

Education for Sustainability of Construction Project Management Curricula in Greece - The Case of Democritus University of Thrace

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Abstract: One of the main issues involved is changing people's attitudes, values, and behaviour 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 Civil Engineering Department Democritus University of Thrace in Greece. More specifically, it describes the course Construction Project Management to develop comprehensive case studies and support material through role playing in order to aid students in understanding the sustainability concepts and how solutions can be developed.

Keywords: Sustainable Education, Role Playing, Competence Based Study

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 [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 [1]. In a sustainable world, environmental protection, economic objectives, and social justice should be linked in harmony [2].

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.

Initially the viability of construction related mainly technical issues, such as the type of materials and energy saving as well as reducing the overall environmental impact. Today the construction sustainability extends to new non - technical issues related to social and cultural problems related to construction. It is therefore understandable that educational institutions mainly focus on the environmental aspects for their Construction Project Management courses. On the other hand, sustainable-construction-related topics include environmental evaluation of construction materials, green building rating systems and environmental assessment. Many studies have shown that role-plays contribute to a positive change in classroom dynamics in terms of sustainability [3].

This paper aims at developing a way in which an approach to teaching approach using role playing that has been embodied in the course of Construction Project Management Civil Engineering Curriculum of Democritus University of Thrace (DUTH).

1.1. The Course of Construction Project Management in Democritus University of Thrace

In Greece Civil Engineering degree programmes date back to the early 1920s, originally in the form of structural design courses. Such applied degree programmes cover many of the aspects of civil engineering, but within a design-specific focus.

Back in the mid-nineties, at the Greek Universities, 'environmental issues' were already being covered within civil engineering degree programs. The resulting courses were used as the main vehicle, with some coverage of related matters in other modules. Formally the method by which environmental issues were covered in the curriculum was reported to the University, as part of the course quality assurance reporting processes.

In redesigning the University's Civil Engineering programs during 2012-2013, sustainability started to be viewed in a broader sense, not labeled as 'environmental issues', but embedded into the learning outcomes of compulsory modules throughout all courses of the degree programs. The need arose from European Community programs and the related courses aim to equip engineering students with a wider horizon of concepts in terms of environmental, economic, and social attributes, for decision making in issues sensitive to sustainability. 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 civil engineering courses of the program. In construction project management the environmental topics covered can be divided into general and construction-related environmental topics. The general environmental issues cover pollution, road transport emissions, greenhouse gases, resource depletion, ecological footprint, ecosystem quality, flora and fauna and renewable energy.

Students would 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.

Accordingly this paper outlines some of the ways in which the University of Thrace has responded to this growing public and professional interest in Sustainable Development education. More specifically, it describes the course construction Project management to Civil Engineering Students in the Department of Civil Engineering of the DUTH.

The course is based on a real ongoing construction projects and has as courses description estimation scheduling, cost control and risk analysis of construction systems requirements of plans and specifications, calculation of cost by trade crewing and histogram development.

Topics include development of WBS, cost estimate and resource-loaded project schedules, risk analysis, baseline/target schedule comparisons, change order preparation, use of decision-support systems and three-dimensional computer models.

1.2. Innovation in Teaching the Course

Teaching communication skills to civil engineering students is not always an easy task; however it is one of the skill that employers are increasingly looking for graduates. Also innovative teaching methods are used to create a stand-out example course in keeping with the connected curriculum vision [4]. New coursework components in which students were asked to make a role playing in small teams to explain a point of view themselves was selected by each team. The report forwarded to be included in the teaching material, to benefit future cohorts, as well as helping students to learn from participation rather than traditional teaching.

The goal of role playing is twofold: raising the students' interest in class content by showing the students the diversity of organizations that claim aiming at sustainable development and sharpening the critical and debating skills of the participants.

1.3. Using Team Work 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 life-long learning and to increase the students' motivation to learn.

2. Roles in the Coursework

Characteristic of the role playing - an active role in designing the course where the teacher supports the students and 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. Specifically the roles are as follows:

2.1. The Role of the Teacher

Teacher's 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. The Role of the Students

The students of will create, on their own initiative, teams comprised of three individuals. Each team will undertake a case study role (supplier, government, project manager, owner) of the project. In particular, each team will search the web looking for additional information on its subject of investigation. Using various search engines and selecting suitable search criteria each team will locate relevant links, record and visit them; finally creating a brief report on the selected subject by enriching the subject with data. Role-playing is also used to explore and debate different approaches. This approach necessitates that sustainability is considered from a multi-dimensional perspective. Students

should critically assess the extent to which sustainable practices in one area of business complement or compromise sustainability in other areas. For example, do environmentally sustainable practices lead to enhanced cost-efficiency or is long-term profitability compromised through such practices? In the Literature similar efforts to create a sustainable basis for civil and environmental engineering curricula should evolve and continue to progress both nationally and internationally [5], [6].

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

The Case Study is the project management of construction projects. The stakeholders involved are:

- Government
- supervision departments
- design companies, suppliers,
- Users
- Partners
- Contractors

The students are separated in 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 were:

- 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 In the Project Team to increase job skills to get experience and broader career opportunity.

Reports should be abided in terms of Government to promote local economic development

- to assure Quality meets the requirements of technical codes and
- to keep up with related national regulations regarding fire prevention through Government supervision departments, in terms of safety, environmental protection, labor and health and other aspects

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

In terms of the User Products quality should be eligible at a Reasonable price.

In terms of Designing Companies the aim was 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 budget scope and 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. Also to get a successful case in order to upgrade corporate brand reputation and to keep a long term cooperative relation with the owner by making the owner satisfied.

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 and get more cooperation opportunities.

An interesting part was the Implementation coordination meeting system where the Coaching professor adopted implementation coordination meeting system to enable positive interaction and efficient communication.

Conflicts were faced after a consultation was held to reach a consensus, whether to make change 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.

4. Methodology

Adopting the Sustainable Development education programmes for engineers is not an easy task; in addition to conventional technical education issues, Sustainable Development education within an engineering context is about giving engineers an understanding of the issues involved as well as raising their awareness of how to work and act sustainably structured to combine both lecture sessions and facilitate small-group discussions on specific topics. It is important to note that case studies and role-playing are also used to explore and debate different approaches. The objective is to enable engineering students to clarify the principles and values on which environmental decisions are made, and help them in developing an ethical framework to address environmental issues as they arise.

Continuing refinement of the course content (e.g. report writing, course reading matter and additional material) is foremost as more examples of sustainability-oriented civil engineering initiatives become available. Similar efforts to create a sustainable basis for civil and environmental engineering curricula should evolve and continue to progress both nationally and internationally [4], [5], [6], [7].

They get the opportunity to practice teamwork, and unusually, to showcase their creativity with the following five steps:

Step 1. Before the role-play starts, the teacher prepares the classroom to materialise roles with chairs and stickers representing their role are posted. The stickers are a pedagogical tool of the role-play, as the students have to role-play accordingly.

Step 2. The participants, acting as decision makers, have to prepare a speech emphasizing how their organization is addressing sustainable development issues and including the related concept that they have previously selected. Then they have to choose the chair that faces the sticker that best

matches their view of the organization’s sustainable development approach, according to the content of the speech they intend to deliver.

Step 3. When all the students are seated, a first round of the role-play may start. The instructor selects the student who will start role-playing. Students are invited in turn to deliver the speech that they have prepared. They must address the previous participants’ speech, so as to make the role-play lively. Furthermore, while a student is role-playing, other students may ask short questions or very briefly react.

Step 4. This feedback is used as an introduction to the second round of the role-play. After listening they have to address the criticisms and verbal attacks that may have been expressed against their role in the first round.

Step 5. The teacher does not intervene at all rounds, 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. The teacher may tackle specific issues that (s)he deems important and that, might have been overlooked by the students.

5. Assessment - The Students’ Opinion

The background knowledge and concepts are assessed in their ability to give the students an understanding of the broad picture of sustainability. Thus all the topics covered in this course are lectured on at an introductory level and embedded in a first year course. The assessment is used to see the students opinion if the course improves the general sustainability literacy of construction management students, which enables them to understand issues relating to sustainability and make choices conducive to sustainable development.

- i. What is your opinion about the course?
 1. good
 2. Improvement
 3. I do not answer
 4. comments
- ii. What is your opinion about the teaching of the course with the method presented in this topic?
 1. good
 2. Improvement
 3. I do not answer
 4. comments
- iii. What is your opinion about the learning method presented in this topic?
 1. good
 2. Improvement
 3. I do not answer
 4. comments
- iv. Do you prefer this method compared to traditional methods?
 1. good
 2. Improvement
 3. I do not answer
 4. Comments

6. Results

To do so a questionnaire survey similar [8] is conducted to show students’ opinion. The questionnaire was consisted of the following questions:

There were 57 questionnaires answered at the end of the course.

The results were as follows:

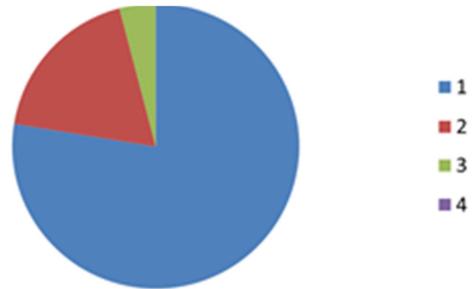


Figure 1. What is your opinion about the course?

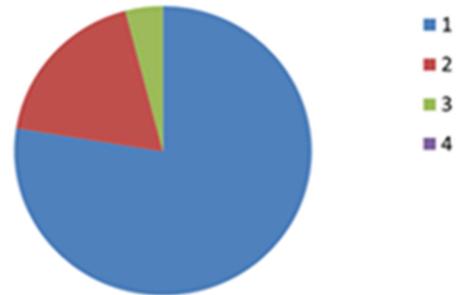


Figure 2. What is your opinion about the teaching of the course with the method presented in this topic?

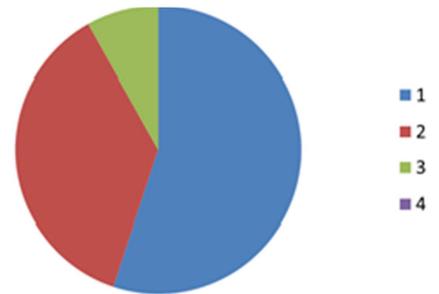


Figure 3. What is your opinion about the learning method presented in this topic?

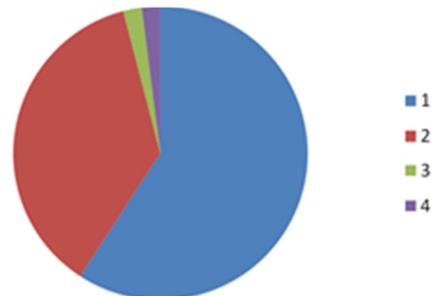


Figure 4. Do you prefer this method compared to traditional methods?

From this research it derives that 60% of the students

prefer this method than the traditional while 22% think that it was a significant improvement. As shown in the above figures, the students show a high level of interest (60%) in sustainability role playing and recognize its importance for their knowledge as construction professionals underlining the importance and its necessity of embedding sustainability knowledge in the construction project management course. For the improvement of the course, students perceive that sustainability knowledge through role playing has been reasonably since 56% of the students answered that the learning method presented in this topic was good and 34% that was significantly improved to existing theoretical construction knowledge and is a more popular and therefore effective way of learning in this context.

Role playing is a new business method that advocates four interlinking principles, where business interests should consider environment interests while satisfying the consumers' needs and profit [8]. This whole-system-thinking approach is briefed with examples in the lecture to inspire students for innovative solutions towards a sustainable built environment.

7. Comparison with Similar Studies

A study using similar methodology – role playing- for sustainable education has been selected for comparison. The description of projects on current research [9, 10] and teaching material in engineering at the University of Surrey, UK and Delft respectively. [8] incorporates a multimedia course already developed there and taught at the postgraduate level. The module is also incorporated in modules in the Engineering Doctorate Programme. Another is that of [8] at Carnegie Mellon [11], [12], [13], [14], [15] and [15]. Another difference between the curriculum programmes [17], [18], [19] [20], [21], and ours in the University of Thrace is that the subjects are taught by a multidisciplinary team and were IT based.

8. Conclusions

The rationale for embedding sustainability in construction degree programs emanates mainly from the growing impetus to improve the environmental performance of the construction industry. Furthermore, research from Greece and elsewhere records the increasing perception of the higher education sector as the major provider of sustainability-focused construction education. From the content analysis of the Construction Project Management course, it can be concluded that the course incorporates a reasonable amount of sustainability components in the existing course, which is appreciated by the students in order to better relate sustainability to other construction knowledge.

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.

Additionally, as the students prefer the method of role playing incorporation in their lectures instead of the traditional method. In this the way in which sustainability

roles is incorporated into traditional construction knowledge should be taken into careful consideration in the development of future sustainability education frameworks.

Didactical skills for project management are strengthened through role playing. Role playing increases students' motivation and enthusiasm to learn. Role-playing contributes to a positive change in classroom dynamics. In addition, they are fruitful tools to teach (and, thus, to learn) Construction Project Management in general and sustainable development in particular.

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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