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The Blended Teaching and Learning Methods and the Implementation of Online Laboratories in Electrical and Computer Engineering Education Programs

Adrian A. Adăscăliței^{1(✉)}, Ashraf Salah El-Din Zein El-Din²,
Sebastian Teodor Arădoaei¹, Marinel Costel Temneanu¹,
and Marcel Dumitru Istrate¹

¹ Faculty of Electrical Engineering, “Gh. Asachi” Technical University,
Iași, Romania

adrian.adascalitei@yahoo.com

² Faculty of Engineering, Menoufia University, Menoufia, Egypt

Abstract. This article describes the Blended Teaching and Learning methodologies and the pedagogical approaches that use Information and Communication Technologies in the field of Electrical and Computers Engineering (ECE) Education Programs. The paper also reflects the collaboration in the field of Online Engineering between the Technical University “Gh. Asachi” from Iasi, Romania and Menoufia University, Egypt, in the context of the Erasmus Plus Program of the European Union. In this paper, we have reviewed the recent documents of: European Society for Engineering Education, International Society for Engineering Education, Institution of Electrical and Electronics Engineers, International Association of Online Engineering, and American Society for Engineering Education to identify the specific pedagogical characteristics used in the computerized training process. The integration of online laboratories in the engineering training process, the use of Virtual Learning Environments, the inclusion of Open Educational Resources are the strategies used in this project. The impact of using Massive Open Online Courses in Education Programs is also analyzed. The cooperation between our universities began in 2017 and have result in the publication of a number of articles in International Conferences Proceedings in 2018 and 2019: International Conference on Virtual Learning, eLearning and Software for Education, International Conference on Electromechanical and Energy Systems. Between August 1, 2020 and July 31, 2021, an exchange of teachers and students will take place within an Erasmus Plus Action.

Keywords: Blended Teaching and Learning · Virtual and remote laboratories · Open Educational Resources · Electrical and computers engineering education programs · Virtual Learning Environments

1 Introduction

The paper reflects the collaboration in the field of Online Engineering between the Faculty of Engineering, the Menoufia University, Egypt, and the Faculty of Electrical Engineering, the Technical University “Gh. Asachi” from Iasi, Romania and in the context of the Erasmus Plus Program of the European Union.

This article describes the Blended Teaching and Learning (BTL) methodologies and the pedagogical approaches that use Information and Communication Technologies (ICT) in the Electrical and Computers Engineering (ECE) Education Programs. In this paper, we have reviewed the recent and programmatic documents of: the European Society for Engineering Education (SEFI), the International Society for Engineering Education (IGIP), the Institution of Electrical and Electronics Engineers (IEEE), the International Association of Online Engineering (IAOE), and the American Society for Engineering Education (ASEE) to identify the specific pedagogical characteristics used in the BTL process.

The cooperation between our universities began in 2017 and have result in the publication of a number of articles [1–6] in Intl. Conf. Proceedings (ISI Thomson indexed) in 2018 and 2019: the Intl. Conf. on Virtual Learning (ICVL), the Intl. Conf. eLearning and Software for Education (eLSE), the Intl. Conf. on Electromechanical and Energy Systems (SIELMEN)-also IEEE indexed. Between Aug. 1, 2020 and July 31, 2021, an exchange of teachers and students will take place within an Erasmus Plus Action.

Both Students and Professors will use the BTL Methods in Iași, and Menoufia. The integration of online laboratories (both Virtual and Remote) in the engineering training process, the use of Virtual Learning Environments (VLE), the inclusion of Open Educational Resources (OER) are the strategies used in this project. The impact of using Massive Open Online Courses (MOOC) in ECE Education Programs is also analyzed.

2 Engineering Education in IGIP and SEFI Vision

Engineering education is the activity of teaching knowledge and principles to the professional practice of engineering.

Some of the aims of the International Society for Engineering Education (IGIP) [9–11] and European Society for Engineering Education (SEFI) [12] are to:

- improve teaching methods in technical subjects;
- develop practice-oriented curricula that correspond to the needs of students and employers;
- encourage the use of new media in technical teaching;
- integrating languages and the humanities in engineering education;
- support the development of engineering education in developing countries.

The following didactical and organizational principles were formulated as guiding principles for Curriculum Engineering Education Model:

Michael E. Auer
Tiia Rüttermann *Editors*

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Volume 2

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Editors

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Editors

Michael E. Auer
Carinthia University of Applied Sciences
Villach, Austria

Tiia Rütümann
Tallinn University of Technology
Tallinn, Estonia

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