Chapter 22
A Blended Course to Teach Graphical Programming Using LabVIEW

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ABSTRACT

In this chapter, the authors introduce a blended learning approach where LabVIEW, an e-learning environment, was integrated into a traditional graphical programming course for engineering students to teach advanced topics and to increase the programming skills of the students. In this course, the students were required to design projects using technology. The students designed small projects and frequently accessed the e-learning system to build real-world applications. The projects that students designed stimulated them to use the e-learning system. The impact of blended learning was evaluated on the basis of student surveys and certification test results. Experimental studies show that blended learning produced higher results in the students' self-assessment and certification test.

INTRODUCTION

Over the last decade, learning environments have changed considerably. Gone are the days when the only learning option was a face-to-face classroom experience, where the teacher came in and delivered a lesson or lecture on the topic of the day. Today, learning options include traditional, blended, and fully online education. To teach in these environments, educators have adopted a variety of pedagogical strategies and innovative technologies to enable better learning in higher education (Nistal, 2011; Macias, 2012; Maloy, 2010). The face-to-face strategies have been combined with technological tools and e-learning processes to form blended courses. Currently, 93% of higher institutions say they use blended learning strategies. Furthermore, they expect more than 40% of their courses to be blended by 2020 (Werf & Sabatier, 2009).

It is important to note that both components of blended education (traditional and online) have their benefits and challenges. In fact, no single learning environment is suitable for all learning needs. Educators who are interested in offering blended instruction need to be aware that they will probably require various learning technologies in addition to traditional methods in providing an optimal learning experience that meets the needs of all students. A blended learning program com-

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bines e-learning and traditional learning methods (Bonk & Graham, 2005). Like many advances in educational practice, blended learning is defined and implemented in multiple ways. Statistics show that a number of schools and instructors have adopted blended learning, and the number has been increasing (Allen & Seaman, 2008). As more schools have adopted blended instruction, several different forms and practical usages have evolved. Many educators believe that blended learning is the best solution to today's educational challenges (Mendez & Gonzalez, 2011; Hadjerrouit, 2008; Hoic-Bozic, 2009).

To gain clarity and a deeper understanding of blended learning, there is a strong need to share the best practices in blended education. Additionally, investigating the impact of blended teaching and learning is extremely important. In this way, we can decide the best way technology can be used in the classroom and understand how it will affect student learning (Golden, 2006; Mohammad, 2012; Zhanga, 2006). Several studies have found that e-learning is as effective as or better than the traditional university class structure (Cybinski & Selvanathan, 2005; Gao & Lehman, 2003; Ho & Kuo, 2010). On the other hand, the results can vary according to the content taught, delivery method of the digital content, e-learning integration techniques, and motivation of students (Hasegawa, 2013). Therefore, more studies are required in order to completely understand the overall impact of blended learning in any discipline, particularly in engineering education. Engineering education has to deal with multiple levels of intelligence requiring intensive and one-on-one interaction with the instructor. Engineering students must be able to work across many different disciplines and fields and make the connections that will lead to deeper insights, more creative solutions, and the capacity to get things done.

BACKGROUND

The goal of the blended approach is to combine the best elements of face-to-face and online instruction. Classroom time can be used to engage students in advanced interactive experiences, while the online portion of the course provides multimedia-rich content anytime and anywhere there is Internet access—such as in computer labs, coffee shops, or at home. The students thus have more flexibility in their study schedules (Garrison & Kanuka, 2004). Moreover, there is early evidence that blended instruction can result in learning outcome gains and higher enrollment retention (Lim & Morris, 2009).

Blended learning is gaining popularity in higher education, although there are no rules in place to prescribe what the ideal mix might be. The term "blended" encompasses a broad continuum and can include any form of integration of face-to-face and online instructional content. The combination of face-to-face and online materials varies depending on the course content, needs of the students, and preferences of the instructor.

The following case study explores an efficient approach for blended learning in teaching graphical programming in higher education in Japan. This method has been implemented for science and engineering students in the last three years, and its positive impact on their learning has been demonstrated by the results of student surveys and final exams.

METHOD

A Description of the Traditional Course

In this chapter, a graphical programming course is introduced, along with the details of how the course was implemented in the traditional teaching approach. Graphical programming is most frequently used in the stages of engineering systems