New course delivery technologies like cloud computing and mobile-learning platforms will be increasingly important as we prepare to meet the expectations of a new generation of students (e.g., deployed military) in areas where Internet access is not always available and as bandwidth demand begins to outstrip supply. The new generation of students has never lived in times when there was not an Internet, electronic means of instant communication, or mobile devices of all kinds. As a result, their expectations and learning preferences differ markedly from those of the students whom we have served in the past. Likewise, ensuring that the student who enrolls in a course is the same person who is completing course assignments and examinations is increasingly important as new distance-learning delivery systems are chosen by more and more students. This paper describes practical ways implemented by one institution to harness new technologies to serve students at a distance.

The Context

Since its establishment in 1973, Thomas Edison State College has had a single mission: to provide flexible, high-quality collegiate learning opportunities for self-directed adults. Although the methods used to deliver these opportunities have changed radically over the years, the commitment to flexibility and to serving adults has remained constant. All of the College’s students are adults who are completing courses at a distance, and many are in the military. In carrying out our mission, we are committed to providing students with flexible options for acquiring course materials and completing course work wherever they are and whatever their Internet access is. Moreover, the courses and programs we deliver are increasingly media rich, requiring streaming and/or large downloads, and the demand for interactivity, or the feeling of interactivity, is high.

The evolution of course delivery technology began with vinyl records and has progressed through 8-track tapes; cassette tapes; CDs, DVDs and BluRay; and SD cards and flash drives. Now, mobile learning involving (or sometimes simulating) cloud computing affords a portable, light-weight tool that provides students in remote locations where Internet access may be restricted or unavailable with the ability to work in an offline setting and complete online courses anywhere. The technology involved allows for an online experience even when students are offline and overcomes barriers imposed by limited, or no, bandwidth service. Use of mobile learning combined with cloud computing also provides students with the learning experience they have come to expect when they take courses online.

Mobile Learning and Cloud Computing

In general, mobile learning takes place across locations and contexts, using portable technologies and devices such as flash drives and cell phones or smartphones. Mobile learning has become a factor in the replacement of distance-learning with technology-assisted learning. Cloud computing involves creating a repository for information that can be transferred from one computer to another, drawing upon a host of...
networks in the cloud for applications, information, interactivity, and manipulation of data. Thomas Edison State College is in the process of developing simulated, portable cloud computing as an integral aspect of mobile learning.

Meeting student expectations and overcoming bandwidth restrictions have been driving forces in the development of Thomas Edison State College’s mobile-learning initiative. The current and future generations of students do, and will, expect an interactive and multi-faceted experience when they study at a distance. It makes no difference to them whether they are actually connected to the Internet at all times or not. Access to e-mail and the usual suite of word-processing and spreadsheet programs is de rigueur, as is access to electronic versions of text books and other learning materials. Such access, coupled with the growing number and diversity of portable and mobile devices such as cell phones, smartphones, iPods, and ultra portable laptops, has resulted in a cadre of students who prefer not to be constantly tethered to a desktop computer. When these students cannot get to the Internet at all times, such access must be replicated.

Bandwidth restrictions also play an important role. Many of our students do not have continuous access to the Internet because they are in remote places. Indeed, restriction of bandwidth may soon become a factor in many parts of the United States as more and more people seek to use the Internet and as downloads involve increasing amounts of data. In some European countries and in South Africa, such restrictions are already in place. With a bandwidth bottleneck, Internet connectivity is expensive, slow, and unreliable. Civilian students in rural areas and military students who are serving in such places as submarines and the mountainous regions of Afghanistan may have only intermittent or no Internet access at all.

Meeting the Challenge

With a rapidly growing number of students enrolling in online courses, and with online learning outstripping all other current delivery systems in popularity, Thomas Edison State College had to develop ways to maintain access and flexibility for our students wherever they live or work. The College took a two-pronged approach to meet the challenges presented by student expectations and bandwidth restrictions. On the one hand, using flash drives, instructional designers provided for self-contained learning opportunities that are independent of time and place, are not tethered to a computer or wireless Internet connection, maintain the learner’s privacy and confidentiality, and are capable of working anywhere and in any environment. On the other, they developed course modules, assessment tools, and general information and reminders for students that can be delivered to their cell phones.

Specifically, the College’s mobile learning initiative involves the use of a specially prepared flash drive provided to the student and/or cell phone push technology. Untethered as it is from the Internet, the flash drive or cell phone acts as a portable computing cloud in that it is a repository for information to be transferred from one computer to another without the need for downloading, it contains all of the tools necessary for manipulating and sending or receiving data (e.g., word processing, spreadsheet, and e-mail programs), it contains all of the course materials (sometimes including the texts), and soon it will have its own embedded operating system so that it can function independently of a host computer. In short, the technologies allow for the replication of an online learning experience offline. Students can complete course work offline, using the tools and materials provided on the flash drive and then upload their work for assessment by faculty when Internet access via computer or cell phone becomes available.

Development of the mobile learning initiative comprised three phases. Phase One involved the development of a customized program launcher application, a GUI interface with the College logo, and a specialized browser toolbar. These were loaded onto flash drives, which also contain course materials, including assignments, assessments, and other materials, drawn from existing courses. Phase Two
involved the creation of a template for offline delivery of courses via the College’s Course Management System, Blackboard. Again, this was developed for flash drives. And Phase Three involved the development of courses whose modules can be delivered to cell phones. In the earlier stages of this third phase, such delivery was limited to diagnostic quizzes and other materials to help learners gain mastery of specific course modules.

Knowing Who Our Students Are

For all courses, including those delivered via mobile learning, College staff must ensure that the students who are enrolled are the same people who are completing the course assignments and taking the course exams. Student authentication is an area of growing importance and has been pushed to the forefront recently as new legislation has been proposed to mandate it. Such authentication has also been a major focus among higher-education accrediting bodies.

Students enrolled in distance-delivered courses must submit assignments and take proctored examinations. In all cases, the faculty member has only the student’s electronically submitted written work or discussion board comments from which to form an opinion of just who he or she is. Therefore, certain safeguards are invoked to guard against fraudulent practices. These include the following:

- Subjecting student papers to assessment for plagiarism against a database of other papers held by online plagiarism detection services. Plagiarism detection software compares key words, phrases, and general content of student papers against those in an online database and assigns a percentage-of-originality rating to the student paper. References are provided for non-original sections of the work, so that the faculty member may make a judgment call regarding whether or not the work has been plagiarized. The faculty member can then make a decision as to whether a student has plagiarized, simply made faulty references, or done appropriately original work.
- Posing assignments that require students to draw upon personal life experience.
- Posing assignments that require students to produce audio and/or video recordings of themselves in courses in languages and/or public speaking.

When it is time for students to take mid-term or final examinations, they must do so under the eye of a proctor. They may take paper-and-pencil tests in approved proctored settings, or they may take tests online at an approved testing center. Online proctoring is made possible with the use of cameras, audio recorders, and streaming video and audio delivered to a remote proctor in real time. (Ways in which exams can be placed and proctored on the flash-drives are currently being researched.)

In the newest of the College’s testing options, a student who has installed the appropriate hard- and software (i.e., a secure Web browser with lockdown functions comprising a Web camera, an audio link, and accompanying software) on his or her computer may take online examinations at home. With this option, when the student launches the testing software, he or she records biometric identification information via a remote proctoring service. A Web camera also records the student’s face. The facial and biometric information is sent to a central repository to be matched with previously stored information. Once the student’s identity is verified from the central server, the examination is released and delivered online from a central server to the student’s computer. Access to the Internet and other areas from the student’s computer is automatically restricted and the student may see only the test or examination to be taken. The camera (which is now focused on the student’s computer keyboard and screen) and an audio recorder monitor and record the student’s activity throughout the testing period. Sound and video data are continually transmitted to a live test proctor in real time. The proctor can warn the student if he or she seems to be behaving in a suspicious fashion; in extreme cases, the proctor can shut the test down. Likewise the video and audio content are recorded and archived, and suspicious activity is flagged for
observation by the faculty member who will grade the test and determine if a breach of exam security or cheating has occurred and take appropriate steps.

Conclusions

Clearly, mobile learning with portable cloud computing is an up-and-coming delivery system that is well-suited to carrying out Thomas Edison State College’s mission to provide students with flexible options for degree-completion, and to deliver those options to students wherever they live or work. Mobile learning is a technology that is still evolving and that will no doubt be shaped by factors that we cannot currently predict . . . especially those that will involve the future of the Internet as we now know it. However, mobile learning is inherently flexible and scalable. It can be replicated by other providers of education for students at a distance, and it is, even now, serving increasing numbers of students, and serving them well.

Author Summaries

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