Chapter 6
Modern Pedagogy Tools in Engineering Education

J. Srinivas
National Institute of Technology, Rourkela, India

ABSTRACT

Engineering pedagogical techniques have received wide attention in recent times. Various fields of engineering have acquainted with progressive teaching methods and training techniques. The concept of pedagogy now has different dimensions. Along with modern challenges in industries, the teaching approaches have been modified in several respects. Earlier teacher training programs are to be upgraded with modern pedagogical concepts. This chapter brings out an introduction and a few application courses following the pedagogical engineering approaches. The concepts of technological pedagogical content knowledge and constructive pedagogy are summarized.

INTRODUCTION

Pedagogy is the act of teaching. It is a Greek word meaning ‘lead’ referring to the progress in teaching concepts for future engineers. The pedagogy employed by the teachers convert their actions into the students’ needs. In general, the teacher is treated as a knowledge holder and students are considered as the recipients of the knowledge. However, the theories of pedagogy identify the students as agents and the teacher as a facilitator. Pedagogy techniques in science and engineering have witnessed tremendous developments during the past two decades (Wilson, 2001; Melonçon et al., 2019). The practical aspects of future engineer’s ability are required

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for modern engineering courses. Thus, teaching with practical skills improves the understanding ability of the recipients.

An object-related reasoning oriented to the design of learning and teaching processes in academic engineering education is very helpful. Modern engineering education has to consider the updates of industrial practice in its curricula and training methods. The International Society for Engineering Pedagogy (IGIP) was formed in 1972. Currently, several universities are working to provide special modules such as engineering education in theory and practice, psychology and sociology, scientific writing issues etc. Slowly, these lead to the development of a curriculum for an advanced training course in the field of engineering pedagogy. Communication between learners and experts is another issue in pedagogy research (Scherer et al., 2018).

Today, due to the developments in computational technology and internet, the webinars and online training programmes help the teachers in developing certain technical modules. However, the regular teaching courses cannot afford the full-time internet orientation and power point presentations at many places. Some other means are therefore necessary. The demand-oriented advanced training is accredited both by the International Society for Engineering Education (IGIP) and by the Scientific Society for Engineering Education (IPW). The IGIP curriculum follows a classical study structure. First, discipline-oriented foundations (pedagogy, psychology, sociology) are taught, followed by selected applications (project work, communication, etc.). The IPW curriculum also focuses on the target group of teachers of engineering sciences. It is a very open curriculum, which can be adapted to the needs of the respective university and the respective engineering sciences. The decisive positive fact is the intensive strive for the pedagogical qualification of university teachers. The exposure of students to the product life cycle gives the technical skills of automation and the critical thinking skills needed to use the contemporary digital design and manufacturing tools. In teaching computer aided design for example, the parametric and feature based modeling tools are required in parallel to core topics such as surface and solid modeling. Likewise, motion simulations and finite element tools are part of the CAD lectures to create interest and utilize the learned concepts. While explaining the pedagogical techniques of design for non-design students, recently the concepts of design based pedagogy were described (Royalty, 2018). It was defined as an education environment with instructional scaffolds that allow students to solve problems through design practice. Such a concept was proved to result in a robust education environment. Similarly, from production perspective, smart manufacturing and automated process planning technologies can be adapted in learning environments to understand more effectively the concepts of manufacturing processes. In recent discovery, it was found that content, pedagogy and technology form a knowledge frame work. Content knowledge refers to the
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