Chapter 12

Massive Online Open Course Assisted Mechatronics Learning: A Hybrid Approach

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ABSTRACT

Massive open online courses (MOOCs), also known as kind of free and accessible online education environment, have been deeply appeals to people and broadly covered in different medium. Nowadays, it seems MOOCs are everywhere. Originally, MOOCs are designed to offer learning content to the participants who do not have an adequate educational infrastructure, or where cost has become a barrier to educational access. However, as the MOOCs become more popular, an important question need to be asked: how do traditional face-to-face learning students benefit from MOOC environments as well? This chapter introduces MOOCs as an assistant platform to rebuild the course structure in order to tie education more closely to work. The major advantage of this hybrid teaching and learning model is that it is flexible as it allows students to work through materials at their own pace and at a time that is most convenient to them. Although the successful integration of such different teaching and learning modalities is a big challenge, the presented case study and the preliminary experimental results demonstrated the effectiveness of the proposed hybrid methodology.

INTRODUCTION

With the increasing trend towards lifelong learning, open educational resources (such as MIT OpenCourseware, iTunesU, and Carnegie’s Open Learning Initiative) has become important places. However, as (Gillani & Eynon, 2014) pointed out that those online course failed to create a space to offer peer-to-peer learning opportunity, at least at their onset. Ten years later, an exciting new developments in online learning is the massive open online course (MOOC). The term MOOC was born when George Siemens and Stephen Downes first opened up Connectivism and Connective Knowledge in 2008. Since then, MOOCs has gained popularity in the USA especially when a Stanford professor, Sebastian Thrun, of-
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fered an artificial intelligence course in 2011 for free (Hu, 2013). These days, everyone is talking about MOOCs, and the list of institutions that have joined the MOOC bandwagon includes Brown, Columbia, Duke, Harvard, Johns Hopkins, MIT, McGill, Princeton, Stanford, Toronto, UC Berkeley, Virginia, as well as schools in Europe, Asia, and Australia (Little, 2013). In addition, companies like Coursera (Coursera, 2015), edX (edX, 2015), and Udacity (Udacity, 2015), which have been created by professors, researchers, and academics to offer online courses, have also grown fast. For example, Cusumano (2013) reported that there are 2.8 million students has registered with Coursera and sees 1.4 million course enrolments every month. In another example, the first MOOC course (i.e., Circuits and Electronics, 6.002x) developed by edX in 2012 has been signed up by 120,000 people (Breslow et al., 2013).

As the trend of MOOCs is increasing day by day, one of the tools to implement this concept is through blended learning (BL), which refers to an instructional practice that combines teaching methods from both face-to-face and online learning (Graham, Woodfield, & Harrison, 2013). The aim of this study is designing a BL inspired hybrid approach, i.e., led by face-to-face teaching and assisted with MOOCs-based learning, for a specific course, namely, mechatronics, in a higher education environment. Although there has been rapid growth in BL implementation, limited research focused on course-level issues. So, in this chapter we investigated a case study to examine the key issues that can guide other lecturers interested in this endeavour, such as the framework on the implementation of BL, the role of the instructors, and the effect of BL on student learning outcomes.

BACKGROUND

What Is Mechatronics?

Mechatronics is a multi-disciplinary field of engineering that integrates mechanics, electronics, computer science, and control theory. It is at the cutting-edge of creating smarter products, devices and processes. Examples of mechatronic systems include an aircraft flight control and navigation system, automobile air bag safety system and antilock brake systems, automated manufacturing equipment such as robots and numerically controlled (NC) machine tools, smart kitchen and home appliances such as bread machines and clothes washing machines, and even toys.

Mechatronics is the field of study concerned with the design, selection, analysis, and control of systems that combine mechanical elements with electronic components, including computers and/or microcontrollers. Mechatronics topics involve elements from mechanical engineering, electrical engineering, and computer science, and the subject matter is directly related to advancements in computer technology. The term ‘mechatronics’ was coined by Yasakawa Electric Company to refer to the use of electronics in mechanical control (i.e., ‘mecha’ from mechanical engineering and ‘tronics’ from electrical or electronic engineering). Auslander, et al. have defined mechatronics as the application of complex decision-making to the operation of physical systems. This definition removes the specific technology to be used to perform the operation from the definition.

Mechatronics at the University of Pretoria

Mechatronics (code: MEG 421/780) at the University of Pretoria (UP) is designed to serve as a course for both under- and post-graduate level of students which imposes a challenge for instructors. As an introduc-