

## Guest Editorial I

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# The Learner in Engineering Education

More and more engineers operate in globalised contexts and need to provide innovative and sustainable solutions to complex problems. Equipping engineers with the knowledge and competences needed, as well as the preparation for professional practice are important aspects of engineering education. Nowadays, many Universities of Technology use active and student-centred pedagogies as learning strategies. Collaborating in small project groups to solve a real-life engineering problem is a good example of an excellent preparation for practice.

The *learner at the centre* of the teaching and learning process is the motto for this special issue, which includes twelve outstanding papers and explores the following themes:

- Mathematics education.
- PBL models and approaches.
- PBL process and student engagement.
- Designing problems and learning environments.
- Transversal competencies and high level skills in PBL.
- Motivation for learning.

The special issue starts with two papers exploring mathematics education in engineering. Triantafyllou et al. focus on mathematic education in a transdisciplinary engineering programme. They report a case study where traditional mathematics assignments are substituted by a programming project in a game engine. Ravn and Henriksen argue that education in universities engineering mathematics should take its outset in contextual problems and discuss Problem Based Learning (PBL) as a suitable approach.

Fernández-Samacá et al. introduce a Project-Based Learning model (PBL) for single courses of a control system that is part of a traditional education curricula. The PBL is applied to facilitate learning and encourage the development of transversal skills. The authors consider the institution's policies, facilities and resources of traditional learning environment and propose a PBL model using these to innovate learning. Zin et al. reports on a qualitative study concerning the challenges lecturers and students confront in a PBL environment at the German Malaysian Institute (GMI), in Malaysia. Novais et al. seek to answer to the following question: "*What are the main strengths, limitations and challenges to implement Active Learning in a higher education institution?*". The authors present a case study of an undergraduate course in Logistics Technology in a Brazilian institution, with emphasis on its implementation actions, feedback from students and professors and experiences obtained from the discipline of Statistical Methods.

Garcia-Martin et al. propose a method based on educational theories to guide the design of Project Based Learning Activities. Dinis-Carvalho and Fernandes present an empirical study based on the application of lean concepts to teaching and learning in student centred learning environments. The aims are to describe the model developed based on the application of lean concepts to teaching and learning and to analyse students' perceptions concerning the application of this new model in the course of "Lean Enterprise".

Ulseth and Johnson present two articles. In the first study they explore the development of self-directed learning abilities by engineering students in a PBL curriculum. The study aims to characterize how graduates understand and utilize self-directed learning at the juncture where they will be entering engineering practice. In another paper, Johnson and Ulseth focus on gaining an understanding of the student experience and identifying which elements of the PBL curriculum affected the student professional competency development experience. Holgaard et al. presents a five-step model for students to identify, analyse and formulate a problem to be addressed from an engineering perspective. The model is the result of an iterative process, where theoretical as well as empirical inputs have pointed to creating a conceptual model for problem design for both students and staff, which is simple and concrete in its conceptual framing and walks the students through their first experience as problem designers in a sequential step-wise systemic manner.

Mora et al. argue that even when PBL is gradually introduced at an institution alongside traditional teaching, it is not perceived by students as an easy way to learn. Consequently, these authors used the MUSIC<sup>®</sup> Model of Motivation as a conceptual framework to identify the difficulties that students have during PBL and to re-design instruction to increase students' motivation. Pedersen et al. presents a study on what motivates students and university teachers to do intensive international courses. The motivational

factors for students include both academic and cultural factors while teachers are highly motivated by both personal and academic factors, especially by a desire to develop and experiment with new teaching methods.

On behalf of all the authors and reviewers contributing to this special issue, we would like to particularly thank the Editor-in-Chief Ahmad Ibrahim for his support to our scholarly efforts to develop engineering education and address the society challenges. We hope the readers find these papers inspiring and useful.

Nestor Arana-Arexolaleiba  
Mondragon University—Engineering School, Spain  
E-mail: narana@mondragon.edu

Aida Guerra  
Aalborg UNESCO Centre for PBL in Engineering Science and Sustainability, Aalborg, Denmark  
E-mail: ag@plan.aau.dk

Anette Kolmos  
Aalborg UNESCO Centre for PBL in Engineering Science and Sustainability, Aalborg, Denmark  
E-mail: ak@plan.aau.dk

Erik de Graaff  
Aalborg UNESCO Centre for PBL, Aalborg, Denmark  
E-mail: degraafl@plan.aau.dk

Rui Lima  
School of Engineering, University of Minho, Portugal  
E-mail: rml@dps.uminho.pt