Chapter 13

CDIO Project-Based Learning: Improving In-Depth Learning With iPad-Integrated Projects

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ABSTRACT

Project-based learning is deemed to be effective in boosting student learning experiences and performance. By incorporating a blended learning approach, the use of iPads has been integrated into engineering project in the foundation in engineering (FIE) program under Taylor’s University, Malaysia. The innovative teaching and learning aspects lie in consolidating the student’s interest in playing with their iPad into productive learning by solving engineering challenges through conceive-design-implement-operate (CDIO) framework. The project requires the students to build a robocar to complete a certain challenge, which benchmarked with the public robotic competition. iPad was used for learning, designing, brainstorming, preparing project management documentation, and controlling the robocar. The practice has raised the in-depth learning skill while creatively solving an engineering challenge when they progress into the undergraduate program. The FIE students show better and satisfactory overall learning outcomes attainment as compared to the non-FIE students.

INTRODUCTION

Project-based learning is well known for its effectiveness in boosting student learning experience and performance. In par with the advancement of technology, students are too engaged into their devices for games specifically. Being the only foundation in engineering (FIE) course that actively utilizes iPad as the teaching tool in Malaysia, the idea of integrating the use of iPad into the engineering project has emerged in Taylor’s University since 2012. The innovative teaching and learning aspect lie on consolidating the student’s interest in playing with their iPad into productive learning and solving engineering challenges through conceive-design-implement-operate (CDIO) framework. CDIO aims to provide students with an innovative educational framework stressing on the engineering fundamentals set on real-world systems and products. iPad was used for learning in class through the iBooks that replac-
**CDIO Project-Based Learning**

CDIO Project-Based Learning involves the conventional textbooks, interactive apps for designing, brainstorming, presentation, preparing project management documentation and controlling the robocar. The project requires the students to build a robocar to complete a certain challenge. Depending on the challenge introduced, iPad will play a significant role in the design of the robocar. iPad was used to wirelessly maneuver and control the motion of the robocar through some simple programming in solving the challenges. This practice has raised the fun and excitement with the use of technology to creatively solving engineering challenges.

This project intends to expand the use of technology, iPad into solving engineering challenge by practicing CDIO framework. CDIO is a framework consisting of conceiving, designing, implementing and operating stages that entail the process of developing a solution for a challenge. Incorporating iPad into innovative CDIO project will increase the interest within students while raising their in-depth learning skill throughout the whole project. The effectiveness of this innovative approach lies in the evaluation of students’ performance from different pre-university education backgrounds in the first semester of the undergraduate engineering program.

**BACKGROUND**

In-depth learning has been a key element in many discussions for improving student’s learning experience. It is believed that the development of in-depth learning skill can be achieved by designing a constructivist-learning platform. Instead of spoon-feeding or teacher-centered learning, student-centered learning can bring constructivism into the picture, where learners create their own knowledge from experience and interaction. Frequently, constructivism was implemented through problem-based learning (PBL), which also promotes life-long learning. Students will immerse into the teaching through self-experiencing in solving the problem that activates the medium level of thinking skill in Bloom’s Taxonomy. Many educators incorporate project-based learning as an element for PBL. The students are exposed and required to investigate and apply their knowledge and theory to produce a solution for the real-world/industrial-based problem related to their respective field of study within a period of time. For effective learning, there are five key features of project-based learning: driving questions, situated inquiry, collaborations, using technology tools to support learning, and the creation of artifacts (Krajcik & Blumenfeld, 2006). These five key features are believed to boost the in-depth learning through thinking skill, teamwork and building skill.

Diverse projects have been demonstrated to achieve constructivist and effective learning outcome (Efstratia, 2014; Lasauskiene & Rauduvaite, 2015; Pelech, 2008). The application of project can go into real world application such as investigating the role of building information modeling (BIM) in managing the sustainability of living design (Wua & Hyatt, 2016). The approach allows students to understand the reason to learn, by applying the knowledge into the real world application.

Nowadays, blended learning is a common teaching medium in many institutions. Blended learning is highly emphasized as the combination of online learning and face-to-face in many works and its importance in realizing the variation theory to the learners (Oliver & Trigwell, 2005). Kaur (2013) believes that blended learning serves as a guide in evaluating and integrating the different components (learning environment, instructional and media) by finding the balance point between the components to enhance the effectiveness of learning. Variation theory states that learner learns better when they feel the variation or something different on the critical aspect of teaching delivery (Oliver & Trigwell, 2005).