

Intercultural, Communicative and Collaborative Skills for Industrial Engineers: Current and Future Trends in Engineering Education

Marcelo Gaspar

School of Technology, Polytechnic Institute of Castelo Branco, calvete@ipcb.pt

Margarida Morgado

School of Education, Polytechnic Institute of Castelo Branco, marg.morgado@ipcb.pt

Abstract - Considering current engineering education landscape, it can be observed that many students use regularly global social networks to widespread their contacts and interact with peers from multiple nationalities and backgrounds. Nonetheless, when asked to use such digital skills in a work situation, communication and dialogue in international teams is not easily achievable or made effective when students are unprepared to handle intercultural clashes and negotiations of any transnational environment. Students require practice in intercultural communicative skills (most of the times through a foreign language) as well as in transversal skills, such as creativity, critical thinking, and tolerance of (cultural) ambiguity. In order to train these skills, a conceptual framework is proposed to enhance the use of Information and Communications Technologies (ICT) in the light of current and future trends in engineering education.

Keywords – Engineering Education, Industrial Engineers, Transversal Skills, Collaborative Skills.

INTRODUCTION

Industrial Engineers apply science, technology and engineering methods to manage operations and increase efficiency, whilst improving overall quality of products and services. To such end, this engineering branch combines technical skills with business expertise to specify, predict, and/or assess results of various complex processes and systems.

Even though this interdisciplinary area of engineering may focus mainly on technical processes and systems, a new industrial revolution paradigm - also known as the fourth Industrial Revolution (Liao et al., 2017) - emphasis that the focus has to be put into people and work cultures to drive transformation and allow for continuous improvement in companies and organizations (World Economic Forum, 2016).

The ability to correctly interpret and perceive change will enhance higher levels of (inter)cultural awareness to prepare for, adapt to and align with paradigm change at the levels of the individual and the organization. A recent global Industry 4.0 survey (Reinhard, Jesper & Stefan, 2016) conducted amongst over 2.000 respondents of more than 26 countries (including Portugal) emphasizes that ultimately success or failure will depend mainly on a broad range of people-focused factors. Thus, amongst the set of key competences mentioned in that report, intercultural, communicative, collaborative and ICT skills are highlighted. This leads to the urgent need to integrate such array of competences and skills in the scope of current engineering education.

Intercultural communicative skills have been defined by many authors as “the overall social, (linguistic) and psychological capacity of an individual to manage appropriately encounters with people from other cultural backgrounds” (Troncoso, 2012). For future engineers one would highlight as critical the development of skills and attitudes to decentre from own cultural practices and acquired specific communication styles, so as to be able integrate and function on global innovative companies and organizations.

To this end, current study discusses the intercultural, communicative and collaborative skills and attitudes required by the profile of future Industrial Engineers and proposes a conceptual framework to relate its implications in the teaching and learning processes of these graduates.

METHODOLOGY

A comprehensive literature review characterizing the state of the art on interculturality, communication and collaboration in Higher Education contexts, along with results of surveys and cases, sustained the discussion on the multiple factors that influence the development of such skills in Engineering Education.

FINDINGS

Companies doing business in the global marketplace require very explicit skills in information retrieval, management and validity; the application of that information to concrete problem solving, as well as the ability to work collaboratively “with colleagues from different cultural, linguistic and racial backgrounds” (Cummins, 1998). The latter have been often redefined as intercultural communicative skills, while the former would come under the framework of transversal skills needed from tertiary education.

In pedagogical terms, not only are there different skills to be developed in engineering students from those traditionally thought of, but there is also the need to substitute top down transmission modes of instruction by cooperative and collaborative learning environments that recreate situations students may encounter at work.

Communication wise, four levels need to be addressed in the education of future engineers through instructional design:

i) Means of communication: using diverse web-based media for communication, given that only connectivist and networked learning can create and sustain transnational networks of peers, teachers and experts across geographical space;

ii) Communication about: learning how to communicate about what they are doing is crucial for efficacy. This requires talking with peers and using the correct technical language as well as intercultural awareness and knowledge of cultural backgrounds;

iii) Communication with target audiences requires language awareness and sensitivity to register;

iv) Context, as the fourth level, underlies all communication and requires from the engineer and his/her work organization a thorough in depth knowledge of local cultures and their organizational, social, economic and religious fundamental principles.

In terms of communication in the workplace, this instructional framework thus needs to promote an active learning environment (through concrete projects) that require the ability to communicate or cooperate with others across geographical and cultural space.

This can be achieved through the implementation of joint projects between institutions from different countries to solve common problems (e.g. through telecollaboration or virtual online exchanges between teams of students who will develop a common project).

It is also important to pursue bilingual education and open up the academy to interdisciplinary projects, as the

separation of subject domains according to teachers does not serve the needed articulation for work environments.

Thus, instructional design needs to overcome institutionalisation and compartmentalisation of knowledge within the traditional disciplinary frameworks and adopt interdisciplinary approaches to education in a digital era.

Moreover, if we are to develop a global citizen in future engineers, engineering projects need to be linked to the social, cultural and economic principles of communities.

CONCLUSIONS

The purpose of this research is to throw light on the intercultural, communicative and collaborative skills required for industrial engineers, as well as on their impacts in engineering education.

A conceptual framework on the subject was discussed. Further implications on the ways to promote such set of skills in current and future engineers have to be further addressed.

The body of knowledge that has been created is meant to support mainly students and lecturers dedicated to engineering education and the role of transversal skills on the profiles of current and future engineers.

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