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## The effectiveness of basic design project (cornerstone) in students' competency development

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### Abstract

Students' lack of ability to relate basic knowledge such as science and mathematics with engineering problems has often been discussed at various levels. As a solution to this problem, a basic design project (cornerstone project) was introduced at the Department of Civil and Structural Engineering of the Faculty of Engineering of Universiti Kebangsaan Malaysia (UKM). Competency measurements have been conducted to determine not only students' ability to apply basic knowledge but also other competencies such as ability to work in groups, communication skills, critical thinking skills and also engineering skills. The study presents the findings of those measurements as well as the intervention done in order to overcome students' weaknesses.

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*Keywords* : Design project; outcome-based learning; learning outcome; measurement and assessment

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### 1. Introduction

The basic design project (KH1013) was first introduced in 2007 to first year students in their third semester. The main objective of the course is to overcome students' obvious lack of ability to apply basic knowledge of science and mathematics to solve engineering problems especially in the field of civil engineering. Basic knowledge skills in science and mathematics are crucial to enable students to solve complex problems and create innovation (Dym, 2004).

In this course, students are given an actual civil engineering project and they are required to solve the problem by first conducting an inter-disciplinary analysis before coming up with a design based on their basic knowledge of science, mathematics and other knowledge learned in school, during matriculation and their first year of university. Although the project is engineering-based, students' abilities in other areas are also developed and assessed.

### 2. Course Implementation

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The KH1013 course is run during the third semester for first year students. Students were divided into groups, with three students in each group. They were then given an actual civil engineering problem to be solved.

### 3. Group Division

Students were divided into 21 groups. Each group consisted of three students from different ethnic group, religion, state, gender, and academic achievement. By forming such groups, it would not only train students to work in groups, but also to understand each other socially and culturally.

### 4. Design Project

Students were given a topography map, a detailed plan and a satellite image of a road area between Kuantan and Sungai Lembing which experiences frequent flood problems. They were required to conduct a study on the area's rainfall, catchment area, river and bridges. A short briefing and a two-hour question and answer session was conducted at the beginning of the project. During the briefing, lecturers from other related disciplines including transportation, geomatics, hydrology, hydraulics, materials strength and structure were also present so that students got to know them and they could seek advice when implementing the project. In week eight, they were required to submit their report and present their proposed solution.

Diagram 1 shows the topography map of the studied area. The map assists them in determining the catchment area and the earth contours for the purpose of calculating the area's annual rainfall. The group then had to propose and design a bridge structure using basic science and mathematics formulas. Diagram 2 shows the area's satellite image which describes the current situation of the studied area. The image provides complete information on the current size and dimension of the river and the bridge. With this information, students could clearly imagine what the area looked like without even going to the site.

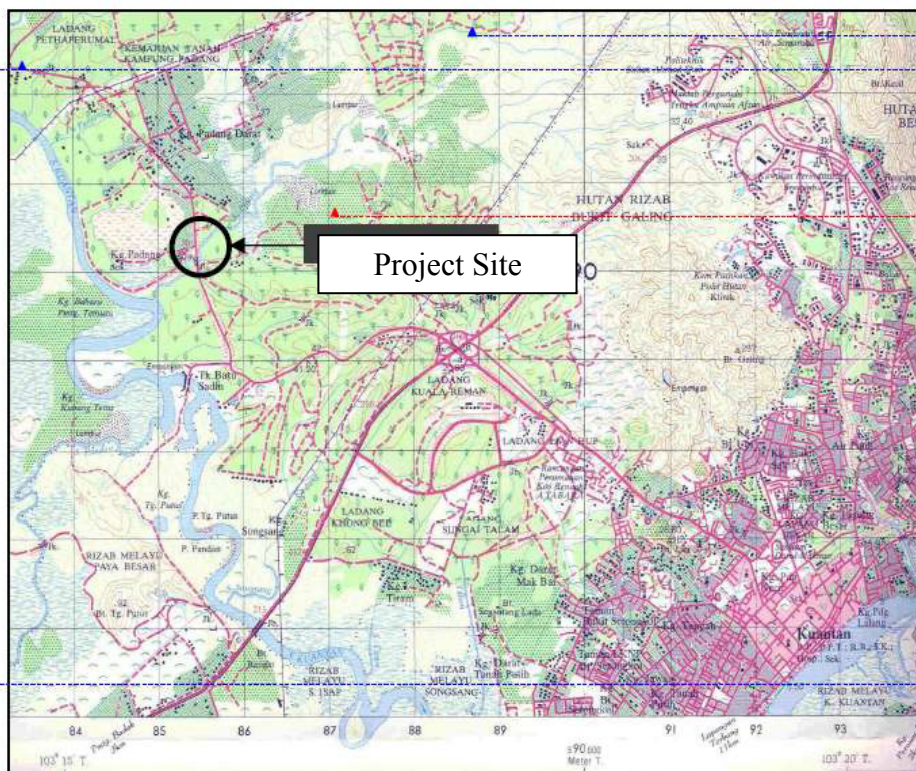


Diagram 1. Topography Map of the Studied Area

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