e. Glascow, 1994; Andrews, 1994; Knapp, 1999; Kamarinou, 2002; Scoullos & Malotidi, 2004, etc.). More specifically, Glascow (1994) draws on the latitude such processes offer for the *pre* and *post* assessment of the implications of alternative courses of actions. Kamarinou (2002) considers reaching decisions as a significant outcome for any simulation game, for students to move beyond the level of conflict, to the level of consent. Andrews (1994) proposes to instil decision making processes into the school daily routine by asking students to chose, i.e. their topics and goals of writing and study, ways of presenting their work to class, etc.; in order to begin to take responsibility for their choices, become more independent in their learning and more reflective on their preferences and talents.

The values analysis strategy is recognised as a rational approach, applying objective criteria, with a strong cognitive grounding. However, values are certainly not scientific facts and whether individuals actually apply deductive reasoning to investigate values and reach decisions is under question. Opponents support that students obtain better realisation of their own value system and communicate it to others through empathetic, than through strict objective approaches (Caduto, 1985).

Of course, the value oriented strategies described above can be applied within a wide range of methods and in combination with tools like simulation games and educational drama, outdoor activities, case studies, surveys & inquiry based learning, theme days, etc. Some specific exercises that can be incorporated in instruction aiming to make students conscious of their views are presented in table 21. The educator must decide *how* and *when* to carry out such activities, within an ESD programme, in order to maximise their effectiveness (Hungerford & Peyton, 1994).

Communication while addressing values

When dealing with values an important task for students is to communicate their judgements, therefore the educator should guide them to explain *why* they answer as they do; this way their rationales can be inferred (Hungerford & Peyton, 1994). Naturally, during values discussions, differences in opinion will arise. This is a good opportunity for students to develop strategies as to how to react when being confronted with opinions that conflict with their own. For this purpose, a set of discussion rules is proposed by Brunner et al. (2001):

1. *Everyone has the right to refuse*: If any student finds that a question is sensitive or difficult he/she has the right to decline to answer.
2. *Respect each others opinions*: Since the value discussions involve neither right nor wrong, we cannot criticise each other. Contrary, everyone is entitled to state his/her opinion.
3. *Speak for no-one but yourself*: During the discussion the use of the first person should be stressed (Example: *"I think/consider that ..."*) instead of sweeping statements and generalisations (Example *"Most people believe that..."*).
4. *Don't interrupt*: Besides being dismissive an interruption is impolite and disrupts the speaker's concentration.

Depending on the maturity and the experience of students in such methods, educators may chose not to give out these rules to students but instead to jointly reach their own *code of discussion* and agree to follow it. Because these types of discussions normally engage students' interest and generate new insights, the given time may prove short for the full coverage of the issue. In these cases, a summing up might be required by the teacher, or an extra hour scheduled, if possible and appropriate.

Overall, values discussions ameliorate the oral communication skills of students, enabling them also to think critically, beyond the surface. Through the development of insights and the awareness of implications of thorny issues, students are encouraged towards a feeling of security and self-confidence in contacts with peers and others (Brunner et al., 2001).

Evaluation while addressing values

The evaluation of activities dealing with values clarification is a difficult process, even when clear instructional objectives are usde (Hungerford & Peyton, 1994). Ethical considerations preclude evaluating students' values against those deemed worthy of the educator, as noted also by Halstead (1996), therefore students should be evaluated merely on the process of their values clarification and analysis strategies.

For this purpose Hungerford & Peyton (1994) as well as Knapp (1999) urge educators to develop themselves appropriate indicators depending on the rational and objectives of their instruction. Such indicators may be quantitative (in the form of check lists, etc.) or qualitative (of a descriptive basis). They may concern various factors such as the actual behaviour of students performed inside and outside school; their expression of interest, enthusiasm and curiosity; their willingness and efforts to carry out action strategies; or even the types of questions they ask, etc. As a means of self-evaluation in values education programmes, many authors suggest the use of diaries and portfolios, which keep a record of students' work over time (Glascow, 1994; Fernandes, 1999, Knapp, 1999). Glascow (1994) considers grids can also prove useful evaluation tools.

3.17 Sources, effects & academic implications of self-efficacy

According to Bandura's social cognitive theory, the beliefs that people have about themselves are key elements in the exercise of control and personal agency. In particular, self-efficacy is an individual's judgement about being able to perform a particular activity in other words the 'I can' or 'I cannot' belief. Research shows that people with low self-efficacy toward a task are more likely to avoid it, while when it is high they are not only more likely to attempt the task but will work harder and persist longer if they face difficulties. On the other hand, low self-efficacy may provide an incentive to learn more about a subject. Moreover, a growing body of research reveals that there is a significant positive relationship between self-efficacy beliefs and students' academic performance (Bandura, 1997; Pajares, 1997 & 2000; Siegle & Reis, 2000).

The impact of such findings is important for any teacher and particularly for EE/ESD educators, who are engaged in student-centred and action-oriented programmes. That is why, further to the basic concepts described in paragraph 2.3, we herewi-

th analise the nature and structure of self-efficacy beliefs, their origins and their effects on individuals. On this basis, some teaching modes are also provided for those who wish to engage in activities aiming either to disclose or to strengthen self-efficacy beliefs of students.

The four factors that affect an individual's self-efficacy on an issue are presented in table 22. It is important to note that these sources of efficacy information are not directly translated into judgments of competence. It is the complex overall process - of selecting, integrating, interpreting and recollecting information- that individuals undergo, which eventually shapes their judgments of efficacy (Pajares, 1997).

Efficacy beliefs influence motivational and self-regulatory processes of individuals in several ways. To begin with, they influence the choices we make: Most people engage in tasks where they feel competent and confident and avoid those in which they do not. Beliefs of personal competence also help determine how much effort people put on an activity, how long they will persevere when confronting obstacles, and how resilient they will prove in the face of adverse situations. Efficacy beliefs also influence the amount of stress people experience as they engage in the task, and eventually *the level of accomplishment* they realise (Bandura, 1997; Pajares, 1997).

People with a strong sense of efficacy in a domain approach difficult tasks in that domain as challenges to be mastered rather than as dangers to be avoided; have greater intrinsic interest in activities; set challenging goals and maintain a strong commitment to them; intensify their efforts in case of obstacles; more easily recover their confidence after failures; and attribute failure to insufficient effort or deficient knowledge and skills, which they believe they are capable of acquiring. Conversely, people with low self-efficacy often consider things to be tougher than they really are, a belief that fosters stress, depression, and a narrow vision of how best to solve a problem (Bandura, 1997; Pajares, 1997).

Specifically referring to the area of environmental protection, research findings are, at times, contras-

TABLE 22 The four sources that affect self-efficacy of individuals, as pointed out by Bandura, presented in order of degree of influence, (adapted from Pajares, 1997).

Mastery Experience (or past performance)	*"Nothing breeds success like success"* The most influential source of self-efficacy is the interpreted result of one's own performance. Simply put, success raises self-efficacy, failure lowers it. For example, when a student has been successful at a particular skill in the past, he/she will probably assume to be successful at that skill in the future.
Modelling (vicarious experience)	*"If he can do it, I can do it as well!"* This is a process of comparison to others: Usually, when a person observes someone (model) succeeding at something, their self-efficacy increases; and vice versa. Actually, the more individuals 'relate' to the model observed, the higher the impact of the model's performance on them. That is why peers are considered better models than the teacher. By observing schoolmates perform tasks, students make judgements about their own capabilities.
Social Persuasions	*Telling someone "You can do it" can increase their confidence to do a task.* These generally relate to verbal encouragements or discouragements and can have an important effect at times (most people remember a time when something said to them has had a profound effect on their confidence throughout their lives). Generally, it is easier to decrease someone's self-efficacy by negative messages than to increase it with positive ones.
Physiological Factors	Often, people estimate their level of confidence by the emotional state they experience, as they contemplate an action. Meaning, the perceptions people have of the responses they exhibit in stressful situations (i.e. shakes, aches, 'high adrenaline', etc.), can alter their self-efficacy. For example, if a person with low self-efficacy gets 'butterflies in the stomach' before public speaking, he/she may take this as a sign of their own inability; thus decreasing their efficacy further. So, it is the person's belief of the implications of his/her physiological response that alters self-efficacy, rather than the response itself.

ting. The majority of these reveal that people with high self-efficacy are more likely to engage in environmental activities (Siegle & Reis, 2000). Axelrod & Lehman (1993) report of several research findings indicating that changes in self-efficacy beliefs are linked with changes in behaviour; and other findings, in the same line, depicting self-efficacy as a parameter that differentiates between those who are environmentally active and those who are not. However, not all research results support that claim (e.g. the results of Tanner, 1999).

Based on the above, some teaching modes and advice are given here for educators wishing to embellish their interventions with self-efficacy issues. As with any other method proposed in this publication, these need not be followed strictly, but rather be used to enrich teachers' repertoire of pedagogic strategies. They are advised to make the necessary adjustments and apply these in the appropriate context. The guidelines presented here, which capitalise on the three strongest contributors to self-efficacy, namely (i) past performance, (ii) vicarious experiences and (iii) verbal persuasion, were developed based on the work of Pajares (1997; 2000) and Siegle & Reis (2000).

1) Setting and measuring objectives is one of the most effective classroom modifications educators can make to increase student confidence. When students achieve short-term objectives, they gain an initial sense of self-efficacy for performing well, which is later substantiated as they observe progress toward longer-term goals. Objectives are effective both in giving directions to a student's effort and also in providing a way to measure pre-vious achievement. Setting, measuring, and recording achieved objectives draws students' attention to their past performance -the strongest indicator of self-efficacy.

When it comes to goal setting, smaller is better: During the initial phase of any project, students should be encouraged to set small, achievable objectives that can be accomplished quickly. As they work through the project, educators can help them set more advanced, longer-term goals. Obviously, one setback during a long series of successes with short-term objectives is much easier to handle than a larger setback with a long-term goal.

Especially young children are not able to focus on long-term goals: When elementary students are taught to carve up large, distant goals into smaller objectives several positive outcomes are observed: Students achieve faster progress in learning skills or content; they learn an important self-regulation skill; and they improve their self-efficacy and interest in the task.

Challenge, is in the eye of the beholder: Objectives that the educator considers challenging may be seen as too stiff by some students, and laughably easy by others. The challenge for the teacher, then, is to assist students in setting reasonable objectives for themselves. Readers may find more information on the categories of educational objectives in the material "Waste in our life" in paragraph 2.6.

2) Using modelling within the instruction is a type of social comparison that has an important influence on childrens' self-efficacy during skill acquisition. In this type of instruction the model is the

My accomplishment plan
(What I want to do better this week)

Name: ....
Week: ....

Objective	How I did	The best thing about trying to reach this objective
1		
2		
3		

Suggested activity for class

Help each of your students to set 3 objectives on a weekly basis, by filling in a form, a type of ´accomplishment plan´. Objectives should be sufficiently specific, therefore, easy for students to recognize progress toward them. They should also be attainable, within the students´ reach with reasonable effort. Help them set improvement rather than benchmark goals. (Example: the student may decide to increase the number of homework assignments completed, as opposed to completing 10 homework assignments). At the end of each week, review each student´s accomplishment plan and assist them in developing new objectives.

(adapted from Siegle & Reis, 2000)

person being observed by the rest, while performing a specific activity. The teacher can be an important model of course, but peers have an even a greater impact, due to the perceived similarity between the observer and the model. Research shows that better efficacy results are obtained in cases when models explain to the observers their coping strategies; when models verbalise the steps of action prior to performing a task; and when a variety of models (e.g. multiple students) are used.

On this basis, educators can easily include peer modelling, for example through classroom demonstrations. It is better to select students with a variety of skill levels to act as models and confirm that they can accomplish the skill sufficiently prior to demonstrating in front of the class. (Of course, in many cases the mistakes made by the model or the misconceptions expressed are good opportunity for feedback and thorough examination by the whole class). Generally, demonstration modelling is better to be incorporated at the beginning rather than the end of a lesson, where students are tempted to compare their work with the model's accomplishments.

During the demonstration, in order for models to be effective, the rest of the class should perceive themselves to be as skilful or more skilful than them. If the students see someone whom they believe is less skilled than themselves succeed, they are easily

convinced that they too can perform the task; and in the case of failure, the negative efficacy impact on them is not as strong. On the contrary, having an over-competent student act successfully as a model, whom the rest of the class believe to be more skilled, will do little to improve their confidence and in the case of failure may frustrate them. (Readers can find more on the demonstration method in paragraph 3.11.b)

The process of modelling occurs also during the common classroom practice of oral questioning, during which students constantly compare and assess competencies amongst themselves. Although oral questioning is an easy method for the teacher to assess students' learning, if not done with caution, it can hinder the learning process. To explain, when a student correctly answers a question, a positive experience should result for him/her. In case of an incorrect response, however, not only does the student's self-appraisal of his/her skill drop, but the self-efficacy of the classmates who perceive themselves as having abilities similar to or less than him/her may also decline, if they begin to question their own ability. The best tactic for teachers is to get correct answers from middle or low achieving students; however predicting how well the target student will respond can prove a hard task.

The process of modelling can occur successfully also during small group work, where students learn with and from each other, serving as each others' models. (Readers can find more on effective group work in paragraph 3.1). When possible to implement, cross-age grouping is another method that allows for effective modelling: Young students look up to the older ones, and older students often act much more responsibly when they assume a modelling role. Cross-age grouping also gives older students the opportunity to recognise their own progress, as they compare themselves with younger ones. Another way to use modelling is to have a former student visit the class and talk about their experiences. The value of modelling lies in letting students know that others, like themselves, have successfully accomplished what they are about to attempt.

Last, but not least, is the option of self-modelling. This can be done by recording a student's performance using a photo camera, a video camera, or a tape recorder, and then viewing these records, while eliciting positive comments about the skills the student (model) acquired. Self-modelling oc-

Tips for effective use of modelling during oral questioning

- Teachers should ask open-ended questions that allow for a variety of responses.
- Teachers may develop a hand signal system where the students raise hands for a "risk-taker" answer that they are unsure about, but would like to share.
- Teachers may wish to allow students, when being unsure or incorrect, to consult in pairs to develop a better answer.
- Teachers should acknowledge all who contribute to solving a question. Even students who have risked giving an incorrect answer at the beginning of a task have contributed toward the solution.
- Teachers may wish to ask students to put their answers on slate boards or sheets of paper and display the boards toward the teachers. (There is something less intimidating about writing an answer that can easily be erased).

(Siegle & Reis, 2000)

curs also through *visualization*, a method particularly successful with studens who are afraid of change: Here, before beginnng a new task, the teacher mentally 'walks' the model through the task (review of the process so far, explanation of the steps to be taken and envision the result of the performance). By talking, students start developing a sense of success before they even encounter the task.

3) Teacher's verbal persuasions can influence self-efficacy of students, particularly of the younger ones.* As stated already, individuals develop self-efficacy beliefs based also on the positive and negative verbal messages they receive from others. In classroom reality, teachers need to pay attention to the way they phrase compliments and criticism, because the words they select can have a significant effect on students' perceptions of their own effort and ability.

In the first place, educators should be specific with their compliments. (Example: *"Good work"* is a general compliment that does not carry the weight of the praise *"You did a nice job providing arguments in your paragraph"* which gives more information about what has been performed well). Students are able to better cognitively appraise their progress when feedback is specific. Of course, to be effective, compliments must be genuine and earned, as children cannot be fooled by empty praise. Teachers who attempt holistic praise disconnected from real accomplishment quickly lose credibility.

Another challenge for teachers is to help students understand that abilities are not innate, but that each one of them can develop the skills necessary for the achievement of a given task. Therefore, they should compliment students on the particular skills and to their development -without putting too much emphasis on their effort. (Example: *"You have really developed the ability to provide supporting arguments for the main theme of your paragraphs."*)

Students, when given unsolicited help by the teacher, tend to consider this as a sign of their own low ability, and so do their classmates watching. That is why educators should avoid giving unsolicited advice or help. (Example: Instead of asking a weak student *"Are you in trouble?"* a teacher may state *"I like your opening topic sentence. What kinds*

of arguments will you give in the rest of the paragraph to support your position?"). In this example, first, the teacher begins with a positive comment on a real strength in the student's work; second, without focusing on the student's ability, a question provides information about what additional avenues the student may want to explore; and third, the statement places responsibility for learning onto the student.

Tips for the educators

There are times when a teacher knows that a student needs assistance, but is not requesting it. Instead of walking directly to his/her desk, it is better to move around the class and randomly stop at many desks before and after visiting the particular student. The practice of random stops at students' desks can help disguise unsolicited help. A good tactic for the teacher is also to inconspicuously put themselves in situations where the student can ask for assistance.

(Siegle & Reis, 2000)

4) Self-evaluation methods can also be used to enhance students' self-efficacy. Educators need to take every opportunity to help students document past success, and thus recognise their growth. There are several appropriate tools such as the following:

(i) Individual charts (i.e. line charts), which students keep in their desk and frequently upgrade. Educators should avoid classroom charts displaying individual progress, because students may fail to appreciate their own accomplishments when focusing on how well others have done. Class charts that present collective achievement (i.e. collective number of assignments performed in a week) are more appropriate for display when trying to increase self-efficacy.

(ii) Student journals, where each day they note something new they have learned, or some skill they have mastered, or something they did well. They should review their journals periodically to reflet on their progress. If students do not enjoy writing, they may instead note a few key words on a monthly calendar poster.

(iii) Portfolios are increasingly used for students to monitor their progress and to become reflective

evaluators of their work. Students can select a sample of their work each week and keep it in a file in their desk. During a periodic review they are usually surprised at how much more complex their current work is when compared to a few weeks before. The same principle goes when using time capsules at the beginning of the year, which are later opened and students can monitor their growth.

Some teachers during the evaluation process tend to concentrate so much on underachievement that they overlook the progress a student is making. This is aggravated by the fact that students often view their mistakes as fatal instead of fixable. Educators are therefore advised to start by commending positively on the tasks carried out correctly and urge students to think *themselves* of ways of improving their performance.

The way educators handle students' self-evaluation feedback is essential for the learning process. To give an example, in the case of failure a student's explanation *"I didn't put much effort"* greatly differs from another's *"I am not good at this"*. The former is an effort attribution for failure that can be readily changeable; decisions about how much effort to expend are under personal control. The latter considers poor performance as a result of their lack of ability/skill, implying he/she cannot do much to improve. Unfortunately, with time, students' skill based attributions for failure -sometimes unconsciously reinforced by teachers' or parents' hints about ability- become resistant to change.

On the other hand, in the case of success, research shows that skill attributions for success results in increasing self-efficacy, compared to simple effort attributions that may allow students to question their competence. Based on the above, when students evaluate themselves educators should help them practice lack-of effort explanations when they perform poorly, and encourage them to emphasize on skills development as an explanation for success.

3.18 *Reading, writing, and presenting ...*

1. News Item Analysis

In the technique of news item analysis, several press clippings are used that pertain to the issue of waste or the environment in general. It is recommended that the students collect the articles themselves, from the newspapers and magazines. Gradually, they may be asked to analyse more sophisticated issues that appear in the press, such as sustainable development etc. (UNESCO etc. No 35, 1993).

This is an activity that can take place over a selected period of time, (e.g. a month, a semester, or a whole academic year), in parallel with the other planned activities of an ESD programme. It is rather useful since it provides for relevance to the timeliness and the society around the school. It helps the class keep abreast of what is happening locally and internationally and generates interest.

2. Writing Letters

Students, in several cases, may write letters to experts, resource persons or institutions involved in solid waste management or other environmental issues, either to request information or to announce their findings. Prior to writing such letters students should do some background reading on the issue of concern and also on the consignee, so as to form an idea about what to ask. The educator may hand out a model for information request and practice in drafting such letters (Marcinkowski et al., 1994).

When writing letters, students should bear in mind the following:
- The mode of expression is important, particularly when addressing officials, e.g. local authorities, academia, etc.
- Firm views should be expressed in a polite manner. Ironic, negative or aggressive comments should be avoided.
- The arguments and positions should be clear, based on accurate information and resources. Objectivity should be pursued.
- Proposals and recommendations on the issue should be included.
- Students should take into account whom they address and adequately underpin the arguments used for their initiatives (e.g. whether these actions would have economic or social benefits in the long-term, etc.)

3. Writing press releases

One of the simplest and most economic ways of providing information to the media is by preparing a press-release, a brief text including only the main points of the issue examined. In general, a press release facilitates the dissemination and communication of results of students' work to the local society, at the right moment.

For students who prepare a press release, the following advice may be helpful (based on Roniotes et al., 1994; WWF-Hellas, 1999).

- Present the text in a simple, comprehensive and attractive way.
- Write a short text, ideally not longer than 1 page.
- Think of an attractive title, indicating the most dominant feature of the press release in the least number of words.
- Mention the key facts and concepts in the first phrases of the text.
- In the case of in advance circulation the phrase 'embargo until the xx/yy/zz' (date) should appear on the top.
- Type the texts in double space using a computer.
- Preferably, add 1-2 profound relevant photos, or graphs, etc.
- Do not forget to present your group, indicating also the name and contact details (telephone and address) of your school, for further information.
- Be well-informed on the subject: Especially those students who undertake to make the contacts with the media should be very well prepared to answer any additional questions.
- Inspire a positive feeling: Overall it is better for a press release to have a positive disposition, providing alternative solutions instead of being merely critical, pessimistic and with accusations.

4. Making oral presentations

Based on the findings and conclusions of their investigations and projects, students may wish to deliver an oral presentation, to inform and sensitize peers, parents, or other members of their community. Such an activity is very important because it gives them the chance to display and reinforce what they have learned and also because they can make collective use of their talents and develop confidence in what they are doing (UNESCO etc., No 21, 1992; Seebach, 2001).

According to the recommendations of Kamarinou (2000) and Seebach (2001), students, when preparing and making a presentation, should bear in mind the following:

- Make sure that the intended basic argument or message is clearly conveyed to the audience.
- Double check the information presented. In order to be more convincing the sources of information could be mentioned.
- Use different means of presentation (transparencies, music, plays, etc.) to keep the interest of the audience high. In any case, image should be complimentary to speech.
- Check the overall structure of the presentation, making sure it builds on a logical sequence in a simple, direct and comprehensive way, without repetitions.
- If the aim of the presentation is also to get the views of the audience on the issue, take provision of giving time enough to discuss and get their feedback.
- Presentations lasting more than 1hr are rather tiring for the audience and should be avoided.

3.19 *Tips on creating a theatrical play*

When the class undertakes to write a theatrical play students should address the following issues:

What do we need to know about the topic of our play? Students should study their topic through an interdisciplinary approach: Physical Science, Social Science, Literature, Arts, Technology, Ecology, Culture, etc., are all disciplines to be involved. Information collection may be not only through bibliographic research, but also through field visits, interviews and/or surveys, etc.

Preparation of the play: Students should become acquainted with the methodology of a theatrical play. To this end, they may read and discuss about selected plays or even, time permitting attend theatrical performances as well as the preparation work for a theatrical performance (rehearsals, etc.). Games and exercises of trust, cooperation and improvisation, of body and emotional expression using imagination and problem-solving skills, educational drama techniques on given situations, etc. can be realised at the preparation phase, preferably with the help of a theatre or drama instructor.

Students should also decide upon their tasks: the director and his/her assistants, the actors, the set-designers, the sound, light, etc. technicians, the costume designer, the managers who will promote the performance, the artists who will make the promotional poster, etc.

Writing scripts: Scripts are of various forms. The most familiar one is that with stage directions suggesting movements and lines of dialogue to specific characters. However, since it is not an easy task, when students attempt for the first time to create a script there are various ways to facilitate them and stimulate their work. The educator could:
❱ Provide a summary of scenes indicating their order but not prescribing dialogue –using only words or pictures. This is particularly suitable when the play includes much of improvised dialogue.
❱ Perform an editing skills exercise : the educator records an interview from TV or the radio and transcribes it. He/she asks from students to cut it down in length e.g. only for 20 seconds.
In general, some simple yet basic questions that might help are: "*In our play, what is our staring point? What do these people/characters want? What is stopping them from getting what they want? What are they struggling for, What are their options?*"

Rehearsing: Students should rehearse a lot to explore and find out about the play characters and the other issues addressed by the exercise.

3.20 *Performing citizenship actions*

A major goal of EE & ESD is certainly to develop effective citizens in the world community who can contribute to the solution of issues. Addressing the controversial environmental issues should be an inherent component of ESD programmes, not only by awareness raising (i.e. through discussions), but also through the actual commitment and the direct actions of students (i.e. Engleson & Yockers, 1994; Hungerford et al., 1994a; Kamarinou, 2000). Using the phrasing of Hungerford, *"If we want future citizens to be responsible citizens we must teach them how to be responsible."* (Hungerford et al., 1994a).

Hungerford et al. (1994a) defend that when in depth investigation skills are taught along with citizenship action skills, substantial citizenship action will result. Certain research findings support their

Just like driving lessons cannot be restricted to the "driver's manual" but need to provide "behind the wheel experience"; an ESD programme cannot be restricted to awareness raising but needs to provide students with real-world experience in citizenship skills for issue remediation

(Engleson & Yockers, 1994)

claim, showing that students who have got involved in eco-citizenship actions tend to have a stronger relationship with their environment and exhibit better social behaviour and higher moral judgments than those who have not. For example, a meta-analysis on the effectiveness of 18 educational interventions revealed, among others, that those interventions that actively involved participants were more effective in improving their environmental behaviour (Zelenzny, 1999).

The variables that affect inclination towards action

What are the driving forces determining the performance of an environmental action? Naturally, people could never deliver an action for a particular issue unless they are aware of its existence; however the linear relationship of knowledge-attitudes-behaviour is neither accurate nor adequate. On the contrary, it seems that simple knowledge and awareness is not enough to lead to a certain pro-environmental action (read more on this Annex). In this respect, Kamarinou (2000) based mainly on the work of Hungerford names three types of variables that affect the inclination towards action. These are:

a. Variables of awareness which originate from any source of information, may that it be in the form of printed text, image, or speech. Awareness can be enhanced when there is some kind of personal involvement in the issue. For example, fishermen have an economic interest to keep the sea clean; people with direct negative experiences living in degraded environments tend to be highly sensitized, etc. The teacher's role is rather important in increasing awareness and sensitization.

b. Variables of deep comprehension of the social and economic parameters of the issue and of the interrelating values, ways of living, etc. These variables go far beyond the awareness level and entail a holistic approach to the issue, a thorough examination of the emerging conflicts, extending to the investigation of alternatives to address it. For example, students may be aware of the negative consequences of the depletion of the ozone layer in the atmosphere. However, in order to address the issue they need to understand these impacts in depth: that except for health threats this depletion may have other secondary and tertiary effects; that it is not necessarily gradual; that there are se-

veral economic and social factors causing the increase in the consumption of substances responsible for depletion; that certain lobbies restrain enforcing laws to ban these substances.

c. The action variables In order for students to exhibit responsible citizenship behaviour, it is important: to cultivate in them the belief that they themselves may perform actions affecting their own lives;* to inform them of the possible types of actions they can perform (action strategies); and of course help them or motivate them to practice, themselves, in the necessary action skills, including planning and executing *action plans*.

The types of environmental citizenship actions

There are a number of ways in which citizens can work to bring about changes to environmental issues. Hungerford et al. (1994b) classify these under four headings for MSLs, explained herewith. In practice, citizens -and students- often employ a combination of these options:

a. *Persuasion:* This is a logical or emotional appeal to motivate others to modify their attitudes accordingly and take positive environmental action. It can originate from an individual or a group, and is basically carried out through discussions. (Examples: *trying to convince friends to recycle aluminium; writing a letter to be published in the local newspaper; preparing and putting up posters that urge people to recycle used food containers; persuading parents to purchase products in environmentally appropriate packaging, etc.*).

b. *Consumer action* refers basically to the buying power of individuals. It involves consuming something that agrees with one's environmental values or refusing to consume something that represents an action or idea one disagrees with. (Examples: *buying only those soft drinks which come in recyclable containers; refusing to buy (boycott) products made by companies with a negative environmental track record, etc.*).

c. *Political action* refers to putting pressure on political or governmental bodies in order to persuade them to take environmental action. (Examples: *supporting and voting for a candidate with a good environmental record; requesting from the city council a recycling centre for the community, etc.*). In this category we al-

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* 1 Read more on locus of control in paragraph 2.3

Step 1 Planning for action	The educators should help the students to identify and clarify the objectives of their action. Students should be encouraged to brainstorm and agree on a series of questions such as: ● Is the action realistic and appropriate? ● Are alternative actions available? ● What are the legal consequences of the action? ● What are the social consequences of the action? ● What are the economic consequences of the action? ● What are the ecological implications of the action? ● Are our (my) values consistent with this action? ● Who is going to be involved? In which way? Why? ● What are the costs/benefits or advantages/disadvantages of the action? ● Do we (I) have enough time, skills, and courage to undertake the action?
Step 2 Moving ahead Drafting the Action Plan	In this step, students should let others know about their planned action and try to get the partners involved (as identified in step 1). The action plan should be open to partners' ideas and proposals, before it will be definitely decided. Students need to address the following: ● Does the action require permission from the authorities? ● Is the action plan well detailed? ● Does everybody understand the procedures of the action plan in total? ● Is there provision in the action plan for adequate roles for each student during the implementation? ● Does every student understand his/her role? ● Do we anticipate any problems or opposing forces affecting our (my) action? If yes, how will we address them?
Step 3 Acting!	Students should put the plan into action, making sure they make any necessary changes to improve its effectiveness.
Step 4 Reflection	Students should evaluate their performed actions. Educators should take caution, because several of the following questions may lead to conflicts within the class: ● How do we (I) feel about the experience? ● Did the action achieve its objectives? ● Were any additional problems created? ● What did we (I) gain as a result of taking action? ● What responses did we receive from those affected (positively or negatively) by our action? ● Did all partners work cooperatively and effectively? ● Were there any communication problems among partners? Why?
Step 5 Sharing with others	After all this effort, why not share it with others? Encourage other students, and especially the younger ones to continue the action, if necessary, or to initiate and get involved in similar ones.

TABLE 23 Based on the recommendations of Kouskoleka, (1991), Marcinkowski (1994) and the outlines of the work of Hungerford, as presented in Engleson & Yockers (1994), this table lists questions that students need to address before and after executing an action plan. Actually, the answers in steps 1 & 2 will help them decide if an action plan should be immediately implemented, delayed, abandoned, or modified.

so find legal actions, such as writing to a legislator supporting the adoption of a pro-environmental law, making a lawsuit, etc.

d. *Ecomanagement* is a positive ***physical action*** with respect to the environment, delivered by an individual or group. Ideally, it results in either maintaining or improving environmental quality. (Examples: *holding a beach clean-up; systematically recycling materials, setting up a composting facility in the school yard, offering voluntary support to an environmental NGO, etc.*). Kamarinou (2000) proposes a different classification

of action strategies within ESD, distinguishing the individual from the social level and adding a third category of actions to be performed at the imaginative level (drama activities, story creating, art handicraft, etc.). The latter category is rather useful especially in cases when real life conditions do not allow the actual action.

Executing an action plan

The first step for educators is to ensure that students are trained in skills of responsible citizenship action, and able to demonstrate these in surroga-

te classroom situations. Once students have had the opportunity to explore and practice citizen action methods, they should be provided with the opportunity to develop action plans for issues they have investigated. Based on current literature, a list of steps in executing an action plan is provided in table 23.

The value of involving students with issues deriving from their local environment has been repeatedly underlined in this publication. According to Kamarinou (2000) such actions:

a) stimulate students' interest and motivate their action, since they have a direct link to their lives. Eventually such actions are more visible and can be easily addressed by friends, neighbours and people of their immediate environment.

b) facilitate the learning process, since the place of activity is familiar and provides opportunities for direct personal experiences.

There is some ambiguity whether teachers, especially in the formal system, should direct or not their students towards a citizenship action in their community. Hungerford et al. (1994a) strongly recommend not urging students to particular actions, unless they themselves agree to do so. If so, the teacher should support their actions, provided of course these are socially and ecologically responsible. Even when students 'fall short' to teachers' expectations, by choosing to engage in issues with no serious political or social overtones, or by deciding to take no further action, an educator's ethical responsibility would be to help and support their decisions.

There are some points raised on the evaluation of the effectiveness of students' actions (steps 4 & 5 of table 23). Practice shows that students face various challenges in the evaluation process, such as low visibility of their results due to space or time constrains (Engleson & Yockers, 1994). (Examples: *If the action decided is fund raising for curtailing forest destruction in Indonesia, the impact of this is not easily confirmable. If the action plan is targeted to a stream restoration and includes reducing hazardous discharge, students should bare in mind that the complete recovery of the stream would take many years*).

Another common feature, according to Engelson & Yockers (1994) is that the impact of the actions may not be as complete as the students originally expected. (Example: *If student action was directed towards a total ban of pesticides spraying on lawns in their city, and the city council, instead, enacted an ordinance requiring posting a notice at sprayed gardens, the action should not be judged to have failed, but rather to have been partially successful*). The role of the educator is to restrain students from feeling frustrated and explain that often the most that can be expected is a partial victory and that a new action plan may be required.

The above arguments provide further support of the added value of getting involved with issues of the immediate environment of students in teaching citizen action skills and in providing citizen action experience.

3.21 *Carrying out an awareness campaign*

In cases when students report a very low awareness and sensitization level on the issues they investigated, they may decide to carry out an awareness campaign, to sensitize their peers, parents, or the members of the wider community.

Overall, an awareness campaign offers many opportunities to extend classroom activities and to deliver the messages to families and local communities. Students, through such activities develop their communication and cognitive skills and have the chance to put their gained knowledge, ideas and artistic skills into practice. Also, such activities encourage them and strengthen their sense of personal stake, responsibility and self-efficacy (Scoullos & Malotidi, 2004). Once again, the oppotunity arises to engage MSLs in issues of everyday lives, one of the main goals of ESD programmes and materials.

When the class is about to undertake a campaign, the following questions can help students organise their work efficiently (Based on the recommendations of UNESCO No 21, 1992; WWF-Hellas, 1999; Kamarinou, 2000):

What is the aim of our campaign? An environmental campaign obviously addresses an environmental issue or problem, or certain sides of it. Students need to specify their goal: Is it to present the findings of their work, to give people ideas for action, or rather to protest against an activity that threatens the environment? (Example: *The goal of a recycling campaign could be to inform people of effective recycling methods or to propose a new legal framework promoting recycling*).

What is the target group of our campaign? Is it the schoolmates, other schools, the school neighbourhood, or the wider community? And why would the central message of the campaign be of interest or relevance to them? Obviously, depending on the size and nature of the target group the tools for the campaign vary: When addressing their direct surroundings (families, neighbourhood, etc.) students can prepare posters, theatrical plays, an exhibition or a presentation in the school grounds. If the campaign is directed to the wider public, they should exploit the local authorities as well as the media, in order to deliver their message.

Who will be involved in our campaign? Students should think of ways of how to actively involve as many people as possible in their campaign. They certainly need to inform their parents about their efforts and ask for their help and support. If appropriate, they may involve student groups from other schools working on the same issue, or relevant NGOs and enterprises to achieve greater diffusion.

If the campaign is directed to the public, they should think of ways to involve the local authorities and media, e.g. local radio, newspapers and TV. (Example: *When organising a drawing competition, a good way to involve the media and the municipal authorities is to invite them to become members of the reviewing committee and participate in the awards ceremony*).

Who will be in charge of what? To be more efficient, students should preferably split in small groups

Can students' letters really help solve environmental problems? A successful example of a letter campaign

During the past few years, members of the "Global Response" (an international environmental network organizing letter-writing campaigns and members including thousands of children and teenagers) have helped many local communities prevent environmental destruction. For example, students' letters helped to:

■ Save a habitat for sea turtles and dolphins by stopping an oil-drilling project along Costa Rica's Caribbean coast.
■ Prevent strip-mining of Kenya's coast for titanium, a project that would have polluted precious forests, wetlands, mangroves, coral reefs and marine life on Kenya's pristine coast.
■ Stop oil development in Guatemala's Maya Biosphere Reserve, one of the world's most biologically diverse tropical wetlands.
■ Save the forests and preserve the way of life of the Warli indigenous people, by stopping construction of an industrial port in Dakanu, India.
■ Stop construction of a dangerous uranium enrichment plant in a poor African-American neighborhood in Arkansas.

(more information on http://www.globalresponse.org/)

and allocate the tasks of their campaign, as follows:

■ **Public relations:** those in charge of public relations will undertake to obtain any necessary licence and have the contact with the media. They should keep in mind that certain newspapers, radio stations etc., may grant some 'space' for free, for issues concerning the well being of the community.

■ **Documentation:** this group will collect all the material that will back the campaign. This may be scientific research findings, photographic material, existing laws, etc. Based on this material the group will prepare the content of the press release, brochure or other text to be used for the campaign.* Students need to be credible and honest, and describe problems by giving simple and factual information. They may refer to success stories from other regions or countries without being afraid to mention failures. All students should help create the campaign *slogan:* a short appealing title.

■ **Lay out & Design:** A group of students will design the products that will be used in their campaign (posters, brochures, artwork, costumes, multimedia, applications, etc.). These should attractive, impressive, and related to the campaign's slogan. They may wish to draw the *logo* of their campaign, themselves, sometimes relevant to its slogan, or they may contact an artist to offer them advice.

■ **Economic matters:** students should prepare in advance a list of materials they need to buy for the campaign, and estimate their cost and source of funding. They may address the municipality, the school, or local enterprises to support it. It is preferable to use recycled or used materials like old clothes, cardboard, corks, etc. that have zero cost.

■ **Diffusion:** depending on the project, students should choose an appropriate display site, frequently seen/visited by the target group, whether inside or outside the school. When the campaign's materials are exhibited students may monitor the number of people passing by, noting their reactions. Every student should take part in the diffusion process by posting announcements, handing out leaflets, and personally informing others on the purpose of the campaign, its importance and the need to support it.

How will we achieve greater publicity? In many cases campaigns start or end with the organisation of a public event, be it an exhibition, a festival, a theatrical play, a meeting, etc. In order to increase its publicity students may invite a celebrity known for his/her environmental profile. If they decide to move outside their school, they may seek for a conference room or hall in their municipality that they could get for free.

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* Find useful tips on preparing press releases in paragraph ##.

Part IV

Info tips
on the implementation
of the activities

Activity 1	**Waste can take up a lot of space!**
STUDENTS' AGE	> 9 yrs
SUBJECT AREAS	Mathematics, Life Sciences (Ecology), Home Economics
ESD TOOLS	group work, experiments, brainstorming & web-charts, teaching through objects, bibliographic research, performing citizenship actions, addressing self-efficacy

Activity 2	**What did you throw away today?**
STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Life Sciences (Biology, Ecology), Home Economics, Mathematics
ESD TOOLS	experiments, brainstorming & web-charts, practical work, teaching through objects, values within education, values within ESD, addressing self-efficacy

Activity 3	**Hazardous substances around the house**
STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Health Sciences, Physical Sciences (Chemistry), Home Economics
ESD TOOLS	experiments, group discussion, group work, writing press releases, performing citizenship actions

Info tips on environmentally friendly & healthier house-keeping products

During the experiment, Team B may follow the following procedure for better results:
- Add 1 tablespoon salt, 1 tablespoon baking soda and a piece of aluminium foil to aprox. one litre of boiling water.
- Submerge the tarnished silverware in the solution for 2-3 minutes.
- Use a piece of cloth to wipe away tarnish.
- Repeat if necessary.

Various toxic-free and even chemical-free alternative substances that could be used in every day activities around the house are listed below:

- For general cleaning purposes: baking soda and soap or chlorine-free cleaning products
- To clear drainage: Use a rubber plunger to unclog the drain. Pour ½ a cup of baking soda plus ½ a cup of vinegar plus 2 litres boiling water
- To remove burnt fat: baking soda and soap
- As a window cleaner: vinegar diluted with water
- As a cockroach repellent: shredded bay leaves
- As a mosquito repellent: citronella candles or essences

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- As a fly & mosquito repellent: a basil plant on the window sill
- As a moth repellent: cedar wood sticks/chips in a cotton bag
- As an ant repellent: red hot pepper at the entrance of the nest
- As a room deodorizer: fresh flowers or herbs
- As a fertiliser: compost
- For wall painting: water-based paint and sprays instead of oil-based ones
- As a paint brush softener: hot vinegar

Activity 4 — Warning signs on hazardous products

STUDENTS' AGE	> 13 yrs
SUBJECT AREAS	Life Sciences (Biology, Ecology), Earth Sciences (Geology), Physical Sciences (Chemistry), Home Economics
ESD TOOLS	group work performing citizenship actions, bibliographic research, writing official letters

Activity 5 — Hazardous substances in various professions

STUDENTS' AGE	> 13 yrs
SUBJECT AREAS	Life Sciences (Biology), Physical Sciences (Chemistry), Home Economics, Social Sciences
ESD TOOLS	surveys (through interviews), moving outside the class, group work

Info tips on removing stains from clothes in an environmentally friendly way

Stain	Active components in cleaning products	Environmentally friendly means of stain removal
Sweat	Bleaching agents, enzymes	Baking soda, soap
Paint	Bleaching agents	Light petroleum, prior checking of colour resistance to fading is advisable
Shoe polish	Bleaching agents	Light petroleum, prior checking of colour resistance to fading is advisable
Coffee, cocoa	Bleaching agents, enzymes	First hydrogen peroxide, then soap and rubbing
Blood	Bleaching agents, organic acids	First hydrogen peroxide, then soap and rubbing
Red wine	Bleaching agents	First hydrogen peroxide, then soap and rubbing
Rust	Bleaching agents, organic acids	First lemon juice, then soap and rubbing
Wax	Hydrocarbons	Placing a newspaper on the stain that is then ironed

Activity 6	**What do I do with this used battery?**

STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Physical Science (Chemistry), Life Sciences (Ecology), Social Sciences
ESD TOOLS	bibliographic research, making oral presentations, concept mapping, performing citizenship actions, organising an awareness campaign

Activity 7	**Waste in our neighbourhood**

STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Home Economics, Social Studies, Mathematics
ESD TOOLS	moving outside the classroom, using maps, group work, writing official letters, organising an awareness campaign

Activity 8	**Construct a mini landfill**

STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Chemistry, Environmental Science, Mathematics
ESD TOOLS	using analogies, physical models, experiments, discussion techniques

Activity 9	**Seeking a landfill site**

STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Life Sciences (Ecology), Social Sciences, Economics
ESD TOOLS	group discussion, role-playing, bibliographic research, news item analysis, problem solving through an action-oriented approach

Tips on the activity

The identification and designation of a site for the establishment of a sanitary landfill is a very controversial issue. Local authorities, inhabitants and local citizens groups are almost always against a landfill of any kind being located in their vicinity, while regional and national authorities together with those experts who identified the site as most appropriate, are in favour. The most popular attitude is the so called 'NIMBY' (Not In My Back Yard) or 'put it elsewhere' approach, which is based on previous negative experiences of poorly functioning landfills.

Precisely because the designation of a site is one of the most difficult issues related to waste management it cannot be completed without a thorough and comprehensive public dialogue. This activity is therefore important: to role-play a public discourse with a wide participation of relevant stakeholders.

Activity 10 — Composting

STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Life Sciences (Biology), Earth Sciences (Geology), Physical Science (Chemistry)
ESD TOOLS	experiments (constructivism approach), bibliographic research, physical models

Info Tips on successful composting

- Cut grass is rather humid and may cause anaerobic fermentation, leading to undesirable odours. It is advised to let it dry a little, before adding it to the compost heap.

- The smaller the particles of the materials added to the heap, the faster the process will be. For big gardens, it is advised to use a shredder to make use of all the pruning materials.

- Avoid adding to the heap materials that tend to form compact unities (like ashes, or saw dust) before mixing them with materials in bigger particles, so as to hinder clustering.

- If the pile gets too moist, add some 'brown' materials to absorb extra water. If it is too dry, spray with some water.

- If the pile gives an ammonia-like odour, there is lack of carbon: add 'brown' materials to the pile.

- Once the composting heap is in 'full operation' the temperature inside the pile should reach 50˚C-60˚C. Once this starts to drop, mix the pile bringing material from the outside towards the centre of the pile. It is advised not to add new material at this stage. If necessary, make a new pile.

- If the pile is not warm enough, this may be a result either of its small size (add composting material); or of lack of moisture (spray with water); or of deficient aeration (mix the pile well), or of lack of nitrogen (add 'green' materials).

- The resulting product (after maturation) should be used at once in pots or on ground, because if it is left exposed it will gradually lose its nitrogen. In any case do not leave it exposed to rain and sun.

- The resulting product may be used also as 'yeast' for another pile, because it is rich in microorganism content.

Students may have fun trying to allocate the following materials in the **YES** and **NO** categories of their compost heap.

YES (desirable)	NO (Undesirable)
Peelings of bananas, water melons and melons (cut in small pieces)	Peelings of citrus fruits (oranges, lemons, grape fruits...)
Stale bread (crumbs)	Eucalyptus leaves
Cereals	Fig tree leaves
Seaweed (only after proper washing)	Pine tree leaves (or up to 10%)
Flour	"Novopan"
Rice	Illustrated paper (of magazines, etc.)
Hair	Meat and animal products
Tobacco	Dairy products
Olive pits	Oil
Shells of dried fruits	Plastic - metal - glass
Wood ash (It may be added to grass because it absorbs humidity; yet, better in small quantities because it is highly alkaline.)	Lime (it kills the decomposing micro organisms)
Wild herbs (before they get seeds)	Sick parts of plants
Manure (in small quantities, only from vegetative animals, contains lot of nitrogen as well as decomposing organisms)	Dog or cat excrements, or manure from carnivorous animals.

Info Tips on activities B and C

▮ When the weather is cold and not sunny enough, the daisy planted in normal soil acquires yellowish leaves after approximately 8 days and its colour becomes light green. Meanwhile, the daisy planted in normal soil mixed with compost, acquires a light green colour and some of its leaves start to turn yellow.
▮ When the weather is warmer, the daisies go dry in a shorter time.
▮ There is no need to let the daisies up completely to prove that compost retains more water than the normal soil. After the appearance of the first yellowish leaves, pupils should water the daisies to avoid their withering.

The lentil seeds are planted as follows:

▮ The seeds should be planted at small depth (2-5cm). Use fingers to push each seed in to the soil and spread a little more soil on top.
▮ When watering the flowerpots, it is important not to uncover the lentil seeds. If this happens, the seeds must again be pushed into the soil.
▮ The experiment should be completed after 3 to 4 weeks.
▮ At the time when after two successive measurements, the same number of lentil sprouts is counted, there is no need to continue.
▮ More seeds will sprout in the compost than in the normal soil since the former retains more humidity and contains more nutrients.

Activity 11 — The decomposition of materials

STUDENTS' AGE > 11 yrs

SUBJECT AREAS Physical Sciences (Chemistry), Life Sciences (Biology), Earth Science (Geology)

ESD TOOLS experiments (constructivism approach), bibliographic research

Activity 12 — Adopt a stream...

STUDENTS' AGE > 11 yrs

SUBJECT AREAS Life Sciences (Biology), Physical Sciences (Chemistry), Social Sciences

ESD TOOLS problem solving, exploiting maps, moving outside the classroom, group work, writing letters, organising an awareness campaign , addressing self-efficacy, performing citizenship actions

Activity 13 — Waste issues in the Press

STUDENTS' AGE > 13 yrs

SUBJECT AREAS Language, Social Sciences, Life Sciences (Ecology)

ESD TOOLS surveys, group work, news item analysis, writing press releases, panel discussions and debates, performing citizenship actions

Activity 14 — Where does construction and demolition waste end up?

STUDENTS' AGE > 13 yrs

SUBJECT AREAS Physical Science, Earth Science (Geology), Economics

ESD TOOLS moving outside the classroom, bibliographic research, group work, addressing self-efficacy, performing citizenship actions, raising awareness

Activity 15 — Using and "abusing" electric and electronic appliances

STUDENTS' AGE > 13 yrs

SUBJECT AREAS Social Sciences, Home Economics, Mathematics, Physical Sciences (Chemistry)

ESD TOOLS moving outside the classroom, group work, survey, bibliographic research, addressing self-efficacy, values within education, values within ESD

Activity 16	What happens to old cars?
STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Earth Sciences (Geology), Physical Sciences (Physics, Chemistry), Home Economics, Economics, Technology
ESD TOOLS	moving outside the classroom, survey with questionnaire / interview, making oral presentations

Activity 17	Recycling
STUDENTS' AGE	> 13 yrs
SUBJECT AREAS	Physical Sciences (Chemistry), Life Sciences (Biology), Home Economics, Technology, Arts
ESD TOOLS	brainstorming, teaching through objects, group work, concept mapping, performing citizenship actions, organising an awareness campaign

Activity 18	Making paper...
STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Physical Sciences (Chemistry), Life Sciences (Biology), Home Economics, Technology, Arts
ESD TOOLS	demonstration experiments, moving outside the classroom, organising an awareness campaign

Activity 19	The life-cycle of materials
STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Physical Sciences (Physics, Chemistry), Life Sciences (Biology), Earth Science (Geology, Geography), Home Economics, Technology, Mathematics, Arts
ESD TOOLS	group work, concept mapping, surveys, theatrical plays, organising an awareness campaign

Activity 20	What is left...
STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Physical Sciences (Physics, Chemistry), Home Economics, Social Sciences
ESD TOOLS	experiments, discussion techniques, debates and panel discussions, addressing self-efficacy

Activity 21 — Composite packaging

STUDENTS' AGE	> 13 yrs
SUBJECT AREAS	Physical Sciences (Chemistry), Technology, Home Economics
ESD TOOLS	demonstration experiments, discussion techniques, concept mapping

Activity 22 — What do we pay for packaging?

STUDENTS' AGE	> 13 yrs
SUBJECT AREAS	Mathematics, Home Economics, Social Sciences
ESD TOOLS	group work, experiments, moving outside the classroom, surveys, addressing self-efficacy

Tips on the activity

The activity may be carried out by groups of 2 to 3 learners. The availability of materials will determine whether they will deal with all the types of packaging described in the experiment or with only some of them. During the experiment learners should be encouraged to exchange packaging containers as much as possible so that they become acquainted with a greater variety of packaging types.

Activity 23 — Investigating our consumption habits

STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Home Economics, Literature, Social Sciences
ESD TOOLS	group discussion, moving outside the classroom, questionnaire surveys, addressing self-efficacy, values within education, values within ESD

Inset 1 — Trash-Art

STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Arts
ESD TOOLS	brainstorming, values within education, values within ESD, addressing self-efficacy, performing citizenship actions, organising an awareness campaign

Inset 2	What is the pH of a battery?

STUDENTS' AGE	> 12 yrs
SUBJECT AREAS	Physical Sciences (Chemistry), Life Sciences (Biology), Geography
ESD TOOLS	demonstration experiments, discussion techniques

Info Tips on the activity

The experiment may be implemented by older students, who have been taught the concept of 'pH', or as demonstration activity for younger ones. Students should be very careful when handling battery fluids. To limit the risks, it is recommended that the teacher empties the car battery and fills it with an H_2SO_4 1M solution. The concentration of H_2SO_4 in car batteries ranges between 2M and 6M!

In the case that no old car battery is available, a H_2SO_4 2M solution can be prepared by a dense H_2SO_4 (Use dense solution of 96% w/w and 1,84g/ml density. For the preparation of 200mL of H_2SO_4 2M, mix 178ml water with 22ml of dense H2SO4 solution in a beaker).

Remember that the dilution of the dense H_2SO_4 solution is a highly exothermic reaction! Therefore you should first pour the water into the beaker and then add the dense H_2SO_4 solution progressively!

Students can take a small quantity of H_2SO_4 2M solution with a dropper, and pour some drops on a pH-measuring paper to calculate the solution's pH. Instead of a dropper, a glass stick can be used as well.

Acronyms

AAAS	American Association for the Advancement of Science
DESD	Decade of Education for Sustainable Development
EE	Environmental Education
EIA	Environmental Impact Assessment
ESD	Education for Sustainable Development
EU	European Union
ICT	Information & Communication Technologies
LoC	Locus of Control
MDG	Millennium Development Goals
MSL	Middle School Learner
MSSD	Mediterranean Strategy for Sustainable Development
NGO	Non Governmental Organization
SD	Sustainable Development
SMART	Specific - Measurable - Audience - Relevant - Time-bound (referring to objectives)
UN	United Nations
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific & Cultural Organisation
UNECE	United Nations Economic Commission for Europe

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Annex

Behaviour change models[1]

Motivating people to adopt a more environmentally friendly lifestyle has traditionally been the focus of EE and ESD. The outdated notion is that by increasing learners' knowledge on a topic, an educator could change their attitude towards this topic, thus create the desired behaviour change. Today's practitioners of EE and ESD recognize that changing behaviour is far more complex even if knowledge and attitude are important factors (variables) in this process.

Today there are three prevailing models depicting the factors that need to be addressed when seeking to change behaviour through an intervention and these are schematically presented in the diagrammes that follow. Variables repeatedly found in these models include knowledge, attitudes, perceived competence (self-efficacy), locus of control (LoC), and intention.

Variables / precursors to behaviour change

Attitudes: people with more positive attitudes are more likely to report engaging in environmentally responsible behaviours than those displaying less positive attitudes (Hines et al. 1987). The researchers identified two types of attitudes: attitudes toward ecology and the environment as a whole and attitudes toward taking environmental action (e.g. recycling, conserving energy, etc.). (Read more on attitudes in paragraph 3.9. table 15 and in paragraph 3.16 table 19)

Knowledge: as with attitudes, although knowledge is necessary, simply providing the facts will not lead to great changes in behaviour (Hines et al., 1987). Two types of knowledge have been identified: declarative knowledge (knowledge of issues) and procedural knowledge (knowledge of action strategies).

Logically, for people to act on their concerns, declarative knowledge is often not sufficient; people also need to understand how to proceed or obtain the necessary skills to do so: Therefore providing both types of knowledge is necessary for changes in behaviour to occur.

Self-efficacy: People tend to seek out situations where they can use their knowledge and, by doing so, make a difference. Correspondingly, they avoid situations where they feel they have insufficient information to guide their behaviour and where there is a risk of looking foolish, helpless, or ignorant. (Read more on self-efficacy in paragraph 2.3 and 3.17).

Locus of control: People with a strong internal LoC would be expected to take action more readily than those who feel that the power to affect change is out of their hands (external LoC). (Read more on LoC in paragraph 2.3).

Intent is one more factor suggested to affect, or even predict, behaviour. Before an individual will deliberately take action, that individual must have the intent to take it (Ajzen, 1991).

Other variables that can affect behaviour change interventions are the interest of participants to the theme of the intervention and the type of environment in which the intervention takes place (whether it is supporting or not, etc.).

DIAGRAMME A: Hines, Hungerford & Tomera's proposed model of responsible environmental behaviour, published in 1987.

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1. Adapted from Dotzour et al., "Crossing the Bog of Habits: An evaluation of an exhibit's effectiveness in promoting environmentally responsible behaviours", 2002.

DIAGRAMME B: Hungerford & Volk's behaviour flow chart, published in 1990.

Entry Level Variables	Ownership Variables	Empowerment Variables	Citizenship behavior

| **Major Variable**
Environmental Sensitivity | **Major Variables**
In-depth knowledge about issues
Personal investment in issues and the environment | **Major Variables**
Knowledge of and skill in using environmental action strategies
Locus of control
Intention to act | |
| **Minor Variables**
Knowledge of ecology
Androgyny
Attitudes toward pollution, technology and economics | **Minor Variables**
Knowledge of consequences of behavior (both positive and negative)
A personal commitment to issue resolution | **Minor Variables**
In-depth knowledge about issues | |

DIAGRAMME C: Ajzen's model of Theory of Planned Behaviour, published in 1991.

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