

The Impact of Distributed Learning on Traditional Face-to-Face Learning

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Introduction

The use of technology in education has impacted our lives in meaningful ways. It has provided us with opportunities to rethink how we design and teach our courses, and how we support our students in their lifelong learning (e.g., Castano et al., 2003; Castano, 2006; Hanson et al., 2004; and Castano Bishop and Larrier, 2009). It has also offered pleasant surprises and “aha!” moments, especially when we combine both face-to-face and online resources. This paper discusses an innovative and synergistic approach, referred to as versatile distributed learning, for a computer programming course at Indiana University South Bend.

Brief Overview of Computer Programming Courses

Computer programming courses present a significant challenge to students who seek a degree in computer science. They also present challenges to educators teaching in this field. Recently, in order to attract and retain students the computer science education community has experimented with a number of new approaches to teaching introductory programming classes (Hakimzadeh & Wolfer, 2009). Some of these technology-based approaches have included thematic courses using robotics (Imberman and Klibaner, 2005; Lawhead et al., 2003); games (Barnes et al., 2004); bioinformatics (Khuri, 2008); security (Taylor and Azadegan, 2008); machine simulators (Stone, 2006); and computer graphics (Matzko and Davis, 2006). In addition, research in computer science education has shown that active learning approaches such as those that promote reflective thinking, working in small groups, hands-on activity, dialogue, discussion, and discovery could produce improvement in student learning and retention (McConnell, 2006). Some of this research has specifically targeted underrepresented minorities and female student populations and has shown promising results (Frieze et al., 2006). While these approaches have proven to be effective in increasing student performance and retention, we have found that the use of distributed learning can also serve as an important tool for achieving similar beneficial results in computer programming classes.

Use of Versatile Distributed Learning in Computer Programming Courses

Chris Dede describes distributed learning as “educational experiences that are distributed across a variety of geographic settings, across time, and across various interactive media.” (Dede, 2006). In the recent past, Dr. Hakimzadeh (one of the coauthors of this paper) has been offering computer programming in both face-to-face and online formats. In his online sections, he has been employing some of the approaches and tools relevant to distributed learning. These include: a comprehensive course web site; streaming video lectures; online self-paced laboratories; virtual office hours using Adobe Connect; online and face-to-face tutoring using Adobe Connect or in person; online quizzes; and online chat using Oncourse CL, a course management product based on Sakai).

Although these distributed learning tools and methodologies have provided some flexibility to online students, surprisingly, these tools have become even more effective for students in the traditional face-to-face sections. For instance, in the summer of 2008, Dr. Hakimzadeh's face-to-face students were given access to the online resources he developed for his online students in spring 2008. Moreover, in fall 2008, his face-to-face students gained access to the online resources he developed for his online students for the same semester. His online students from that semester, some of whom were local residents, were encouraged to attend his face-to-face lectures and/or laboratory. We refer to this ability to "swap" educational resources and modalities designed for specific audiences outside of their originally intended users as *versatile distributed learning* (VDL). The versatility comes from students' ability to choose the best mode of learning during the semester. For example if a face-to-face student finds the course too slow, she can get ahead by viewing future lectures online, and working on labs and assignments. If, she misses a lecture due to illness, she can view that component online and catch up before the next class period. Alternatively, if the video lecture does not sufficiently explain a topic for an online student, she would have the option to attend the face-to-face lecture and ask questions in person or participate in the discussions. As will be discussed later in this paper, face-to-face students who took advantage of the online resources tended to stay and complete the course.

The goal of using VDL is to make computer programming more reachable to the aspiring computer science majors as well as students from other majors who take programming to fulfill a requirement for their discipline. The VDL approach leverages the tools and educational materials available for both face-to-face and online students to accomplish performance goals and student outcomes. Equally as important is student retention which is the focus of this paper.

Preliminary Results

For several years, Dr. Hakimzadeh has taught Computer Programming at Indiana University South Bend. Below we describe the impact of VDL tools and methods on both online as well as traditional face-to-face learning.

Between 2003 and 2007, the course was taught a total of five times in a face-to-face format. In spring, 2008 the course was taught entirely online. In the summer of 2008, the course was taught face-to-face but students were given access to the resources developed for the online course. Students were encouraged to use these resources before and after class, and for review before quizzes and exams. In the fall of 2008, two sections of the same course were taught but this time with a new twist. One section was offered entirely online and the other section face-to-face. During the fall semester, he encouraged his students in the face-to-face section to use the online resources, and students in the online section were given the opportunity to attend the face-to-face classes. This twist offered versatility in distributed learning that is both creative and effective.

Early observations from using the VDL approach appear promising, especially for students enrolled in traditional face-to-face classes. Table 1 below provides a summary of our observations.

Table 1. *Student Retention*

	Registered	Successful Completion	%Retained	Teaching Mode	Academic Level	VDL
Fall 2003	9	8	89%	Face-to-face	Graduate	NO
Fall 2004	7	7	100%	Face-to-face	Graduate	NO
Spring 2006	7	7	100%	Face-to-face	Graduate	NO
Summer 2007	12	9	75%	Face to face	Mixed*	NO
Fall 2007	15	9	60%	Face to face	Mixed*	NO
Spring 2008	17	10	59%	Online	Mixed*	NO
Summer 2008	7	7	100%	Face-to-face	Mixed*	YES
Fall 2008	14	11	79%	Face-to-face	Mixed*	YES
Fall 2008	9	2	22%	Online	Mixed*	YES

* *Mixed* indicates combined graduate and undergraduate students were in the same course but approximately 80% were undergraduates

As shown in Table 1, during the first 3 offerings (2003 to 2006) the primary audience for the course was exclusively “graduate” students and the success and retention rate was high. Removing the graduate sections from the mix, the average retention rate in “mixed” face-to-face sections (summer 2007 and fall 2007) was approximately 67% which resonates with national and departmental norms for beginning programming classes. At the same time, the retention rate in the online sections (spring 2008 and fall 2008) is quite low, approximately 46%. Although, efforts are being made to improve the retention in the online offering, what is interesting and worth noting is the retention rate among face-to-face sections in which the students were given access to online course material (summer 2008 and fall 2008). The average retention in these sections is approximately 85%, representing an 18% increase over prior face-to-face offering of the course.

Conclusion

These results suggest that there is work to be done to retain online students. For starters, better screening of online students is necessary. Providing an infrastructure to ensure that students are well-prepared to meet the expectations inherent in an online course could be developed.

The use of online resources developed for online courses by face-to-face students could improve the performance and retention of students in face-to-face classes. Online students seem to not take advantage of the opportunity to attend face-to-face classes, even if the instructor has invited them several times to do so. Lack of participation and use of online resources for engagement such as chats, virtual office hours and online quizzes, seem to correlate with lower performance and higher drop-out rate. The use of versatile distributed learning has opened the door for better accommodations to students’ styles of learning and engagement, pedagogy and instructional support.

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Biographical Sketches

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