Education For Sustainability - Experiences From Greece

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Abstract. One of the main issues involved is changing people’s attitudes, values, behavior and consumption patterns. University education in Greece aims to educate engineers so that besides acquiring theoretical knowledge, they also learn to show competences and are motivated to act accordingly. Educating for sustainable development also entails the development of critical capacities and the necessary skills to be able to identify and formulate problems. This paper outlines the way in which an approach to teaching sustainability has been embodied in the Industrial Design, West Macedonia Greece. More specifically, it describes a course to develop comprehensive case studies and support material in order to aid, Industrial Design students in understanding the sustainability concepts and how solutions can be developed.

1. Introduction

Sustainable Development, as defined by the Brundtland Commission in 1987, is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs according to the World Commission on Environment and Development [1]. In a sustainable society, environmental protection and economic objectives belong to a common framework. The President's Council on Sustainable Development's definition of sustainable development has been broadened to include social equity (United Nations Conference on Environment and Development [2] In a sustainable world, environmental protection, economic objectives, and social justice should be linked in harmony.

In Greece nowadays sustainable development is a big challenge to universities, although incentives and barriers for implementation of the curriculum are addressed. In this respect ‘sustainability’ had moved from being a discrete coverage of ‘environmental issues’ to embedding social, economic and environmental aspects of sustainability alongside other courses. Students should learn about and view sustainability as an integrated part of civil engineering education, not as an added extra; sustainability had become part of the mainstream curriculum. This paper aims at developing in the way in which an approach to teaching approach using role playing that has been embodied in the Industrial Design, West Macedonia Greece.

1.1. The Department of Industrial Design of TEI West Macedonia

The Department of Industrial Design is one of the two Divisions, Mechanical Engineering and Industrial Design, belongs to the School of Engineering of TEIWM. It is a large department with a significant record of exceptional teaching and research.
The structure of the curriculum of the Industrial Design degree program is such that graduates of the department develop integrated scientific and technical knowledge across the spectrum associated with the Industrial product design.

The philosophy of the whole program is based on the principle: Graduates are qualified and capable personnel who will staff the productive units, combining informatics, operations research and integrated design - development systems, would contribute effectively to economic growth. Industrial product design is one of the main characteristics of the graduate that maintains after completion of the course, preparing a thesis and six-month internship in the profession.

The course Product Design II and is taught in the 5th semester of the curriculum.

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

- Description of the level of learning outcomes for each qualification cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

Upon successful completion of the program, students will be able to:

1. Design products.
2. Use CAD systems in the process of designing products.
3. Solve problems arising during the process of designing a product.
4. Apply knowledge gained in courses in ergonomics, marketing, materials science and technology, manufacturing processes and cost analysis.
5. Analyze the relationship between cost and technical solutions.
6. Be creative in solving design problems.
7. Work as part of a designing team.
8. Write and present reports.

1.1.1 General Competences

Taking into consideration the general competencies that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim are:

Search for, analysis and synthesis of data and information, with the use of the necessary technology

- Adapting to new situations
- Decision-making
- Working independently
- Team work
- Working in an international environment
- Working in an interdisciplinary environment
- Production of new research ideas

Upon successful completion of the program, students have the basic theoretical and practical knowledge in the fields of the subject area of Industrial Design Engineering and the related profession and are able to properly apply the theoretical and practical knowledge acquired during the study period - be able to creatively implement the scientific knowledge and modern technology in understanding and solving problems in industrial Praxis, and to promote innovation in design and development of new products and services in Greece and internationally. Have gained the necessary competencies to proceed to their second cycle study.

1.1.2 The Framework for product design is

- Process design of new products.
- New Product Marketing Plan.
- Product life cycle.
- Product design and technology
1.2. Methodology - Innovation in teaching Industrial Design The Department of Industrial Design in TEI West Macedonia

Teaching communication skills to industrial design students is not always an easy task, however, it is one of the skill sets employers are increasingly looking for in graduates. When an industrial design course this year I wanted to use fun and innovative teaching methods to create a stand-out example course in keeping with the connected curriculum vision. [3]. New coursework components in which students were asked to make a role playing in small teams to explain a point of view themselves (seller buyer) was selected by each team. The report forwarded to the relevant lecturer to be included in the teaching material, to benefit future cohorts. As well as helping students to learn from participation rather than traditional teaching, they got the opportunity to practice teamwork, and unusually, to showcase their creativity.

1.3. Using Teamwork in a project based case study

Team work is a way to train the demands of work life of professionals, especially to learn how to communicate, to learn self-organization and to cooperate. From the other hand Project based case studies, simulation are useful to stimulate effective competences for solving problems, to provide a basis for lifelong learning and to increase the students’ motivation to learn.

2. Roles in the coursework

Characterisation of the role playing-an active role in designing the course where the students usually learn better than passively listening students, especially social competences, conflicting roles while lectures can be useful for developing complex technical knowledge – and it should be mixed with physical attendance

2.1 The role of the teacher

Teachers' role is changing from a broadcaster of knowledge to a coach that supports the students’ process of learning and transfers knowledge from practice to lecture halls

2.2 Role playing Description

The role playing is a synthetic view of the three dimensions of sustainability namely, economic, social and environmental.

Before playing, Students are required to work as a team for about a month and to retrieve information concerning a role in the project organization that selected and assigned to them... At the end of this preliminary phase, they have to hand a report assignment, which contains:

(i) Sustainable development issues,
(ii) A short review of the role that is related to sustainable development and the organization that has been assigned to them
(iii) A critical assessment of the information collected.

Studying a specific concept associated with sustainable development deepens the students’ knowledge around sustainable development issues. The document does not reflect the workload associated with the information gathering and analysis tasks. Instead, it only acts as a memo that has to be clear and concise. Such an exercise is designed both to develop the students’ synthesis skills, and to help them in the perspective of the role-play.

Before the role-play starts, the teacher prepares the classroom to materialize the three dimensions of sustainable development with chairs and stickers that are posted on the participants, acting as decision makers, have to prepare a five-minute speech emphasizing how their organization is addressing sustainable development issues and including the related concept that they have previously selected.
The teacher does not intervene at all except to make sure that the time limits are respected. The last sequence of the session is devoted to debriefing. The teacher asks the students to wrap up what they have learned about the concept of sustainable development as well as its related concepts. (S) he makes sure that what the students' state is correct, and stresses important issues.

3. An example –Production of a Sustainable –Green Product -Case Studies

The Case Study is the production of several industrial design green products. The agents stakeholders involved are:
• Government
• Supervision departments
• Design companies, suppliers,
• Users
• Partners
• Contractors

The students are separated into interesting groups and are asked to describe their role as well the Project environment (organization) Objectives (points of view) in a report after a Relative team brainstorming. The objectives of the role playing where
• To accomplish the requirements of the project role descriptions;
• To establish a project team with high-level performance;
• To accumulate experience for following real life projects;

Most importantly the Project Team
• To increase job skills
• To get experience and broaden career opportunity

Reports were prepared in terms of Government to promote local economic development and to assure Quality meets the requirements of technical codes; through Government supervision departments to keep up with Related national regulations regarding fire prevention, safety, environmental protection, labor and health and other aspects should be avoided.

In terms of Local Government was To create new job opportunities; and to lift up city competitiveness.

In terms of the User Product quality should be eligible at a Reasonable price.
In terms of Designing Companies To get economic benefit; To obtain successful cases in terms of technology and design; To train and foster designing teams; and To establish strategic cooperative partners

In terms of Partners the aim was to implement and complete supervisor’s job within the agreed project term, to ascertain that Quality meets the requirements on design and Project investment should be controlled within the budget scope. To get economic benefit and Safety should be under control;

The Contractors point of view is To get economic benefit to train technical teams, and introduce and master new technologies via project applications to get a successful case in order to upgrade corporate brand reputation and two to make the owner satisfied and keep a long term cooperative relationship with the owner.

As for the Suppliers the main issue was to promote corporate reputation; to get economic benefit; To get a successful case regarding related technologies to lift up products quality, R&D level and efficiency and get more cooperation opportunities.

An interesting part was the Implementation coordination meeting system where the Coaching professor adopted an implementation, coordination meeting system to enable positive interaction and efficient communication [4]

Conflicts were faced After a consultation was held to reach a consensus, whether to make changes or how to change was decided. The deriving project objectives were imparted, realized, checked and adapted The aim of the project was Reaching strategic not reacting objectives [5]
4. Assessment- The Students’ Opinion
A questionnaire survey similar to Katz [6] is conducted to show students’ opinion. The questionnaire consisted of the following questions:

5. Results
There were 57 questionnaires answered at the end of the course. The results were as follows:

![Figure 1 Students opinion about the course](image)

- 76% of the students think that the course was good

![Figure 2 Students opinion about the teaching with the proposed method](image)

- 56% of the students answered that the teaching of the course with the method presented in this topic was good while 36% think that it was significantly improved.
56% of the students answered that the learning method presented in this topic was good and 34% that was significantly improved.

60% of the students prefer this method than the traditional while 22% think that it was a significant improvement.

5.1 Comparison with similar studies

A study using similar methodology –role playing- for sustainable education have been selected for comparison. Perdan et al [6] is the description of a project on current research and teaching material in engineering at the University of Surrey, UK. It also incorporates a multimedia course already developed there and taught at the postgraduate level. The module is also incorporated into modules in the Engineering Doctorate Program. Another is that of [7] at Carnegie Mellon. The main difference between the above mentioned programs and ours at the University of Thessaly is that the subjects are taught by a multidisciplinary team in Surrey and it was IT based.
6. Conclusions
A team-based design project with a problem-based learning approach is outlined. There is an added value in implementing of competence based case studies on project management courses. Didactical skills are strengthened through role playing. Role playing increases students’ motivation and enthusiasm to learn. Conclusively the methodology can be used after modifications for students in other engineering departments of other universities. The interactive models developed may be used to enhance their quantitative understanding.

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