Promoting sustainable human development in engineering: Assessment of online courses within continuing professional development strategies

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**A B S T R A C T**

Higher Education Institutions play a critical role in societies transition towards sustainable development, educating future professionals and decision makers. In the last few decades, a number of technical universities have devoted major efforts to integrating sustainable development into engineering curricula. There is still, however, an increasing need to further transform learning and training environments and build capacity of educators and trainers on sustainable development issues.

Against this background, this paper assesses the role of online training courses, within continuing professional development strategies, in promoting sustainable human development in engineering degrees. It was built upon the implementation of a European initiative, the Global Dimension in Engineering Education, promoted by a transdisciplinary consortium of technical universities and non-governmental organisations.

In terms of method, this study analyses two sets of quantitative and qualitative indicators to assess i) the perceived quality/relevance of the training proposals, and ii) the learning acquisition of participants. Quantitative indicators were complemented by a descriptive analysis of findings from a semi-structured survey. The results provide evidence that online learning can be an effective approach for continuing professional development of academics. The findings also suggest that participants perceived online courses’ contents and curricula, developed jointly by academics and practitioners of non-governmental organisations, as relevant and useful for integrating sustainability principles in teaching activities. To conclude, authors recommend the leaders of higher educational institutions to explore the integration of online courses addressed to faculty into university policy and strategies, as a way to promote professional development and the engagement of academics on sustainable development.

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**1. Introduction**

The early years of this decade have seen increased political will in relation to sustainable development issues. The considerable political support for the Millennium Development Goals (United Nations, 2000) has added political impetus to the argument that there cannot be sustained progress towards the achievement of development goals without active and critically aware citizens in...
Europe. This, along with strategic work by global and development advocates, has led to historical agreements such as the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (United Nations, 2015), and the Paris Convention on Climate Change (UNFCCC, 2015), which strengthens the link between climate and energy policies at both national and international level.

The most recognized definition of ‘Sustainable Development’ (SD) comes from the United Nations World Commission on Environment and Development in 1987, stating that “sustainable development is the development which meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987, p. 42). The different meanings of this generic definition of SD and its misconceptions have been discussed in academic literature (Filho, 2011; 2000).

Other development approaches, such as those based on Human Development (HD) and Sustainable Human Development (SHD), focus specifically on addressing global inequalities (extreme poverty, gender equality, human and civil rights, etc.), and the promotion of a more socially just world. HD and SHD approaches define development as a process of expansion of capabilities and real freedoms that people enjoy (Sen, 1999). The Human Development Reports (HDR) of the United Nations Development Program have institutionalised and operationalized the HD approach, by combining both aspects of development (sustainable and human) and, in the year 2011, by defining SHD as the “the expansion of the substantive freedoms of people today while making reasonable efforts to avoid seriously compromising those of future generations” (UNDP, 2011, p. 18). Theoretical boundaries between the concepts of SD and SHD are not clear and precise and thus present diverse possible interpretations (Abell, 2015). In this study, the concept of SHD is specifically used when highlighting the fulfilment of basic needs and the expansion of human capabilities within SD approaches.

Higher Education Institutions (HEIs) play a critical role in societies transition towards SD and SHD since they educate future practitioners and decision makers who will face important and complex decisions on environmental, social and political issues (Lozano et al., 2013). In the framework of the United Nations Decade of Education for Sustainable Development 2005–2014 (DESD), a number of countries devoted considerable efforts to promote the integration of the principles of Education for Sustainable Development (ESD) into all aspects of education (UNESCO, 2014), including higher education. With varying degrees of success among countries, it is worth highlighting some encouraging trends, such as: i) the reorientation of education programmes, at different levels, increasingly addressing and integrating sustainability issues; ii) the convergence between sustainable development agendas and education agendas; and iii) the increase of essential pedagogical innovation, such as whole-institution approaches towards ESD.

The DESD final report, however, also indicates that actual changes in curriculum and educators’ practices, at all levels of education, have been slow and characterised by incremental advances, and more efforts are needed in order to properly institutionalise ESD in HEI. Among the priority actions identified in the final report for HE is the need to further transform learning and training environments and build capacity of educators and trainers (ibidem).

Recent scientific literature reaches similar conclusions (Lozano et al., 2015). More specifically, the implementation of SD competencies through teaching appears to be challenging in various ways. From one side, learning processes enabling changes depend to a large extent on academics and their capability and willingness to support transformative processes (Barth and Rieckmann, 2012). From the other side, various studies identify a number of barriers to change that persist and prevent lasting faculty engagement (Lozano, 2006; Velazquez et al., 2006; Verhulst and Lambrechts, 2014).

Engineering is widely recognized as a critical discipline to address SD challenges and contribute to a sustainable future (Davidson et al., 2010; Karatzoglou, 2013), and the impact of engineering on the achievement of Sustainable Development Goals (SDGs) is beyond question (Clifford and Zaman, 2016). In the same vein, international institutions recognise the impact that engineering has on societies, ethics and ones’ individual value-base (UNESCO, 2010). Consequently, abundant literature reflects the increasing need for improving the connections between engineering and SD (Lozano and Lozano, 2014; Mulder et al., 2012; Rose et al., 2015).

Globalization of the higher education arena has also contributed to build momentum in this direction. It is essential to provide future engineers with skills and capabilities to enable them to exercise their profession in a globalized and changing society, and with appropriate approaches that support global needs (Boni et al., 2015). The effect of globalization on the development and practice of the engineering profession, alongside the increasing challenges of SD, are calling for significant adaptations to the curriculum of engineering studies.

Over the last decade, technical universities and engineering faculties have been involved in embedding SD into their academic systems, improving teaching strategies (Boni and Pérez-Foguet, 2008; Mulder et al., 2015; Pérez-Foguet et al., 2005; Segalas et al., 2010) and ensuring that the approach is incorporated into professional education (Boni and Pérez Foguet, 2006; Holmberg et al., 2008; Lozano and Lozano, 2014; von Bloytnitz et al., 2015). However, a number of scholars highlight a lack of a proper understanding of the principles of SD among engineering students (Azapagic et al., 2005; Byrne et al., 2013; Segalas et al., 2009).

The debate about which practices or processes can enable change at university level (Ferrer-Balas et al., 2010; Lozano et al., 2015; Pérez-Foguet, 2008; Pérez-Foguet and Cruz López, 2011; Ramos et al., 2015) and, specifically, in engineering education (Davidson et al., 2010; Mulder et al., 2012; von Bloytnitz et al., 2015) is still open; nonetheless, the active engagement of academic staff has been indicated as a starting point to drive transformative changes in curriculum innovation toward SD (Barth and Rieckmann, 2012). Increasing their interest and improving their competencies is indeed vital to engage faculty in the process of SD integration. However, previous studies suggest that the understanding and knowledge of SD remains a major challenge in this regard (Filho, 2011; Jones et al., 2008). The different understandings and the interdisciplinary nature of the terms involved have been described as blocking academics’ engagement in education for SD (Cebrián et al., 2015; Sammalisto et al., 2015). An unquestioned issue is therefore to increase the awareness and knowledge of SD among university educators.

In the last decades, diverse educational initiatives have been promoted through a variety of initiatives addressed to different profiles of learner (Casey and Asamoah, 2016; de Wit and van der

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