Chapter 2
ICT and Education:
A Review

ABSTRACT

This chapter reviewed the literature on the trends and paradigm shifts in engineering education. Through the literature, the problems in mechanical engineering specifically for the learning of mechanics dynamics were identified. The importance of information and communication technologies (ICT) and the application of computer-aided learning (CAL) in engineering education was discussed. In the last section of this chapter, the theory of learning styles associated with engineering education was studied.

ENGINEERING EDUCATION

Engineering education is regarded as one of the important educational domains in the tertiary education. As defined by Cheshier (1998);

"Engineering education for the professional focuses primarily on the conceptual and theoretical aspects of science and engineering aimed at preparing graduates for the practice of engineering closest to the research, development, and conceptual design functions" (p. 36).

In the earlier days, when the engineering education was introduced, it followed the apprenticeship form with an emphasis on hands-on practical education (ASEE, 1987). Later, engineering education was formalized into

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the academic studies and followed a general pattern of teaching and learning. In general, engineering education involves two distinct learning environments which are the classroom teaching on theoretical knowledge for conceptual understanding and the laboratory sessions to obtain the practical knowledge (Balamuralithara & Woods, 2009).

Recently, the paradigm shift in engineering education raised the attention of the engineering communities and is actively discussed in numerous reports (Auguestine, 2005; Froyd et al., 2012; National Science Board, 2007; Prados, 1998; Wince-Smith, 2005). As discussed by Duderstadt (2008), one of the characteristics for new paradigms of engineering education is the change of pedagogical style that shifted from classroom based pedagogy to active learning approaches that engaged problem-solving skills and team building, by which it is more focused on discovery oriented, interactive and collaborative learning experiences. Table 2.1 summarizes the characteristics for old and new paradigms of engineering education as discussed in details by Duderstadt (2008).

Froyd et al. (2012) identified the five major shifts which have reshaped (the first and second shifts) or currently reshaping (the third, fourth and fifth shifts) the engineering education for the past 100 years. The details are summarized in Table 2.

In response to the aforementioned paradigm shift in engineering education, the engineering communities from academic, research and industry have contributed invaluable efforts. One of the efforts that the engineering community focused on is the utilization of information and communication technology (ICT) to foster the teaching and learning in engineering education (Manjit, 2006; Froyd et al., 2012). Although educational technology is not an ultimate solution for the paradigm change in engineering education, but at least, educational technology supports some of the attributes in the new engineering education paradigm such as support for educational methods that stress active learning; communication, team work, group problem-solving skills; cater to different learning styles and foster more effective learning for engineering education. The issues related to ICT and its impact on education are discussed in section "Computer-Aided Learning (CAL) for Engineering Education."