



15th Global Conference on Sustainable Manufacturing

Sustainable Innovation in a Multi-University Master Course

Bartłomiej Gladysz^a, Marcello Urgo^b, Lorenzo Gaspari^b, Giovanna Pozzan^b, Tim Stock^{c*},
Cecilia Haskins^d, Elzbieta Jarzebowska^e, Holger Kohl^c

^aFaculty of Production Engineering, Warsaw University of Technology, ul. Narbutta 85, 02-524 Warsaw, Poland

^bMechanical Engineering Department, Politecnico di Milano, via La Masa 1, 20156 Milan, Italy

^cChair for Sustainable Corporate Development, Technische Universität Berlin, Pascalstr. 8-9, 10587 Berlin, Germany

^dDepartment of Mechanical and Industrial Engineering, NTNU, S.P. Andersens vei 5, 7491 Trondheim, Norway

^eFaculty of Power and Aeronautical Engineering, Warsaw University of Technology, ul. Nowowiejska 24, 00-665 Warsaw, Poland

Abstract

Mobility, multi-locality, and transnational migration are current social developments among the population of the European Union. These social developments in society and companies, linked to the challenges of sustainability, lead to new requirements for working in the European Union. Teaching and learning in higher education needs to adapt to these requirements. As a result, new and innovative teaching and learning practices in higher education should provide competencies for transnational teamwork in the curriculum of tomorrow's engineers in order to ensure their competitiveness in the job market and advantage in their future careers. Thirteen European students from four countries participated in a new project-based course, called the "European Engineering Team". Students focused on the development of two innovative and sustainable products. The goal of this paper is to present the thermal pallet cover, which is the result of the first one-year transnational and sustainability-oriented project. This paper also aims to present the process of performing the project. It provides the overview and discussion of engineering and management tasks that students completed in the transnational environment, working remotely at their own campuses between scheduled transnational meetings. The work contributes to project-oriented learning that may constitute a basis for teaching holistic engineering courses at mechanical and industrial engineering departments.

© 2018 The Authors. Published by Elsevier B.V.

Peer-review under responsibility of the scientific committee of the 15th Global Conference on Sustainable Manufacturing (GCSM).

Keywords: sustainable innovation; sustainable development; engineering education;

* Corresponding author. Tel.: +49 (0)30/314-24457

E-mail address: stock@mf.tu-berlin.de

1. Introduction

Conventional classroom teaching methods are sometimes considered inadequate for preparing graduates for facing problems that require their knowledge application to new domains [1]. Graduates should be prepared to perform in a turbulent, European- and world-wide, transnational and multicultural environment, which is coined continuously by new social, economic, and environmental trends promoted by globalization. This dynamism is reflected in the EU's strategy EUROPE 2020 [2] with its focus on the importance of economic growth and creating new jobs, energy and climate change, welfare and social security. Vernon [3] concludes that an effective learning program in engineering education should (i) be student-centered; (ii) be project-oriented, and (iii) include some elements of economy and management. There are a number of initiatives related to new forms of collaboration with industry [4], including education of future engineers. Ziemian and Sharma [5] address possibilities of utilization of so-called Learning Factories to develop the competencies of engineers in Europe and give the necessary priority to the transfer of technology from science to production, but they do not address the initial phases of inventing innovations. Another approach is called Experiential Learning resulting from works of John Dewey [6], Kurt Lewin [7], Jean Piaget [8], David Kolb [9,10] and others. However, there are not so many multi-university and education-oriented initiatives.

With the intention of filling this gap, a new multi-university master course focused on action-based as well as on blended teaching and learning in transnational and interdisciplinary project teams has been developed and implemented at the university master's level. The European Engineering Team (EET) is a unique transnational course based on experimental learning and teaching in Europe, which expands sustainable engineering to competitive technological innovations for empowering a global sustainable development. The uniqueness of the EET course relies upon its holistic approach incorporating areas of management, mechanical and industrial engineering, and oriented toward sustainability challenges.

Examples of similar multi-university and education-oriented initiatives in the scope of the European Engineering Team are e.g.:

- “POLE – ON track” [11] from FH Nordwestschweiz is an international and interdisciplinary project-oriented study platform that permits the development of projects in cooperation with industry partners.
- “Global Engineering Teams” [12] managed by Global Education Team UG is an international and interdisciplinary project-oriented study course specifically for engineers. Students from universities in different countries such as the USA, South Africa, and Brazil form one Global Engineering Team. The international and interdisciplinary group of students works throughout the course on a project provided by an industrial partner.

2. Concept of the master course

Each university brings in three to four master students, one professor as a supervisor, and one PhD, PostDoc, or assistant professor as an assistant supervisor to the course. The students of this European Engineering Team jointly work on a sustainable, technology-based innovation. The applied approach to this first cohort could be referred to as a seemingly random walk. The idea behind it was to see how the students following a regular university education path could organize and establish a structured team. The unguided team building phase resulted in freedom in the following activities:

- Free to organize work, groups for tackling the sub-problems, restructuration of the groups for better self-empowerment and management,
- Free to make wrong decisions,
- Free to select their own topic within sustainability.

The freedom enabled the students to feel much more the authors of the engineering topic, be the authors of the scope of work and responsible for wrong or missing project assumptions. From the supervisor's side, the students' preparatory activities gave an insight into a process of organization of a team of people who meet for the first time and have to start collaborating. The supervisors are university teachers and these observations are useful for organizing project-oriented learning in the future. The price for this freedom is a longer process for setting project objectives and specifying requirements for a product.

Four transnational project meetings took place at each partner university. Between meetings, students worked at their own campuses, cooperating virtually with other students and supervisors. Students were grouped in smaller topic-

Download English Version:

<https://daneshyari.com/en/article/7544918>

Download Persian Version:

<https://daneshyari.com/article/7544918>

[Daneshyari.com](https://daneshyari.com)