Chapter 12
Teaching Machine Design Curricula in Developing Countries: A Case Study

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ABSTRACT

In this chapter, a feasible approach to implement machine design curricula in developing countries is presented. The argument by the authors is that machine design should train engineering students in such countries to utilize local resources to solve practical societal problems. The approach illustrated here was used during 2015-2016 to teach machine design at Dedan Kimathi University of Technology, DeKUT, in Kenya. The approach involved grouping students of different interests and capabilities and tasking them to identify and study various problems in society. The groups were then required to propose machine design solutions to the identified problems. Finally, the groups were tasked to undertake the theoretical design and build CAD models for their projects. The students were monitored through individual weekly presentations to the instructor. The approach was seen to be successful to facilitate training in machine design.

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INTRODUCTION AND BACKGROUND

The pedagogy in engineering courses has shifted from the deductive approaches to inquiry/investigative-based learning in which the students are encouraged to undertake their investigations to problems with the trainers (lecturers) acting as supportive figures to offer guidance and control (Wood et al., 2005). This way, the students are positively challenged to reflect critically on the problems and issues in their society and the impacts of their skills to the industry. Such approach cultivates perseverance, free thinking and adaptivity, which are necessary qualities for their future professions. These approaches are very useful when training engineering courses such as machine design (Royalty, 2018). For the approach to work effectively in teaching machine design, there should be enough and relevant facilities such as study books and equipment. Most engineering schools have extensively invested in books, journals and periodicals necessary to facilitate the teaching and training of machine design courses. However, while these materials are important to provide students with guidelines and challenging questions, the problems in those texts are mostly replicable, theoretical and do not sufficiently demonstrate the capability of the student to apply the concepts to real world cases. Hands-on experience is key to satisfactorily training of mechanical engineers and its importance has been underscored by Kolb’s model of learning (Wood et al., 2005). There is therefore need for investment in industrial machines and facilities within the engineering schools to promote this mode of learning. This has been achieved, well, in developed countries and as such, the training of machine design in such schools is advanced, relevant and useful to the graduate students. The lack of training facilities in developing countries such as in Kenya leaves the trainers and trainees with the option of relying solely on the texts.

Most universities in developing world are underfunded and lack the basic training facilities in mechanical engineering. Another challenge with the training of machine design in developing countries is the ‘curriculum’; the contents of the courses are formulated to match with those of the renowned engineering schools in the developed world. This makes it impossible for the instructors to deliver the core mandate of the course to the students and therefore compromising on the quality of the graduate engineers in those parts of the world. The syllabi of the machine design modules in the developing world should have realistic and achievable mandate. This can only be achieved through focusing on the issues of the society in which the universities are anchored (Seif, 1997). Therefore, the trainers of machine design in the developing countries must be creative to guide the students into utilizing their machine design concepts in proposing solutions to the local problems. This way, the students can gain deeper understanding of the underlying principles of the subject rather than just tackling theoretical problems from the developed world.