Enhancement of traditional mode of teaching based on the experience of Project-Based Learning

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***Abstract*-Project based learning (PBL) has become more popular due to its student centered nature of learning compared to traditional modes of learning. However, it is not always feasible to implement it due to several reasons. At the University of New South Wales, the PBL mode was trialled on an introductory Digital Signal Processing course for two consecutive years and the evaluation was previously reported. After that, based on the experience of PBL implementation, some elements of PBL have been incorporated with traditional mode of teaching to enhance the traditional mode and that enhanced traditional mode have been continued. The experience of enhancing the traditional mode with components derived from PBL, particularly the inclusion of conceptual design presentation and laboratory tests, are promising. This paper presents the task description of PBL and experience of how some of the components of PBL can be utilized to enhance the traditional mode of teaching.**

Index Terms— Project Based Learning, Digital Signal Processing, teaching, design presentation.

I. INTRODUCTION

Due to the vast variety of Digital Signal Processing (DSP) based applications in today's technology savvy world, the education of DSP in universities is becoming important. Today many products are embedded with DSP microprocessors and therefore engineers require a thorough understanding and depth of knowledge of DSP. The desire of engineers for education in DSP is acknowledged in [1] and the need for a DSP course in a tertiary electrical engineering degree program is emphasized in [2].

However, teaching digital signal processing course presents challenges in conveying complex mathematical concepts, stimulating students' motivation and addressing individual student needs in a large classroom. Two avenues to address these challenges are (a) increasing the use of educational technological tools and (b) moving towards independent self-directed teaching modes. These modes of teaching, such as problem-based, project-based and inquiry-based learning, motivate the students more, as these modes first present a specific challenge such as a project, problem or experimental data that make the students realize the need for facts, skills and conceptual understanding [3]. This is followed by guiding the students in learning the required materials.

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In engineering, project-based learning (PBL; the acronym, PBL, is used for both problem-based and project-based learning modes but in this paper PBL is used for project-based learning) and problem-based learning are becoming more popular in recent years. In problem-based learning students are confronted with an open-ended, ill-structured, real world problem and they work in teams to identify learning needs and solve the problem without direct explanation from instructors, while in project-based learning students begin with an assignment to carry out one or more tasks that lead to the production of a final product – a design, a model, a device or a computer simulation [3, 4].

Project-Based Learning (PBL) is a self-directed mode of course delivery and students gain knowledge of the course material through designing, investigating and decision-making at each step of the project. Several advantages of PBL are listed in [5].

Teaching DSP in self-directed modes is not common. There are a few instances in [6] and [7] where DSP has been taught as project-based learning and problem-based learning respectively. The University of New South Wales (UNSW) experimented self-directed project-based learning in 2007 and 2008 [8-10].

The purpose of this paper is to present the task descriptions of PBL materials (evaluations of PBL were reported in [8,9]), discuss the problem encountered and present the development and related experiences of how various elements of Project-Based Learning can be adopted into traditional modes of teaching as a way of enhancing the traditional modes of learning and teaching.

II. TRADITIONAL MODE OF TEACHING

At UNSW the introductory DSP course had been taught according to the traditional lecture-centric mode for a long time and then gradually moved towards the self-directed learning mode. The gradual change from traditional lecture-centric mode towards the self-directed learning mode was initially facilitated by the increased use of educational technological tools. The use of these educational technological tools for this course were periodically evaluated and reported in earlier publications, such as the use of the Tablet PC and the electronic white board in [10, 11]. These technologies gradually enabled this course to be a more self-directed learning based course and in 2006 a trial was conducted without any live lectures in a full semester, except for an introductory live lecture in the first week. Here, instead of live lectures, pre-recorded lecture videos were given to