PROMOTING ECO-DESIGN IN SCHOOL

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Abstract: The paper gives an overview of the efforts made by the "Vasile Alecsandri" University of Bacau, Romania together with six European Universities to increase the students' awareness concerning the environment protection, by improving their engineering curricula with an eco-design module. These efforts were made in the frame of the project: "Eco-design: An innovative path towards sustainable development", developed with the financial support of the European Commission.

Keywords: education, eco-design; sustainable development;

1. INTRODUCTION

The problem of relation between humans and environment is not new. It once appeared with the first human communities, since human being, with the intelligence and creative spirit that define him, started with tenacity and courage to transform the nature according to his needs.

Until a certain moment, the natural balance has not suffered unless, maybe, on very small areas, which could not affect the whole. But with the Industrial Revolution, which provided mechanical power, invention of steam engine and many other machinery, greater use of metals, etc., the power of man increased inordinately, giving him opportunities to modify the environment and raise the average living standards everywhere. Unfortunately, the reverse of contemporary industrial civilization, of material progress, has been the environment worsening. Under the impact of economic development, soil, water and air have been polluted more or less seriously, different species of plants and animals have disappeared or are endangered and human being is confronted, in turn, with various diseases caused by pollution, phenomenon that now encompasses all countries and continents. It was stated that within a decade, the civilization deviations have caused environmental damages greater than in a millennium. The environment has already been degraded to such an extent in certain areas that people are forced to migrate. They are facing scarcity of resources like food and energy. Currently, we spend far more environment than we have; a recent study developed by Global Footprint Network clearly demonstrates that in present times the population of Earth consume more than it naturally can provide us (in net terms, humanity has moved from using about half of the planet biocapacity in 1966, to over 1.5 time the biocapacity of the Earth in 2007 [1]).

Thus, we must reconceptualise how we live on this planet and we must do this as quickly as possible. We cannot afford the luxury of evolutionary thinking; ecological consciousness must become our first imperative to ensure a future for our planet. Terms like design for the environment, environmental product development, sustainable product development, eco-design, should become familiarly for each of us, not only for the specialists. Each of us should be ecologically literate by understanding how ecological systems works and by understanding that we

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are part of the environment, it is not something separate from us. This could be the most powerful solution to the current environmental problems and the best source of hope and confidence into a future healthy life. Environmental education is necessary to move from ignorance to appreciation, understanding, participation, action.

The aim of this paper is to give an overview of the efforts made by the "Vasile Alecsandri" University of Bacau together with other six universities from Romania and abroad to strength the ecological consciousness of their students - the future engineers and designers of society, by enriching their courses curricula with an eco-design module. The eco-design module was developed with the financial support of the European Commission in the frame of the curricula development project "Eco-design: an innovative path towards sustainable development".

2. PROJECT DESCRIPTION

2.1. Why eco-design?

Protection of the environment is one of the major challenges facing the world. With global ecosystems degrading at an ever increasing rate, calls for sustainable development, have become louder and more urgent. Integrating the concept of sustainability as well as environmental consideration into the product development process is the guiding idea of eco-design. The European Environmental Agency defines eco-design as "the integration of environmental aspects into the product development process, by balancing ecological and economic requirements. Eco-design considers environmental aspects at all stages of the product development process, striving for products which make the lowest possible environmental impact throughout the product life cycle" [2]. Therefore, eco-design means designing for a safer future. It is a tool in the hands of designers and engineers helping them to reach the goal of protecting the environment and forestalling further ecological damage. However, in order to attend this goal, they need information on the challenges and the options available for more sustainable patterns of production, consumption and development.

The main sources of education in ecological product design and design engineering are the technical universities. Design students have to learn how to integrate ecological aspects into the design process in order to create more environmentally friendly products. Besides, a design student should be trained as an opinion leader, meaning that he must be capable to stimulate desires. In other words, designers should do more than designing and making products - they should create the market demands. Designers should influence people, the customers of their products, to change their way of thinking and persuade them to join in this work of preserving and protection the environment. From this perspective, the role of ecological education in product design and design engineering is far more important.

2.2. Aim of the project

The aim of the project "Eco-design: An Innovative Path Towards Sustainable Development" was to improve and enrich the curriculum of Engineering courses, especially those from Industrial Design and Environmental Engineering specializations, in all the partner institutions, at bachelor level, by implementing into the current engineering curricula an European module of eco-design; this was an answer to the European demands for a sustainable development and, according to it, the needs of the labour market imposed to the engineers.

2.3. The partner universities

Starting from the principal that "multicultural education is most effective because diverse human mind encompasses numerous forms of intelligence" [3], the project was developed in an European partnership consisting of Technical University of Vienna – Austria, Technical University of Tallinn – Estonia, Technological Educational Institution of Athens – Greece, University of Brighton - United Kingdom and three Romanian universities: "Vasile Alecsandri" University of Bacau, "Petru Maior" University of Targu Mures and "Transilvania" University of Brasov.

3. DEVELOPMENT OF THE TEACHING AIDS

The Eco-design module was structured into four subjects, for which the teaching aids - books and CD-ROMs with supplementary information - were elaborated. The four subjects were: Eco-design: Fundamentals, Product Life Cycle Assessment, Product Recycling Technologies and Embedding Eco-Design in Product Development. Before starting the elaboration of the teaching aids, the partners agreed upon the necessity of introducing into the material content many examples and case studies, to facilitate students a better understanding of the eco-design principles and the possibilities for their application. Besides knowledge, we wanted to develop skills, to provide the students with a capacity of critical and independent judgement and with the ability to solve at a certain level the environmental problems.

3.1. Presentation of the books

3.1.1. Fundamentals [4]
The aim of "Fundamentals" was to introduce students into the world of eco-design. The book is structured in five chapters (Figure 1), divided into 14 lessons, corresponding to the 14 weeks of an academic semester from the Romanian universities.

The students are introduced in the terminology of the field, the life stages of a product and their environmental impact. The last chapter of the book informs students about the most important management aspects regarding the ecological development of products. Some case studies presented for each chapter of the book help to illustrate and explain the new theoretical knowledge that becomes in this way more accessible to the students.

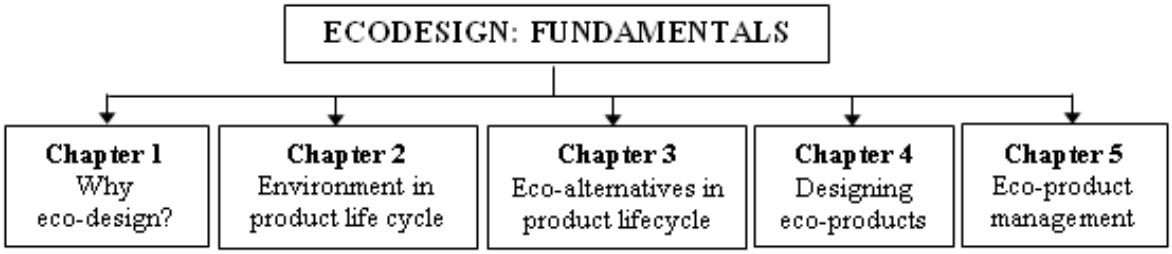

Fig. 1. Content of the "Fundamentals" book.

3.1.2. Product Life Cycle Assessment [5]
„Product Life Cycle Assessment", the second manual of the Eco-design module, is structured in 8 lessons (Figure 2). The book intends to improve students' knowledge regarding the product life cycle analysis and to present them some methods and tools to find more environmentally friendly design solutions for a product. During each lesson some case studies are presented and different exercises are suggested.

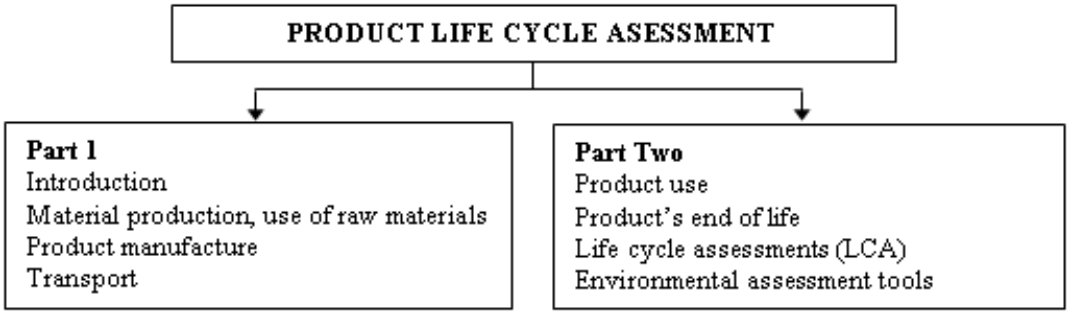

Fig. 2. Content of the "Product Life Cycle Assessment" book.

3.1.3. Product Recycling Technologies [6]
The book "Product Recycling Technologies" is structured in five chapters (Figure 3) divided in 14 lessons and is concentrated on the theoretical, legal and operational aspects concerning the products recycling process. At the

beginning of each lesson are presented the lesson objectives and at the end of the each lesson, some assessment questions or supplementary study reports are suggested.

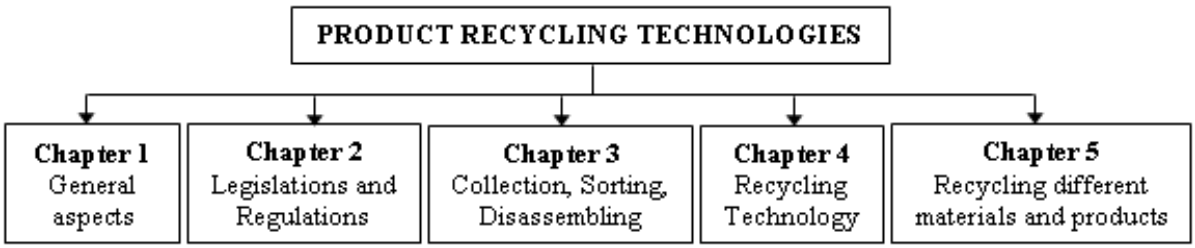

Fig. 3. Content of the "Product Recycling Technologies" book.

3.1.4. Product Development [7]

The forth book of the Eco-design module, "Product Development", represents a guide of how to analyze a product, considering its environmental impact and how to improve its design in order to be less harmful for the nature. This book presents also a very useful and easy to use software, Eco-design PILOT's Assistant, that was developed by the specialist from Technical University of Wien, in order to evaluate the environmental performance of products. The book is structured in 14 lessons (Figure 4).

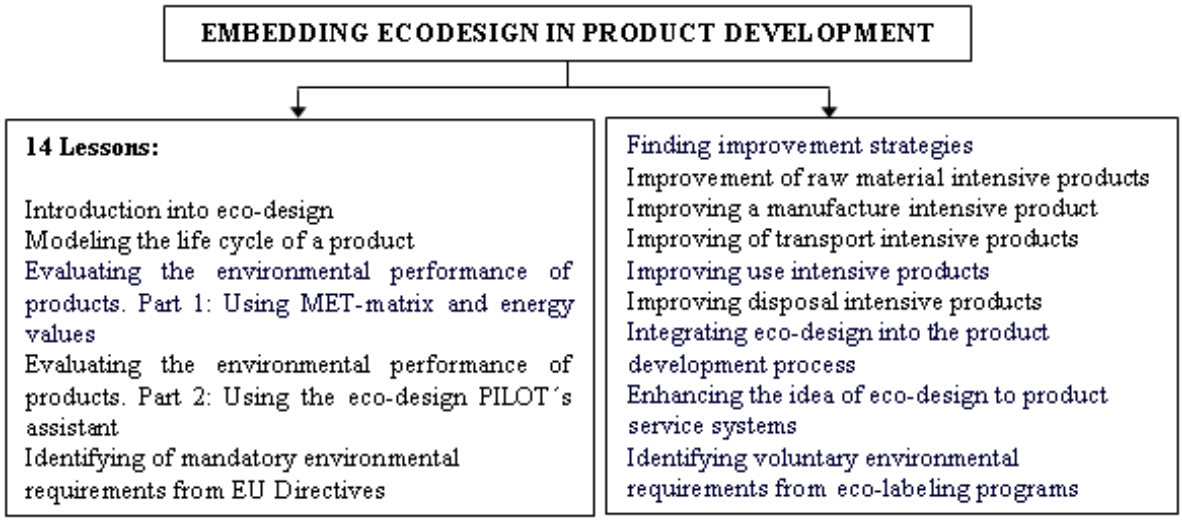

Fig. 4. Content of the "Embedding Eco-Design in Product Design" book.

4. IMPLEMENTATION OF THE ECO-DESIGN MODULE TO THE "VASILE ALECSANDRI" UNIVERSITY OF BACAU

At the "Vasile Alecsandri" University of Bacau, the four subjects treated in the project have been implemented into the teaching planes of four specializations of the Faculty of Engineering, as follows (Tables 1÷ 4):

Table 1. Eco-design: Fundamentals was included into the content of the following courses.

No.	COURSES	Specialization(s)/Year of study
1	General ecology	Environmental Engineering /II
2	Study of the ecological impact	Environmental Engineering /III
3	Environmental engineering	Industrial Design and /III Machine Building Technology/III
4	Eco-design	Industrial Design/IV

Table 2. Product life cycle assessment was included into the content of the following courses.

No.	COURSES	Specialization/Year of study
1	General ecology	Environmental Engineering /II
2	Study of the ecological impact	Environmental Engineering /III
3	Product life cycle	Industrial Design/III
4	Ecological materials	Environmental Engineering /III
5	Eco-design	Industrial Design /IV

Table 3. Product Recycling Technologies was included into the content of the following courses.

No.	COURSES	Specialization/Year of study
1	Equipments for waste recycling	Equipments for Industrial Processes/III
2	Waste management	Environmental Engineering /IV
3	Ecological materials	Environmental Engineering /IV
4	Eco-design	Industrial Design/IV
5	Study of the ecological impact	Environmental Engineering /III
6	General ecology	Environmental Engineering /II

Table 4. Embedding Eco-design in Product Development was included into the content of the following courses.

No.	COURSES	Specialization/Year of study
1	Study of the ecological impact	Engineering and Environmental protection /III
2	Product life cycle	Industrial Design /III
3	Eco-design	Industrial Design /IV
4	Ecological materials	Engineering and Environmental protection /IV

5. CONCLUSIONS

A group of three Romanian Universities decided to initiate a project that allows to improve the engineering curricula of their students towards a more life-cycle oriented approach, with the environmental aspects and working tools truly integrated.

In order to develop a module at European level, it was necessary to search an European partnership, considering the most experimented institutions and departments. Thus, another four European Universities were involved into the project and all together elaborated the teaching aids consisting in four books and CDs with supplementary information, guidelines and strategies for future designers and product developers on how to avoid or minimize the environmental impact of the products.

The project was a success from at least two points of view: the eco-design module was implemented into the curricula of all the seven partner universities, and in the mean time, very good relationships between universities were created or improved. Being an Erasmus Programme, the project facilitated the motilities, both of teachers and students, between universities, so the less experienced partners could learn from the institutions with large experience in the field of eco-design (Technical University of Wien and University of Brighton).

As concern our university, the feedback from students was very good. They found very interesting the information provided in these courses and have shown particular interest in applicative activities. Some students even decided to deepen the eco-design aspects by choosing for their graduation project a theme in this field. And what is more important, they have become more aware of the importance of protecting nature and conserve the resources and the beauty of our Planet.

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