Chapter 6

Using Real World Applications as Technological Tools in Engineering Education

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ABSTRACT

“Scientia” is the investigation of something to acquire knowledge. This chapter is based on a number of engineering courses taught by the author in recent years. During the author’s delivery of lectures and tutorials, he took the opportunity to use real world applications and situations to arouse interest and enabled students to understand basic underlying principles before progressing to theoretical treatment and mathematical modeling. The abstract nature of the latter is often a hurdle in technical education. The author observes that students are most attuned to matters already in existence – things of common interest that exist in society at large and/or matters that can be found in nature. As soon as each principle is mastered, the author gradually adds more building blocks. The methodology and pace allow the confidence of his students to improve which leads to better motivation. This also provides students with the ability to look deeper into concepts and creates a virtuous environment for both teaching and learning.

INTRODUCTION

When exploring various educational technological tools that can be utilized for teaching and learning in engineering, there is no better means than to first look for their application in our surroundings – in nature, in society or in history.

Traditionally many resources are exhausted on tailor-made technological tools to be used for teaching and learning. In fact, many of these tools are available already and serving us in different ways. They can readily be identified and extended to teaching and learning discourse. These tools can be found everywhere – in school, the workplace, the office, the home, etc. They appear in different forms and applications; and many of them share common principles. Usually when a principle is presented, students with potential should be able to make a connection and group related and unrelated entities.
As well as the benefits from learning from real world technological tools, the chapter describes how opportunities are taken to assess the outcome of learning. Assessments would usually be in the form of a preliminary engineering design exercise, based on technical specification accompanying the tool/equipment. For example, how to design a heat pump using the placard at the back or side of a domestic fridge or air-conditioner? The lack of available information combined with a briefly defined task requires a student to carry out research and thought. Performance assessments are usually based on how close the outcome of each submission is from the in-service tool and equipment. Students initially feel apprehensive but, eventually, find pleasure in learning this way – as can be observed from the maturing quality of their submitted assignments.

Running through the basics before learning and understanding new concepts is important. Students are more ready to accept things that they are used to - and familiar with - in their everyday lives. Therefore, the use of real world technological tools in teaching and learning would be analogous to “the investigation of things towards the understanding of underlying principles in which these tools are based upon”. Once basics are mastered, teachers and students would then be in a position to deliver/accept and comprehend what is complex. Resources can be more effectively deployed on serious tools and equipment for higher learning and scholarly activities.

This has been applied by the author throughout course delivery. Beard et al (2002) describe this as a sense-making process of active engagement between the inner world of the person and the outer world of the environment. It is important for students to experience something first hand and through this concepts/theories become more memorable.

In this chapter, field-based is referred to as field study, fieldtrips, site demonstration and analysis of practice. Learning Beyond The Classroom (LBTC) provides students with opportunities and challenges which can better equip them for the future. It requires practice in environments that closely resemble more realistic contexts (Bearnes et al, 2012). Through LBTC, learning experiences can become clearer and help students make closer connections with the world we live in.

Awareness of different learning styles among students is essential in achieving effective teaching. Different styles have been broadly categorized by Honey et al (1982). In the present technical education context, whilst observing each learner would possess varying degrees of the said learning styles, the author’s positioning is, firstly, in the order of meeting the needs of activists and pragmatists before leading students towards that of reflectors and theorists.

Effort has also been directed towards establishing a constructivist learning environment (Savery et al, 2001) whenever possible. Cooperative/Collaborative learning has been encouraged by means of peer learning (Sampson et al, 2001) and teamwork on problem-based approach (Engel, 1997) assignments. With individuals responsible for their agreed assigned duties, each member is contributing toward the goal of the team and, in the process, team spirit is nurtured. Whitaker (1995) describes the value of small group work, in terms of it being an opportunity for students to reflect collaboratively. Moreover, social interactions among students, such as exploratory discussion and collaborative negotiation help to integrate learning.