Chapter 6
A Problem-Based Laboratory (PBLab) Model for an Electrical Engineering Program

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ABSTRACT

A problem-based laboratory (PBLab) has replaced the conventional instructional based laboratory in Universiti Teknologi Malaysia (UTM) since 2007. The 4th Year Electrical Engineering Laboratory is part of the curriculum of the Bachelor of Engineering (Electrical) program known as the SEE program. The initiative to replace the conventional 4th year laboratory was derived from various issues including feedbacks obtained from former students, industry, and the Engineering Accreditation Council (EAC) that evaluated the program in 2005. This chapter presents an implementation model of a problem-based laboratory (PBLab) that was established as one of the core courses in the SEE program and has been running for the past four years. The preparations made as well as the tools developed to support the implementation of the PBLab will be the main points of elaboration in the chapter. This is followed by description of the of the PBLab model in terms of laboratory conduct, facilitation, activities, and evaluation criteria. Analysis on the performance of students who had undergone the PBLab, particularly, the acquisition of generic skills is included. Finally, examples of feedbacks from the students are highlighted as these are the indicators to measure the level of acceptance towards the overall implementation of the PBLab.

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INTRODUCTION

In recent years, engineering education has changed from lecturer-centered to student-centered learning. In line with the demand from the industries, the traditional engineering laboratory sessions typically consisting of teacher-structured laboratory experiments (Orla C. Kelly & Odilla E.Finlayson, 2007) need to be revised. Problem-based Learning (PBL) is one of the student-centered educational approaches that highlight the importance of the shift from lecturer centered to student centered as an approach to encourage active learning among students (Tan, 2004). Nowadays, PBL is not only being used in classrooms but also during laboratory sessions. Several institutes and universities around the world have already implemented the PBL approach in their teaching and learning (T&L) courses conducted in laboratories (Coral Pepper, *2009*; Srikumar Chakravarthi & Nagaraja Haleagrahara, 2010).

Upon realizing the importance of changing the T & L approach in laboratories, in 2007, the Bachelor of Engineering (Electrical) program or SEE program offered at Universiti Teknologi Malaysia (UTM) has begun to conduct its 4th Year Laboratory in a non- conventional way with the introduction of a Problem- based laboratory (PBLab). Prior to that, the 4th Year Undergraduate Laboratory, one of the core courses in the engineering curriculum was conducted using traditional methods where students were provided with specific instructions and followed a step by step procedure to complete their laboratory tasks.

Research and references about several laboratory models applied in engineering degree programs (Macías-Guarasa, San-Segundo, Montero, Ferreiros & Córdoba, 2005; Moore, 1997; Cline & Powers, 1997; Pan, Liddicoat, Harris & Dal Bello, 2008) have shown that the PBL approach for laboratories courses benefitted the students greatly in terms of enhancing their learning. In addition, the PBL approach has been acknowledged as a T&L method that develops further the students' interpersonal, problem solving, critical thinking and communication skills. These acquirements are also in line with the demand of the industries for graduates to be equipped with the knowledge on how to learn, tackle and solve problems in the real-world as well as posses transferable skills in terms of communication and group work (Mohd. Sahandri Gani Hamzah & Saifuddin Kumar Abdullah, 2009).

The Australian Chamber of Commerce and the Industry & Business Council of Australia (2002) reported that lately, most employers seek generic skills as the main requirements for recruiting workers. Employers seek to retain and select employees with generic skills because these skills can encourage the workers to be more reflective and self-directed in the workplace (Hager, Holland & Beckett 2002).

This chapter presents the implementation of a Problem-based Laboratory model known as PBLab, established as one of the core courses for the SEE program which has been running for the past four years. The preparations as well as the tools developed to support the implementation of the PBLab are elaborated in the following sections. Then, descriptions on the implementation model of the PBLab in terms of laboratory conduct, facilitation, activities and evaluation criteria are presented. Analysis on the performance of students who had undergone the PBLab, particularly, the generic skills acquirements will be discussed. Finally, examples of feedbacks from the students are highlighted as indications on their level of acceptance towards the PBLab overall implementation.

PBLAB CHRONOLOGY

The PBLab history goes back to 2003 when 4th Year Laboratory Coordinators were instructed to propose a laboratory structure for a new four-year Electrical Engineering degree program to commence in the 2004/2005 academic year. The