



2nd International Conference on Higher Education Advances, HEAd'16, 21-23 June 2016,  
València, Spain

## Sequential exercises and Personal Response System in project management courses

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### Abstract

Large classes are becoming a common feature of higher education. Although the dynamics of these classes are very different from smaller classes, the learning principles are still the same. Active learning and students' engagement provide better learning outcomes. There are strategies developed to overcome the limitations of large classes. This paper presents the result of the implementation of two teaching strategies – guided sequential exercises, and collection of instantaneous student responses. The student responses were collected through a Personal Response System (PRS). The strategies have been implemented in a large project management class. The student feedbacks have been used to investigate the effectiveness of these strategies. 323 students participated in formal surveys over four years. The results of these surveys showed that they found the teaching method very effective and the learning experience very interesting. They believed the best aspect of the course was the lecture and its interactive nature. The paper demonstrates how a conventional setting of lecture delivery can be transcended to a pleasant and effective learning experience. The sequential exercises and Personal Response System articulated in the paper can be adopted in other technical courses.

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Peer-review under responsibility of the organizing committee of HEAd'16

*Keywords:* interactive lecture; active learning; personal response system, project management.;

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## 1. Introduction

Active learning engages higher cognitive process in students. Students are involved in question, reasoning, organising and interacting within the subject context. This interactivity makes the learning process more enjoyable by addressing and harnessing the students' attention span. On a more deeper level, the interactive lectures substantially enhance the students' learning (Bates, Howie, & Murphy, 2006). Having discussions, engaging with students, and giving and receiving feedback in small classes is possible through one on one interaction. However, creating this engaging environment is a challenge in large classes.

Undergraduate classes are growing in size. The large classes are more common in foundation studies and the courses common between different majors. In these large classes, the lecture is the mainstream format for delivering course material. Students also expect to receive the material through formal lectures. The lecturer in this system is the centre of attention and is responsible for transferring knowledge to students. However, there is well established evidence that one way communication in the lecture setting does not result in good learning outcomes (Gysbers, Johnston, Hancock, & Denyer, 2011). Students retain only a small percentage of the learning material.

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In this setting, there are technologies developed that make the real time feedback possible and create an engaging environment for learners. One of these technologies is Personal Response System (PRS) also known as Clickers or Electronic Voting System (EVS). PRS has primarily been adopted to enhance the learning experience. It has been used in different contexts and subject areas (Liu & Taylor, 2013; Masikunas, Panayiotidis, & Burke, 2007; Moss & Crowley, 2011; Voelkel & Bennett, 2014; Wolter, Lundeberg, Kang, & Herreid, 2011).

There is a growing demand for project management courses. The number of undergraduate and postgraduate students studying project management is increasing. There is also a demand from other majors such as engineering and business in which students are suggested to undertake courses in project management as their electives. The case study course in this paper is a first year undergraduate course in project management that is common between different programs and therefore involves a large cohort of students. The course is called Project Management Techniques.

This paper presents the implementation of principles of active learning in a large lecture hall through sequential exercises and Personal Response System (PRS) in delivery of this course. The following sections provide a background into the implementation of these teaching strategies and their results.

## 2. Background

The Project Management (PM) Techniques course is a first year undergraduate course common between three different programs - Project Management, Construction Management, Property and Valuation. The course is delivered through weekly lectures and tutorials. Each week is dedicated to a particular PM technique such as project selection methods, Bar Chart, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), cash flow management, and Earned Value analysis.

These techniques are mathematical methods that need to be learnt through practice. Listening to the theories would not lead to learning and proficiency. Students need to engage with the course content and practice what they hear from the lecturer. Further, most of these techniques are step-by-step processes. Students learn the process by going through the steps. If a step is missed, the following steps are incomprehensible. Therefore the lecturer needs to make sure all students are taking the steps and there is no confusion in each step before moving on to the next step.

For example, implementation of Critical Path Methods needs three steps:

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