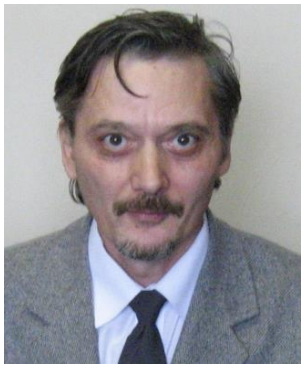
Traditional vs. smart engineering education



Due to the complexity of contemporary global challenges, such as sustainable resource consumption and adaptation to climate change, supporting and investing in engineering education are essential to improving societies. Changing the engineering education through a major restructuring of the accreditation criteria and curricular innovation would have significant long-term effects.

In universities and higher education institutions, lectures are still the predominant method of teaching courses in fundamental and specialized disciplines. Learning is largely passive in this traditional format, with limited possibilities for interaction between students. Learning is enhanced when students are offered the opportunity to be actively involved with the new content through group discussions and problem solving.

In the last decade of the last century, the educational offer of the faculties in the engineering practice has determined an important difference between what is taught in faculty and what the employers and their clients expect from the young engineers. The first two years of the curriculum - which in many respects have changed little since the late 1970s - are primarily devoted to basic sciences, when students apply scientific principles to technological problems. The resulting engineering graduates were perceived by industry as insufficiently prepared to practice in the industrial environment due to changing requirements from theoretical to practical (which implies a combination of skills, attributes and characteristics to obtain solutions to engineering challenges by integrating human needs, sociology, economic and environmental criteria).

For design, students need instruction in additional fundamental disciplines such as discrete mathematics (essential for digital information technology), biomechanics science, industrial design, and knowledge of global cultural and business contexts.

Changing the educational paradigm should have two key components: soft skills and technical skills. The soft skills are the skills that allow the professional conversion from jobs that will disappear, and the technical skills are the key skills for the jobs that have not yet been created. The best scenario would be to combine the two sets of skills, and the challenge for this will be to combine them into a new educational platform for the next generation of engineers. In the new millennium, the students and the answers of the engineering design faculties to the new intelligent learning environment have been predominantly positive, with some key areas highlighted in order to optimize its effectiveness.

Design for sustainable development and long-term competitiveness is considered as the central or distinctive activity of engineering. Engineering programs should graduate engineers who can design effective solutions to meet social needs (including practical training such as: modeling concepts, geometric transformations, industrial design, animation, image processing, and communication design). Engineering department leaders must be able to recognize the intellectual complexities and resources required to support a good design education.

Industrial Design and Product Development disciplines have a significant impact on engineering education in the new millennium. Industrial design is an emerging engineering area that is likely to change the fundamental nature of engineering education in mechanical engineering disciplines. It can provide an academic model for the development of multidisciplinary programs in the structures of the engineering faculties that integrate the classical fields of mechanical engineering, electrical engineering, computer engineering and information technology to establish the basic principles for a contemporary engineering design methodology.

The integration of the industrial design area in the engineering curriculum would support the synergistic integration of mechanical engineering, product development and design models that think intelligent products based on multifunctional elements, which leads to a new construction structure, which presents a reduced complexity, reduced weight, high adaptive functionality, as well as economic efficiency. The master program in Engineering Graphics and Design from the Faculty of Aerospace Engineering of the University POLITEHNICA of Bucharest provides engineers with a platform to apply their engineering knowledge to solve the problems of new product development, environmental protection and sustainable development imperatives. The characteristics of efficiency, functionality, precision, self-repair and durability must concern today the designers of the engineering structures.

The active use of information and technologies (using modeling, simulation and practical educational activities) in the pedagogical process is one of the conditions for the formation of a harmoniously developed engineer. The analysis of current smart systems, smart technology, smart devices and their applications in education clearly shows that a combination of Smart Learning concept and innovative technologies will be a dominant paradigm of learning in the next 5-15 years.

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