The COVID-19 pandemic and the growing need to train engineers aligned to the Sustainable Development Goals

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International Journal of Sustainability in Higher Education 01 Jan 2020
DOI https://www.emerald.com/insight/content/doi/10.1108/IJSHE-06-2020-0217/full/html

Since January 2020, the rapid spread of COVID-19 has created supply chain disruptions worldwide. WHO (2020) and WHO Regional Office for Europe (2020) highlight that it has been a great challenge to maintain a regular supply of food and medical instruments, including masks and medicines. This is in addition to the demonstrated deficiencies in the development of domestic and international humanitarian actions.

International forums and magazines specializing in engineering education have been discussing new educational methods that better align professionals' training with the objectives of sustainable development as proposed by the United Nations 2030 Agenda (Montenegro de Lima et al., 2020; Rodriguez-Andara et al., 2018). Considering the current global context, it is little surprise that these discussions have gained momentum. It is expected, among other characteristics, that future engineers trained around the world will be able to conduct their work in a systemic manner, presenting a multidisciplinary vision that considers the interests of all stakeholders in the projects they will develop throughout their professional life (Quelhas et al., 2019). The purely economic bias that governed the performance of engineering projects for many years needs to be increasingly balanced by environmental and social aspects (Baroutian et al., 2016; Quelhas et al., 2019; Rampasso, Anholon, et al., 2019; Sharma et al., 2017). This vision needs to be taught, debated and practiced from the first years of engineering courses throughout the entirety of the undergraduate degree (Rodriguez-Andara et al., 2018). This is so, for three main reasons:

1. Engineers and their professional activities may potentially have a strong impact on the environment
2. The means to address or solve many environmental problems often require engineering-based interventions
3. Engineering activities and projects are usually long-term, often lasting decades, which makes it important that due considerations to sustainable development are part of their work

There are many pedagogical methodologies that can contribute to the achievement of this vision (Trede et al., 2020; Winberg et al., 2020). Social work is characterized as one of them, (Ornellas et al., 2018; Rambaree, 2020) and it represents a great opportunity for engineering students to develop a more open mind about each person's contribution to society. In fact, there is a lot of knowledge about different engineering modalities that can be applied to provide welfare for excluded social groups, better living conditions for local communities, and social justice, among other examples. The understanding of how

to bridge the gap between engineering knowledge and the needs of society is a great learning experience and, subsequently, its implementation can be characterized by even greater learning. It is logical that there is the development and implementation of actions related to this from within the field of social work. What we corroborate here is the point of view of some authors and institutions that defend the need for future professionals, regardless of the area, to have a broader view of human rights, social justice, collective responsibility and respect for diversity ("Appendix II: The Global Agenda for Social Work and Social Development - history and process", 2014; Beecher et al., 2010; Costello and Aung, 2015; IFSW, 2014) and, in particular, the responsibility that they have as trained professionals to act in favor of sustainable development, and to take into consideration the social, economic and environmental aspects of their work (UNESCO, 2017).

Despite this view being heavily debated and valued by researchers in the field, many higher education institutions in the world are still not seen to be putting it into practice and are doing little to motivate their students to develop any kind of project or social work (Edvardsson Björnberg et al., 2015). It is common to observe, especially in developing countries, curricular structures that are not aligned with this new conception of education. At most, sustainable development related issues are considered as isolated subjects, and are not integrated with other subjects offered in the course (Pérez-Foguet et al., 2005; Rampasso, Siqueira, et al., 2019).

The COVID-19 pandemic introduced the need to adapt decision support criteria and work routines. Will the world population change its patterns of consumption? Will unemployment increase? When and how will the economy recover? Will home-working, the main work modality of many engineers during the pandemic, actually replace face-to-face work? Could home-working actually be considered more sustainable than face-to-face work? Evidently, we need to reflect and rethink how to adapt engineering teaching.

It is important to note that COVID-19 is revealing profound interconnections in supply chain management in unforeseen ways. Examples of negative consequences include, among other things, difficulties increasing the capacity to manufacture medical products, difficulties providing rapid responses to crises, the accumulation of food causing bullwhip effects, as well as the fragility of supply chains ultimately contributing to economic chaos. Even in companies in which part of their operations are being conducted by staff at home, these problems are still present.

Within the scope of sustainability, society has started to demand greater commitment from companies when it comes to social and environmental responsibility, human rights, sustainable management of operations and people and business ethics. Companies need to be managed with a focus on the UN's 17 Sustainable Development Goals (SDGs) (PwC, 2015). Global companies that used to struggle to have flexible operations will, after COVID-19, need to change their priorities to "resilience to crises" of the production process. Can this "resilience" be achieved through sustainability? We believe so, and for this, it will be necessary to train engineers qualified in the skills discussed above.

The COVID-19 pandemic has generated and will continue to generate negative impacts on countries' economies. Companies around the world are beginning to put in place containment plans to maintain what they consider strictly necessary (Fernandes, 2020; Hartmann and Lussier, 2020). The problem is the fact that most of these companies just focus on economic factors; environmental factors are minimally developed to comply with legislation and developed social practices end up being put on the backburner or ignored entirely. Therefore, it is necessary to change the view of engineering problems, leaving the passive view towards a more proactive and holistic view. It is no longer sufficient to simply teach engineers to design and solve problems considering only technical and economic factors. In situations such as this, it is important to remember the statement of Santos and Mortimer (2001). According to them, the curricular proposals for teaching science from the perspective of "science, technology and society" have as their main goal to prepare students to exercise citizenship. Students should act as citizens, first and foremost, making decisions and acting with social responsibility, and social engagement. The COVID-19 pandemic is proving these needs.

Engineering students have traditionally been very interested in business and financial market issues and, in this pandemic period, they may have the “false impression” that social practices and environmental preservation can be “cut off” from business actions in times of crisis. They could argue that social work and environmental protections are not essential for organizational survival. Therein lies a great concern, since the conditions of this moment (in both economic and psychological terms) can lead to the development of an entire generation of engineers with a mentality that will not value socioenvironmental action, nor the well-being of others, or collective responsibility, among other issues. It will take a quick educational response from academic staffacademic staff in engineering courses around the world to not allow this erroneous mentality about what really matters to be crystallized in engineers' training. Many educators in the field may not have noticed this yet, but it is clear and well-known that action needs to be taken quickly.

Although most of the world population is socially distancing and educational activities are taking place virtually, academic staffacademic staff of engineering courses need to emphasize to their students the importance of social work at this moment. In fact, the debate on how the knowledge of an engineering discipline can be applied to benefit those who suffer the most in this pandemic is already characterized as a great learning experience. Additionally, academic staffacademic staff should encourage their students to develop some type of voluntary action for the benefit of others. It should be noted that many activities can be carried out in different and creative ways that were previously unthinkable. As an example of social action that can be easily carried out in a virtual way by engineering students, we highlight the support of social entities in the idealization and dissemination of online campaigns for fundraising, since many social entities around the world have been severely affected by cuts in donations.

This pandemic period can also be used with engineering students to debate the benefits of sustainable lifestyles, as addressed by UNEP (2015). This pandemic period can provide interesting information about goods and services that can be used in sustainable consumption strategies. Another interesting theme to be debated in engineering classes is “eco-innovation” and for this specific case, the United Nations

Environment provides excellent material with tools, examples and methods to develop sustainable business models (UNEP, 2017).

In short, this Viewpoint is characterized as a warning to academic staff academic staffacademic staffin the field of engineering to continue valuing the principles of sustainable development with their students during the COVID-19 pandemic. In particular, it is recommended that action and social work should be pursued, which in situations like this pandemic can be mistakenly pushed to a second tier of importance. We understand that academic staffacademic staffacademic staff are facing great challenges in their profession, after all, in most cases they needed to suddenly change their way of teaching and deal with totally virtual environments. We emphasize, however, that this commitment will be reflected in a generation of sustainability-aware engineers who will use their knowledge and skills over the decades to come.

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