From Technology Enhanced Learning to Ethics and Critical Thinking as Part of the Engineering Education:

Skill Driven with Humanities Comprehension Editorial

https://doi.org/10.3991/ijep.v10i1.12927

Manuel Castro(✉)
Electrical and Computer Engineering Department, UNED, Madrid, Spain
mcastro@ieec.uned.es

Elio Sancristobal
Electrical and Computer Engineering Department, UNED, Madrid, Spain
elio@ieec.uned.es

It is a great pleasure to contribute some words to the debate about Engineering Education as well as to broaden the discussion about the future evolution of this discipline in which we were involved in the last fifteen years. One of us is in his last period of a professional life full of research and the other one still in the early stages of a career in engineering education. Both of us come from different backgrounds and have different visions which are complementing each other. Therefore, we are striving to develop new actions and activities inside this amazing discipline.

Thanks to the International Journal of Engineering Pedagogy (iJEP) and its editor-in-chief, Matthias Utesch, as well as to the collaboration between the IGIP (International Society for Engineering Pedagogy), IAOE (International Association of Online Engineering) and the IEEE (Institute of Electrical and Electronics Engineers) some of the major institutions in the world together build the future of engineering and work on its implications for the community of engineering educators.

We will start on the discussion of the previous editorial, 'Five Theses on a Renaissance of Engineering Education: Skill-Driven Learning and Teaching SDLnT Editorial', iJEP, vol. 9, issue 5, (https://online-journals.org/index.php/i-jep/issue/view/433). Above all, we agree that SDLnT should be included as part of the knowledge areas of TEL (Technology Enhanced Learning) whose main objectives are the research and implementation of present, past and future technologies, thus facilitating an enhanced learning of competences, knowledge and skills.

Future actions must follow the way we teach and the way we promote learning for our students and colleagues. The previously mentioned five theses support different visions of all the learning activities and environments, which promote active learning:

1. The future demands lifelong and continuous learning. Why? According to all recent employment studies, more than 50% of the jobs in the short run don`t exist today. And of course, our engineering students must be ready for these unknown challenges. Preparing them is our responsibility as engineering educators!
   Consequently, tutoring (and personnel guidance) is the future: Not only striving to develop technical competences but focusing on skills like social and

emotional intelligence, collaborative work, entrepreneurship and diverse integration, with all the tools provided by present and future digital technologies are revolving around these competences and skills.

2. Project-based-learning (PBL) in its different approaches is another keystone of those theses. Project-based, practical oriented, problem-solving: our future life is like mountaineering - or a videogame - where all along the way we have to collect as many tools as we can in our backpack resp. inventory in order to apply them in solving our everyday challenges.
3. Horizontal competences are part of the skills or tools we must be familiar with: Writing, speaking, organizing, training others and being trained, researching and - most important - be empathetic and collaborative in all the feasible senses. The future is ambiguous, fuzzy, blurred, and all of our competences and skills must fit together like the pieces of a puzzle.
4. Internationalization is the future (coming from the past). After some problematic and complicated times of externalization and relocation, we have learned some lessons. Now a new way of globalization (glocalization) is emerging, balancing good internationalization visions and the local component. This part of our future hopefully will promote more sustainability and social responsibility.
5. Education and learning activities must be consistent, but as we pointed out some paragraphs before, we do not know the future. But the only thing which is sure, is that in the future we must strive to master change. Therefore, flexibility, awareness, engagement, synergy, empathy, etc., must be included in our syllabuses and the technological progress must be one of the core areas of this future.

So recently we (Spaniards) had the honor to host the 2019 United Nations Climate Change Conference, (COP25, as the 25th United Nations Climate Change conference), held in Madrid, Spain, December 2019. It was a big challenge to be prepared on such a short notice as the conference site changed from Chile to Spain, and some main lessons had to be learned:

1. The number one lesson learned is that the views of the political elite deviate to such a vast extent from the insights of the scientific and civil communities. Similarly, some young newcomers gain influence though currently being so far away from scientific principles, practical experiences and the ways of actions.
2. Second one is that we are in a deadlock. Once again, we postponed the main decisions and key actions to the year 2020. It is a shame that mankind never seems to learn the lessons from the past and again favors the ‘no action’ as the action for the future.
3. Some past emerging countries and nations are now giants and although they are undertaking a lot of efforts like green plantations and trees/forests, smart cities, pollution new actions, etc., their political frameworks seem far away from civil wishes based on Western democratic values.
4. And our last impression is that year after year, our ethical and sustainable vision of engineering education must continue to penetrate inside our practitioner and academic communities, to reinforce our actions and commitment to the global society.

Ethical behavior, responsibility and the alignment of our efforts on a sustainable and greener future must be a core part of us and our actions. IEEE emphasizes their vision and orientation on the lemma 'advancing technology for humanity' as the cornerstone where engineering, education and life merges.

We would like to thank all our friends and colleagues inside the IEEE, IAoE and IGIP, as well as our academic and research colleagues and our students at UNED, from whom we learn everyday how the future is evolving and how we must maintain and improve our own research and teaching aiming at ethically justifiable sustainability in technology, education and engineering. We kindly invite you to spend some time looking at one of our last keynotes in the UCAmi 2019 conference (https://es.slideshare.net/mmmcastro/from-the-personal-smart-cities-to-the-smart-education-a-journey-for-academy). We hope you will enjoy it and work with us in this area of ethics and critical thinking as the core part of engineering education for a better human and sustainable future.

Manuel Castro and Elio Sancristobal
Madrid, December 2019

Manuel Castro *is Professor at the Electrical and Computer Engineering Department of UNED, IEEE Fellow; member of the Board of Directors of the Institute of Electrical and Electronics Engineers (IEEE), President Emeritus of the IEEE Education Society and co-Editor of IEEE-RITA Journal.*

Elio Sancristobal *is Associate Professor at the Electrical and Computer Engineering Department of UNED; IEEE member, and member at large of the Education Society of the Institute of Electrical and Electronics Engineers (IEEE).*