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An Integrated Approach to Environmental Education and Research: A Case Study*

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Industrial processes have different levels of impact on the environment and there is a need to foster knowledge of the environmental consequences of industrial activities. One of the ways of achieving this is by the application of the concepts of industrial ecology (a multidisciplinary research approach) to industry's day-to-day activities. Another possible way of pursuing this goal is to use environmental education as a tool for increasing awareness with regard to the social, political and economic relevance of, as well as the need for, environmentally sound industrial methods. Technical universities in the Baltic Sea region, under the framework of the BALTECH consortium, have decided to develop and implement a new MSc Programme in Environmental Management and Cleaner Production, based on an integrated approach to industrial ecology towards current and long term/strategic environmental goals. The programme focuses on technologies and concepts in environmental planning and management for sustainable industrial development. The programme began at Kaunas University of Technology in September 2002. The Institute of Environmental Engineering (APINI), which is the main organisation responsible for the Environmental Management and Cleaner Production MSc programme in Kaunas University of Technology, treats the multidisciplinary approach as the main priority in the design of curricular models and views it as a strategic device in training graduates who will succeed in the labour market. This paper outlines a new educational model that provides students with both a systemic perspective and a more technical attitude for handling environmental multidimensionality.

Keywords: curriculum development; environmental knowledge; awareness and actions; sustainable development; multidisciplinary research

INTRODUCTION

POLITICAL CHANGES AND INDUSTRIAL DEVELOPMENT in the twentieth century brought many social and economic benefits to the people of Lithuania. However, these changes have also caused a range of environmental problems. Overcoming these problems depends on collaboration between research organisations and governmental institutions to find scientific, technological, legislative and economic solutions. Many of these solutions also depend on the availability and quality of relevant education programmes.

Indeed, the international community is in agreement that education has an enormously important role to play in educating and motivating citizens to participate in environmental improvement and protection. In the last decade, major international reports have stressed that education is 'the greatest resource' in this endeavour. *The Brundtland Report of the World Commission on Environment and Development* (1987), *Caring for the Earth: A Strategy for Sustainable Living* (prepared as the World Conservation Strategy for the 1990s) (1991), and *Agenda 21* (the Report of the United Nations Conference on Environment and Development in Rio de Janeiro, 1992) stress that it is possible to sustain cultures and redress environmental decline without jeopardising the ecosystem or resource base for the future. The reports accentuate the imperative of education in striving towards this goal [1].

In Lithuania, education has also been identified as a critical factor and the country has adopted a range of strategies to implement programmes in environmental education. Many training programmes for industry, governmental institutions and NGOs have been organised. Significant work is taking place in the incorporation of concepts of sustainable development in university curricula.

As international experience shows, the development of educational programmes based upon these principles poses problems for many lecturers, especially those who work in formal, centrally organised education systems. In the Work Group Meeting of the Baltic Sea Region Technical Universities Consortium (BALTECH), the following was stated [2]:

> The curriculum goals of environmental education overlap with, but also differ quite markedly from other more familiar components in the university curriculum. Environmental education in its fullness involves very major changes in the ways lecturers conceive of, and act in their lectures. There are many ways lecturers can contribute to education for the environment that involve smaller, but significant

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changes of thought and action. Conceptual and real behavioural changes, however large or small, are not easy and lecturers are no different from others in not finding significant change easy.

Invitations to change, or to try innovatory teaching strategies are almost inevitably seen as 'additions' and hence requiring extra time and effort. The suggestion to innovate often comes as part of an external innovator's timetable and not at the point in the lecturers' lives when he or she is dissatisfied with their present practice, and hence are looking for alternatives to solve a problem they have personally identified. The uncertain outcomes of using alternative pedagogies are also more likely to be seen as a threat to the lecturer's authority and the stability of their students groups than as improving these relationships, as they may in fact do.

The rising popularity of the notion of sustainable development has increasingly provoked the need for operative rather than exclusively ideological insight into the background of environmental education concepts (i.e. practical, measurable and policy relevant).

On the grounds mentioned above, several relevant issues should be evaluated during environmental education curriculum development: the sharing of responsibility between all social actors and the fairness of ongoing environmental policy attitudes; the link between the consumer's and producer's perspectives; and the integration of scientific information into an effective policy decision-making process. From this point of view, environmental academic education has—at least in principle—a major responsibility of promoting the role of scientific knowledge within both the public and private sectors.

Yet, as suggested by the Arrow–Fisher theorem (Arrow and Fisher, 1974; Arrow, 1979) [3], dealing with uncertainty in technology and resources dynamics is not an easy task for scientists or analysts, and efforts have to be rooted in the educational process. Conceptualising this stance in the academic world means producing students who are able to have a dialogue with experts in different environmental sciences as well as with managers and decision-makers. In other words, the students will have to deal with the critical social actors on the political and economic stages. In this sense, the creation of a network of teachers and trainers is a necessary tool for sharing experiences, discussions, and reflecting on successes and failures [4].

After analysing the barriers to sustainable industrial development it can be stressed that one of the main reasons that managers fail to achieve effective implementation of environmental improvement measures is the lack of relevant information from both public and private sectors. The competitiveness, technological innovations, international trade, and the economic viability of firms also cannot be neglected. Information about environmental dynamics and the relative sustainability of activities becomes a strategic tool. In this sense, environmentally-oriented universities, and consequently their graduates, are important resources in which to invest. They provide a scientific basis for understanding the size of the environmental problems, and the graduates can speak the language of the decision-makers. That is, the students not only know the basic models of company behaviour but also know the current environmental legislative requirements. They understand that environmental legislation directly influences the firms' short-term balance sheet and know that, in the long run, it indirectly drives investments and marketing strategies [5].

The analysis provided in this paper suggests that the environmental labour market needs graduates with a foundation in technical education to take on managerial roles. Environmental science education is viewed as a means of interaction between experts from different environmental branches and an integration of different scientific perspectives, rather than as a tool for dealing with specific technical tasks. In this paper, the significance of producing young professionals with a broad educational basis, which also includes the socio-economic disciplines, for the environmental labour sector is promoted, as opposed to training highly specialised people, whose skills can already be found in other more traditional scientific faculties (such as chemistry, geology, biology, physics).

ENVIRONMENTAL EDUCATION IN CURRICULUM OF KAUNAS UNIVERSITY OF TECHNOLOGY

The Baltic Sea region technical universities, under the framework of the BALTECH consortium, aimed to develop and implement a new MSc Programme in Environmental Management and Cleaner Production, based on an integrated approach to industrial ecology, looking at current and long term/strategic environmental issues, and focusing on technologies and concepts in environmental planning and management for sustainable industrial development. This is a two-year (120 ETCS Credits) programme suitable for graduates with qualifications in a variety of engineering fields, such as chemical engineering, mechanical engineering, civil engineering, environmental engineering among others. The programme began at Kaunas University of Technology in September 2002. As the results of admission analysis show (Fig. 1) the programme relatively quickly became popular with graduates from different Lithuanian universities and backgrounds.

A number of institutions participated in the development and implementation of the programme: the Technical University of Denmark (DTU), Denmark; Tallinn Technical University, Estonia; Helsinki University of Technology (HUT), Finland; Riga Technical University, Latvia; Kaunas University of Technology, Lithuania; Vilnius Gediminas Technical University, Lithuanian; KTH, Royal Institute of Technology, Stockholm, Sweden; International Institute for

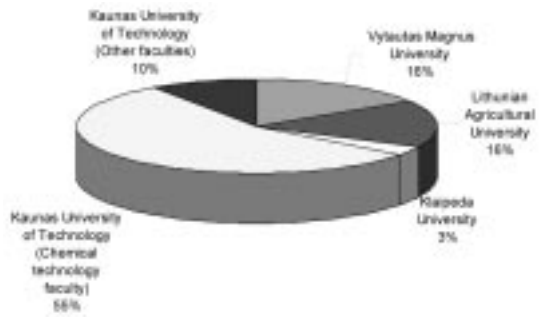

Fig. 1. Background of students in the MSc programme Cleaner Production and Environmental Management at Kaunas University of Technology.

Industrial Environmental Economics, Lund University, Sweden; and Linköping University, Linköping, Sweden.

During the curriculum development process, valuable information was gathered regarding employment opportunities, and the profile of environmental managers in industry, as well as in state and semi-state organisations. The results revealed that most environmental practitioners had a background in natural sciences or engineering, but there were also practitioners with other backgrounds. It was also established that each year approximately 30 employment opportunities become available in Lithuania; these included corporate environmental managers, environmental management consultants, environmental technicians, environmental auditors and environmental impact experts.

According to the results of the analysis performed and the future needs of the industry, the MSc programme, Environmental Management and Cleaner Production, was developed. Taking students with a technical background, the programme enables graduates to:

- integrate preventive managerial and technological tools in achieving a more sustainable development for industry and society;
- lead and sustain the process of change in industry, academia and other organisations;
- understand the interdependence of environmental, technical, economic and social sciences, and to perform interdisciplinary research and development.

This was achieved by providing the MSc students with:

- skills to identify and assess the effects of human activity on the environment;
- knowledge of national and international environmental policy and legislation and the management of environmental issues in industrial and service systems;
- knowledge of technical systems, strategies and technologies for applying the principles of cleaner production in developing products and production systems;
- practical experience in implementing preventive environmental measures. This point is extremely important in the education process, because students get the chance to develop a real project and very often participate in its implementation and monitoring processes.

A first year student under the supervision of a responsible lecturer, performs a CP audit, generates proposals, makes a feasibility study and presents the results to the company management. Very often such a project is approved by the company and further steps are taken—development of an investment proposal, project implementation and monitoring.

For example, in one Lithuanian textile company, MSc students together with the managerial staff of the company and the Cleaner Production group defined the main objectives of Cleaner Production assessment. The company was interested in saving all types of resources, especially heat energy resources in all production processes.

After the assessment, the following main environmental problems were determined:

- water was wasted in the acrylic yarn dyeing;
- there was inefficient consumption of water and energy.

The students produced seventeen CP proposals. For the practical development project, heat recovery from the waste water from the acrylic yarn dyeing for water heating was chosen.

Technical evaluation revealed that hot water from the yarn dyeing and washing processes was discharged to sewage and a large amount of heat was lost to the environment. Therefore it was suggested that the water be directed into a precipitation tank and pumped further along the piping system where it could be used for soft water heating.

The environmental benefits of the proposal were that heat was recovered from the waste water, giving a saving of approximately 670 Gcal/year of steam. This makes up 6% of the total steam consumption in the company.

The economic benefits were also calculated. Implementation of heat regeneration from the waste water from the yarn dyeing process required an investment of €6790, resulting in annual savings of €18 240 with a pay-back period of less than 5 months.

PROGRAMME STRUCTURE

The programme comprises the following core compulsory courses (35–45 ECTS cr): Environmental Technology; Environmental Assessment; Cleaner Production; Environmental Policy, Law and Economics; Environmental Management; and Eco-Design (see Fig. 2). These compulsory courses are developed and delivered with collaboration between the participating universities. Each of the participating universities is responsible for a particular course, but teachers and tutors from the

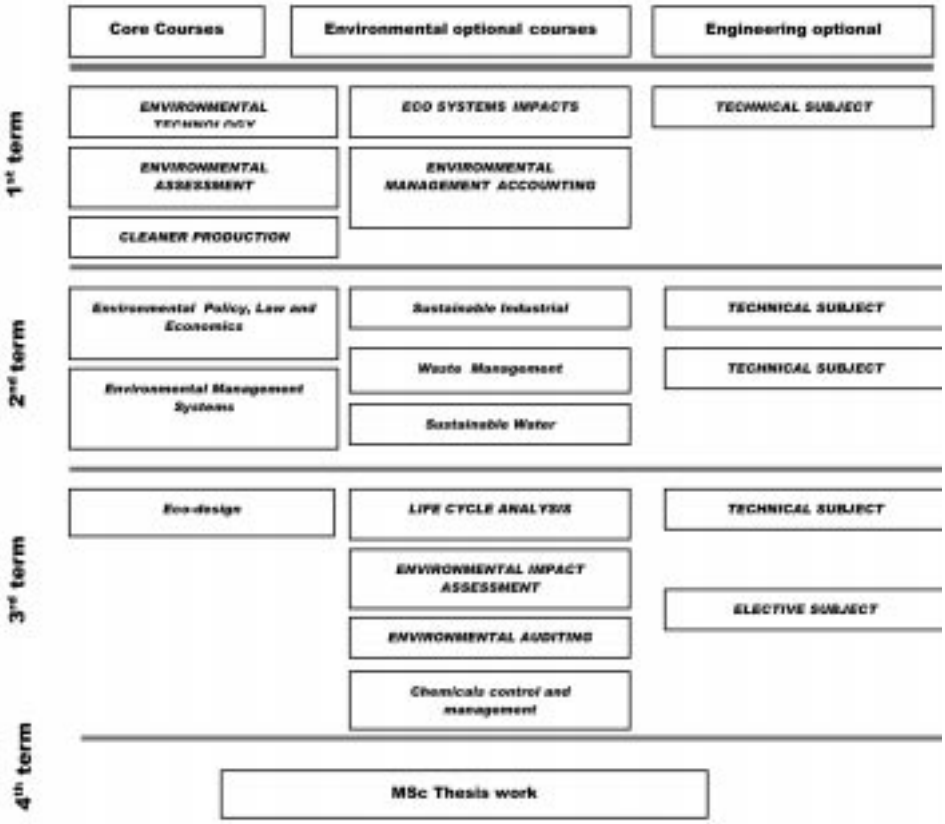

Fig. 2. Structure of the Kaunas University of Technology MSc programme in Environmental Management and Cleaner Production

other universities can have an input, and provide comments and recommendations. For each course there is at least one local tutor from the universities with participating students.

In addition to the compulsory core courses, the student takes a selection of optional courses (45–55 ETCS cr) in two different subject areas:

- advanced courses in environmental and related subjects;
- advanced courses in one engineering subject.

The contents of the programme are based on an industrial ecology approach, i.e. on industry–environment interactions to aid industry in evaluating and minimising impacts to the environment. The programme courses reflect one of the most important concepts of industrial ecology, which, like the biological system, is to avoid waste. The programme covers technologies for coping with industrial residues, particularly those technologies aimed at reuse and recycling of waste (course—Environmental Technologies); identifying, evaluating and implementing technical and managerial options for improving the environmental and economic performance of companies (courses—Environmental Assessment, Cleaner Production and Environmental Management); designing industrial processes and products from the dual perspectives of product competitiveness and environmental impact (Eco-design), and developing policy framework, that provides appropriate incentives for enterprises to adopt preventive environmental management practices and to increase their efficiency (course—Environmental Policy, Law and Economics). Therefore, the compulsory courses of the programme cover all the basic aspects of the industrial ecology approach. The optional courses are used to cover these issues in more detail and to provide additional knowledge that ensures that graduates of the programme will be able to apply this industrial ecology approach, i.e. will be capable of conducting a systematic analysis of industrial activities and finding optimal solutions for many of the problems related to sustainable industrial development.

In education, it is very important to combine expert and educational skills in lectures, i.e. ensuring this combination enables the lecturer to incorporate well-chosen examples and case study analysis into the teaching process. The Institute of Environmental Engineering Kaunas, University of Technology (APINI), which is the main organisation responsible for the MSc programme in Kaunas University of Technology, treats the multidisciplinary approach as the main priority in the design of curricular models and it is viewed as a strategic device for graduates to succeed in the labour market. To this end, APINI researchers became lecturers—experts in the main MSc programme courses. In the courses, their cognitive skills, in particular their abilities to define and recognise relevant problems, are fully utilised.

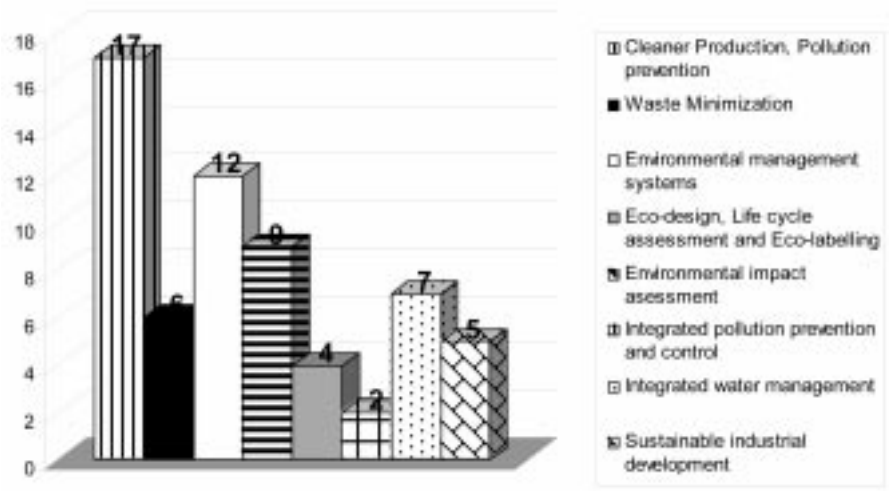

Fig. 3. Participation of APINI lecturers in international projects whose results are used in environmental education and research [6].

Table 1. Implementation of CP in Lithuanian industry

Industry sector	Number of enterprises	Number of CP options analysed	Number of implemented CP measures	CP investments, (€)	Savings from implemented CP measures, €/year
Textile industry	14	42	39	2 734 000	2 474 000
Food industry	13	27	25	2 027 000	1 365 000
Chemical industry	6	15	14	435 000	493 000
Machinery production	5	5	5	1 033 000	389 000
Production of radio, TV and telecommunication equipment	2	6	6	1 478 000	613 000
Furniture production	6	10	10	1 030 000	421 000
Wood industry	3	6	6	1 431 000	1 067 000

Since 1993, APINI lecturers participated in different international projects on waste minimisation, pollution prevention, cleaner production, environmental management systems (EMS), eco-design and eco-labelling, environmental impact assessment, integrated pollution prevention and control (IPPC) directive implementation, integrated water management and sustainable development (Fig. 3).

The main focus of cleaner production project development was to reduce energy and water consumption. In terms of types of innovation, most of the investments have been used for process optimisation and technology change. Detailed information about cleaner production (CP) activities in selected industry sectors is given in Table 1.

Results from implemented CP innovations are summarised in the Table 2.

The experience gained in the international projects and the projects implemented in Lithuanian industry provided APINI lecturers with the possibility of 'breaking' the boundaries of formal teaching, i.e. making progressive changes, focusing on a much broader area, including industrial activities. Another problem addressed the sustainable use of natural resources, because to teach students how to make intelligent decisions about the use and management of natural resources is the best insurance for sustaining the production of goods and services, while protecting the natural resources on which the world depends. By integrating education, research and practical training, students can learn more about the relationships between natural resources, environmental sustainability and human well-being [7].

The integration of theory and practice leads to achieving the key objective of the curriculum in environmental education—to prepare students for practical work and to open the possibility for

Table 2. Results from implemented CP innovations

Number of companies	126
Number of implemented CP innovations	211
Environmental results (yearly):	
El. Energy consumption reduced	27 584 000 kWh
Heat Energy consumption reduced	60 518 000 kWh
Waste amount reduced	86 700 t
Chemicals consumption reduced	850 t
Air emission reduced	79 500 t
Drinking water consumption reduced	297 500 m^3
Diesel consumption reduced	387 000 l
Natural gas consumption reduced	5 883 000 m^3
Fuel consumption reduced	656 800 t
Wastewater amount reduced	622 500 m^3
Industrial water consumption reduced	468 900 m^3
Economic profit:	
Total investment in CP innovations	16 529 000 €
Yearly savings from CP innovations	9 605 000 €

Fig. 4. Structure of the category system for the qualification profile of an environmental management and cleaner production MSc programme student represented as a hierarchical tree.

qualified research. Therefore, the following main categories have been combined (Fig. 4):

- general abilities,
- scientific knowledge; and
- environmental problem-solving ability.

Three years' experience of the MSc programme showed that the students trained in accordance with this model of integration of education and research:

- learned to operate within the environmental area outside of the university in a problem-oriented way;
- obtained knowledge about the political, legal, economical and social factors and constraints (e.g. limited financial means, conflicts of interests), under which solutions are developed in the environmental area;
- gained experience of the problems that occur when they apply their knowledge in practice (e.g. decision-making on the basis of limited or insecure information, inaccuracies of data).

Therefore, in the MSc programme, the transition towards this new structure led to an educational model that provides students with both a systemic perspective and a more technical attitude for handling environmental multidimensionality [8].

For example, in the course on environmental economics, the main aspects of micro- and macroeconomics as well as some fundamental issues of neo-classical environmental economics are reviewed (e.g. valuing non-market goods, managing environmental pollution, renewable and non renewable resources). Other courses focus on the relationships between the environment and enterprises, and cover tools such as environmental accounting, eco-labelling, eco-auditing.

The programme resulted in the following benefits.

1. It provided a broad perspective for considering environmental issues and understanding the context of environmental and sustainability problems and gave a wide range of actions (Fig. 5).

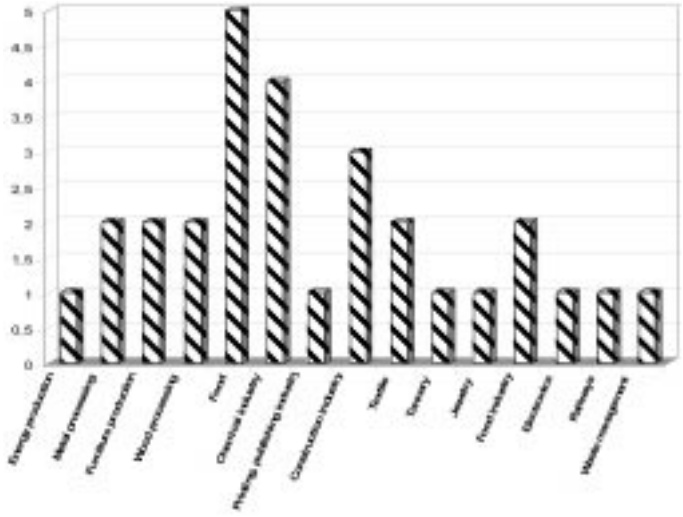

Fig. 5. Real CP projects developed by MSc students in the Cleaner Production and Environmental Management programme at Kaunas University of Technology.

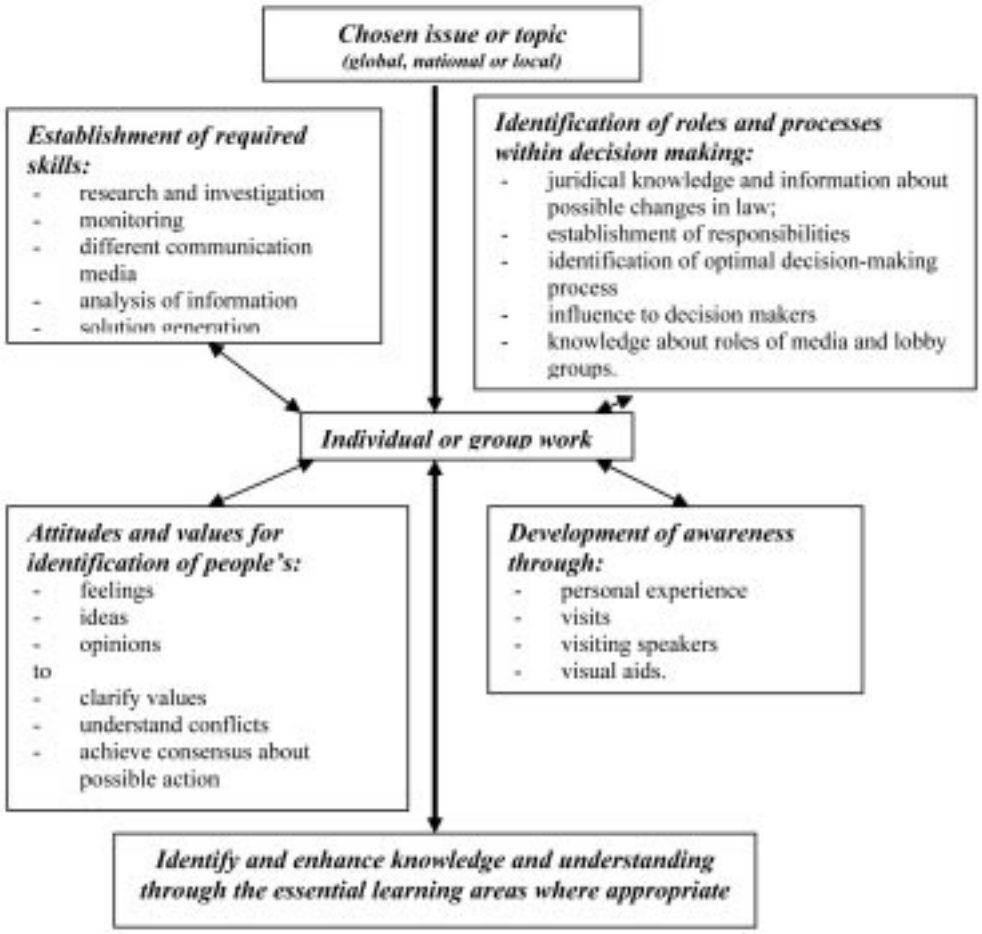

Fig. 6. Action-oriented approach to environmental education.

2. The advantages of a multidisciplinary approach were considered in the programme: the class debates and development of new ideas originated from the multi-focused views and were enriched by real data and case studies.
3. In addition to teaching, there were considerable research efforts—confronting new research fields that are worth deeper analysis to understand the context of environmental, social and economic interconnections.

Bringing together these aspects fosters greater interaction between industry and academic institutions.

Currently, Lithuania is facing a large environmental challenge: the EU accession process required a harmonisation of laws; this refers to both environmental legislation and enforcement. Industrial sectors may have different environmental problems, but the need for better environmental performance, the need for preventive environmental protection and the need for self-regulation methods appear in all sectors and sub-sectors of the economy. To reach all these targets the ways of thinking must be radically changed. One of the cost efficient methods of changing attitudes is by education.

The success or failure of environmental education depends very much on the absence or presence of a multidisciplinary attitude spreading from the environmental sciences to the socio-economic disciplines. Results from the survey carried out by the authors confirm the importance of such a management paradigm in educating environmental specialists and suggests that the academic world should continue with this approach. A greater emphasis on technical education could help environmental science graduates to become more competitive with graduates from other disciplines (Fig. 6).

BENEFITS GAINED FROM INTEGRATION OF RESEARCH AND EDUCATION

Currently the aims of education are becoming more and more ambitious and integrate:

- *a holistic approach* (system approach, complexity, interrelatedness);
- *a multidisciplinary and integral perspective* (integrated into every discipline, with themes in common);

- *problem-solving and project-oriented teaching* (development of problem-solving capacity, outdoor projects);
- *the incorporation of ethics* (environmental values, environmental attitudes); and
- *a critical attitude* (attention to conflicts of interpretation in science, attention to conflicts of interest in society, equitable attention to North–South issues on the global scene).

According to the aims presented above, industrial ecology may be seen as a combination of a scientific field and a practical industrial sector, where environmentally sound processes may be tested and implemented. Environmental education is often seen as a process in which educational approaches and methods are introduced to raise environmental awareness. It focuses on the soil, water, air, plant and animal life, forests and other ecosystems. It also incorporates land-use planning, the concept of shared decision making, and the use of information systems. Environmental education also addresses renewable and non-renewable natural resource use in urban and rural settings. It involves people, communities, and organisations in experiences that apply appropriate technology to everyday problems. Reliance on scientific methods and principles enables educators to deliver objective information, even if issues are emotionally charged. This illustrates how complementary the two areas are and the usefulness of approaches aimed at their integration [9].

The goal of integration can be achieved in various ways, for example:

- via the design of projects where there is attention to research and education;
- via case studies in which multidisciplinary research is combined with educational approaches such as, for example, industry-based environmentally-focused training programmes;
- by means of individual work in which the development of analytical skills is combined with environmental problem-solving efforts;
- by developing competence among students in relation to environmental dialogues, so as to enable them to deal with industry and society;
- by integrating principles of environmental communication and information as part of the normal business practice in industry.

Comparison of the perspectives provided by multidisciplinary research and systems theory with some of the perspectives by environmental education shows a number of interesting similarities (Table 3) [10].

In addition, some further common features of multidisciplinary research and environmental education reside in the fact that both:

- are interdisciplinary: both areas cannot be effectively worked out without a body of knowledge from related fields such as ecology, economics, mathematics, sociology, etc.;
- are integrative: both areas try to encompass information deriving from different sources and from different fields, which they then assimilate and integrate as part of their own profile;
- focus on sustainability: no matter the angle from which one looks, in both areas, their ultimate focus is the search for ways through which sustainability may be pursued;
- are participatory: the research and environmental education rely on the active input of individuals in pursuing their goals and aims and in their participation in influencing ever-changing scenarios.

Last but not least, both are continuously going through a process of change. Such a change, albeit not always dramatic, is indeed a common element of both areas and enables them to evolve within society, as society itself is going through its own changes.

In addition, the areas where the different approaches are mutually complementary may include four main domains: the views adopted, the objectives, the approach used and their target groups. Let us look at each item in turn [11].

1. *The views adopted*: Multidisciplinary research looks at things from a critical, systemic perspective, angles that environmental education tends to ignore. On the other hand, environmental education sees environmental matters as globally interconnected, with a combined input to the understanding of nature.

Table 3. Perspectives in multidisciplinary research, systems theory and environmental education

Multidisciplinary research, systems theory	Environmental education
• focuses on long-term approaches • focuses on concerns of regional and global scope	• is a long-term process and entails long-term results • its concerns encompass local, as well as regional and global issues
• focus on cases where human activities overwhelm natural systems • attempts to understand and protect the resilience of natural and human systems	• it has a preventive as well as a curative dimension, also trying to prevent ecosystems from being overwhelmed • focuses on raising awareness and motivation towards environmental protection, focusing on the role of humans
• uses systems techniques as mass-flow analysis to understand economic and environmental systems	• uses role-play, scenery building and hands-on approaches to help in understanding environmental issues and problems
• views economic production agents as central to mitigating environmental impacts and seeks to understand how to make them more environmentally friendly	• sees economic phenomena and political and social contexts as influencing environmental dynamics and seeks to integrate them in the environmental problem-solving process

2. *The objectives*: Strictly speaking, a main concern of multidisciplinary research is the integration of environmental considerations into industrial activity, paying attention to economic aspects. Environmental education seeks to foster awareness on environmental matters and, as a result, catalyse active participation in environmental action.
3. *The approach used*: Multidisciplinary research works intensively via incremental improvements in environmental management with a view to improving the efficiency of industrial activities. Environmental education, in its turn, tries to develop a sense of commitment towards the environment and prevent the exacerbation of environmental problems by working at the conscience level.
4. *Target groups*: Multidisciplinary research will primarily focus on those whose activities are directly related to industrial practice, while environmental education—be it performed in formal or informal teaching—aims at all individuals since it works on the assumption that every person has an impact on the environment.

Multidisciplinary research and environmental education may also be integrated by focusing on issues of global concern, but they need to do that, not from their separate industrial or merely pedagogical angles as has largely been the case so far, but in integrated way [12].

DISCUSSION

A diverse range of publications, including conference proceedings, edited collections of articles and journals, now contain reports on studies that have sought to advance sustainable development in the curriculum and operations of higher education organisations. These studies generally focus on one or more of the ecological, economic, equity or political pillars of sustainable development [13].

The researchers who conduct such studies may not necessarily relate their research to the goals of sustainable development, because many scholars outside the mainstream environmental field do not yet recognise the significance of sustainable development for their research. The higher education sustainability movement is relatively new and has not yet been able to reach out to all scholars and university managers. It may also be that many, if not most, advocates of sustainability in higher education have tended to come from the fields of environmental studies, education, and facilities management and, thus, have tended to concentrate on the economic and ecological pillars of sustainability, and have not often seen the relevance of sociological, political science and cultural studies research to their goals [12].

Consequently, much research on sustainability in higher education does not address the pillars of sustainability in a holistic, interdependent and systemic way. This is a key problem that attention to alternative paradigms of research may help to redress. It may also help redress several related problems that characterise much of the current research in this area.

Research funds are always limited and research policies increasingly tend to fund single-purpose, short-term studies, often with a strictly problem-solving approach and targeted objectives. The supreme role of research, namely the advancement of knowledge, and thus the transfer of this knowledge advancement, is often overlooked or forgotten. Therefore, the Institute of Environmental Engineering, Kaunas University of Technology is emphasising the dictum 'research and education always go together' and seeks the promotion and improvement of transfer efforts and mechanisms.

However, sustainable development is not a pure technological problem; engineers must learn to be receptive to non-technical issues, and must be able to communicate with the people involved and other experts. The world needs engaged engineers who are willing and able to contribute to sustainable development.

CONCLUSIONS

As the 21st century begins, the world's attention is focused on how to make sure that the environment and natural resources are sustainably used. Global trends and concerns are often expressed through community level actions. However, policy makers and industrialists in urban and rural communities are the ones who are making the most decisions about the use of energy and other resources, which, if not carefully exploited, invariably leads to problems such as overflowing landfills, poor air quality or polluted rivers, etc.

Industrialists and educators want to protect wildlife habitats and open spaces; they want to understand global change and to address dozens of other environmental questions. They can do this better by changing the ways in which environmental issues are usually handled.

Policy makers' actions, resulting from thousands of decisions, collectively influence the sustainability of our natural resources and our environment. Making intelligent decisions about environmental issues is critical, but it is not always easy. The amount of environmental information available is astounding and includes both fact and fiction. Some experts tend to emphasise the tangible benefits to society through harvesting natural resources. Other sources may highlight environmental health as the only relevant consideration for natural resource management decisions. The most accessible information may not be the most useful and the job of searching for particular knowledge may be overwhelming. Teaching people how to make intelligent decisions about the use and management of natural resources is

our best insurance for sustaining the production of goods and services, while protecting the natural resources on which we depend. There is a perceived need to help people to acquire the knowledge, skills, and tools they will need to make informed decisions about natural resources and the environment. This also applies to the industrial sector.

By integrating systems theory (research) with environmental education and other programmes, millions of people can learn more about the relationships between natural resources, environmental sustainability, and human well-being. This knowledge, accompanied by appropriate action, is necessary to maintain not only our natural resources, but also our way of life. Research and environmental education thus need to reach closer cooperation and more involvement in expanding their combined effect. With the support provided by these two areas, industrialists on the one hand and educators on the other, can do more than ever to help people understand—and act on—environmental concerns.

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