A COMPUTER-BASED ASSESSMENT MODEL
FOR COMPUTER AND INFORMATION TECHNOLOGY EDUCATION

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Abstract

This paper describes a project to demonstrate methods to accelerate the preparation of computing professionals for upward mobility in the fields of computer and information technology through vendor certifications and college degree completion. The methodology also has the potential to level the playing field for access to technology education and associated employment opportunities by making delivery of affordable technical education neutral to the diversity of the client base. The project focuses on demonstrating that access to and proficiency in post-secondary computer and information technology education can be enhanced significantly through distance education via computer, specifically the World Wide Web, and outcomes-based assessment via computer-based testing.

The primary strategy is to use the Regents College model of the virtual university that stresses assessment versus instructional approaches for degree programs at the associate and baccalaureate levels in computer and information technology. Project activities culminate with the award the Regents College Associate in Science or Bachelor of Science in Computer Information Systems degree programs. Project participants will earn general education credits through examinations offered by Regents College and technical credits by examinations such as those offered by the Institute for Certification of Computing Professionals (ICCP). Students also are able to apply credits earned by examinations for various IT vendor certifications, e.g., Microsoft, CompTIA, Novell. All examinations are administered through a national network of examination delivery centers. Examination preparation is available on-line through specially developed guided learning modules in self-paced and facilitated modes.

As computer platforms and the Internet's World Wide Web become more prevalent as vehicles for educational delivery and assessment, these innovative programs of educational delivery at virtual universities will offer solutions to the looming crisis in engineering and technology employment. This project relies on access to personal computers and the Internet. With that, the proposed approach offers opportunities are particularly vital to displaced workers and those historically underserved and underrepresented in technical higher education. The project seeks to create a replicable model of use to other distance learning based programs and institutions.

Background

Post-secondary education "at a distance" has evolved tremendously since the early days of extension programs, correspondence courses and external degrees.   More than 750,000 students were enrolled in an estimated 25,000 courses during the academic year 1994-1995. In 1995, more that 3,000 students received degrees and nearly 2,000 earned certificates by enrolling in distance learning courses exclusively.[1] Perhaps no technological innovations have had a greater impact on education and information technology development than the computer and the World Wide Web. In the last quarter-century, the personal computer has revolutionized the way Americans get their information and communicate with each other. It is no surprise that formal educational enterprises have also been computerized to the point where over 10,000 college courses (and some entire degree programs) are available at a distance--and increasingly on the Web--and proficiency testing by computer is commonplace. There is virtually no potential student any place in the world or in any lifestyle condition who cannot be accessed, instructed and evaluated electronically via a phone connection and computer, and at increasingly affordable prices. In today s marketplace, access to computers and on-line services is more a matter of choice rather than cost, meaning that socioeconomic status is not a deterrent to having access to technology. Virtual universities, which take full advantage of this new computing environment, hold the promise to revolutionize education delivery in the 21st century.

During the 1996-2006 decade, employment in science and engineering (S&E) occupations is expected to increase at more than three times the rate for all occupations. While the economy as a whole is anticipated to provide approximately 14% more jobs over this decade, employment opportunities for S&E jobs are expected to increase by about 44% with nearly three-fourths of the increase to occur in computer-related occupations.[2] Yet, current market conditions show a marked shortfall in college-trained computer and information technology (C&IT) professionals to the degree that the demands and compensation levels for professionals with post-secondary education evidenced by vendor certification and partial degree completion rival those at the baccalaureate level.

The recent study known as Workforce 2000 indicates that the majority of new workers in the next century will come from among groups--women, minorities, and the disabled-- traditionally under-represented in S&E. The expanding need for technically trained workers in C&IT demands expanded access programs to offer technical training and education to members of these groups. At the same time, the massive structural shift of America's corporate workplace to a service economy has created a glut of displaced workers, many of whom are mid-career professionals now in need of technical re-training and re-education to re-enter the workplace. Ironically, some studies even show a severe problem of civilian under-employment of highly-trained individuals emerging from the U.S. military services, arguably the most technologically advanced fighting forces in the world. The U.S. workforce of the 21st century will be increasingly diverse in many dimensions and must be increasingly competent to the challenges of the global marketplace.

The Information Technology (IT) Profession

One distinguishing characteristic of the IT professions is the prevalence of vendor-based credentialing (i.e., certification of proficiency with proprietary commercial products, e.g., Microsoft, Novell, Oracle, Cisco, CompTIA) as opposed to academic credentialing of general and discipline knowledge (i.e., college degrees and school diplomas). Certification earns for the individual industry-wide recognition with credentials signifying specialized technical product knowledge which enhances employability—significantly. This is due in large measure to demand for "currency" in the rapidly changing nature and sophistication of IT products with which the typical college curriculum cannot keep pace. However, as the IT field continues to mature, the preparation of college-trained and credentialed manager, groups leaders and executives will become increasingly important. Advancement and leadership positions will require many of the non-technical skills that general education acquired at the college level provides. Even at entry level, the college degree is still a clearly desirable credential.

Many practicing IT professionals, and some aspiring one, have earned college credits but have not earned the college degrees they need to advance further in their careers. Many do not have the time or opportunity to take college courses in the traditional mode, i.e., day or night classes offered in face-to-face meetings at designated times during regular terms. However, many have or want vendor certifications attesting to their practical knowledge for which they seek college credits. Moreover, many are skilled independent learners who can or prefer to study at their own pace (and in their own space) using modern technology tools, e.g., the personal computer and the Internet. This learning style may well suit many other potential IT professionals who may be dealing with similar barriers (be they real or perceived), but could be taught to overcome them.

The Regents College Model

Regents College, the First Virtual University in America, is founded on the belief that what one knows is more important than where or how that knowledge was acquired. As an assessment and evaluation institution, the College offers no course work itself, but rather recognizes credit from other institutions and validates learning acquired by many methods. With no residency requirement, the College recognizes students knowledge and competencies demonstrated through alternative modes: traditional college courses delivered by other regionally accredited institutions, including those delivered at a distance through various media (e.g., print, video tape, Internet); college-level courses delivered by business, industry and the military and validated by the American Council on Education; and special and portfolio-based assessment; and **credit by examination**. Currently, approximately three-fourths of Regents College students meet program requirements by taking examinations.

> Among institutions of higher education, there is an erosion of educational monopolies and the need for these institutions to support the changes that technology offers if they plan to remain competitive in attracting students during the 21st century. If learning can be successfully validated by **assessment** techniques, then controlling the processes of **instruction** loses its primary quality assurance role. [3]

Regents College is one of the few institutions which de-couple assessment and instruction for

educational credit and degree award. The College insures quality in its programs through an Outcome Assessment Framework closely matching the evaluation criteria of the Accreditation Board for Engineering and Technology (ABET).

The model of the virtual university as embodied by Regents College is instructive as an innovative alternative to traditional technology education.   The practice of validating learning in various modes proffers technical education credentials to a broad base of clients. As computer platforms and the Internet become more prevalent as vehicles for educational delivery and assessment, the innovative programs of educational delivery at virtual universities will offer real solutions to a looming crisis in engineering and technology employment and college enrollments by providing opportunities for re-educating displaced workers and providing enhanced access to technical education for individuals heretofore disadvantaged by artificial barriers.

Goal

The purpose of this project is to demonstrate that access to and proficiency in post-secondary computer and information technology (C&IT) education can be enhanced significantly through distance education (via computer) and outcomes-based assessment (via examination). Specifically, the project goal is the validation of the Internet as the delivery mode of educational services and computer-based examinations as the assessment vehicles leading to vendor certification and degree completion. The ultimate goal is to demonstrate a leveling of the playing field for access to technology education and associated employment opportunities by making delivery of affordable technical education neutral to the diversity of the client base.

Strategies

The over-riding strategy is to use the Regents College model of the virtual university which uses assessment vs. instructional approaches for degree programs at the associate and baccalaureate levels in computer and information technology. While many sources of credit are acceptable by the College, the focus of this project will be computer-based distance educational services delivered via the Internet. Primary emphasis will be placed on credits earned by examination delivered through a national network of computer based examination centers.

Project Description

The purpose of the project is to determine the efficacy of Internet-based preparation and computer-based examination for degree completion and professional certification compared to alternative approaches. In fact, the project is designed as an experiment with a control group pursuing the degree and certification requirements in a conventional classroom setting while the experimental group pursues project objectives exclusively via computer. Current conventional means for completing these requirements as well as other educational services associated with degree completion will be offered to the experimental group via the Internet: assessment of prior educational credits; enrollment and fee payments; courseware including guided learning packages; advising, counseling and tutoring services; preparation for computer-based examinations for general education; and preparation for computer-based examinations and assessments of technical proficiency.

Examination Preparation

Since outcomes assessment is in the form of examination performance for experimental participants, the successful preparation for examinations is absolutely critical. For experimental participants, the preparation is designed to be self-paced with periodic tutorial assistance--but not formal instruction. For the general education and information technology exams, guided learning packages will be provided for all test takers. Currently available packages are generally in the form of print materials (textbooks, workbooks, monographs), audio tapes, video tapes and CD ROM's. In the conduct of this project, guided learning packages will be "upgraded" to electronic format accessible via the Web. The upgraded multi-media packages will have streaming audio and video content material available on demand with built-in tutorials, adaptive practice tests, etc. Professional instructional designers and commercial authoring software (e.g., Lotus Learning Space, Media Magic Director, WebCT) will be employed for this task. Student will prepare for examinations with personal computers at home or in campus computer centers with 24-hour access to the Internet. All examinations will be administered at local Sylvan Technology Centers.

Preparation for vendor certification examinations will take two forms. Control group participants will enroll in traditional classes typically spread over 10 – 12 weeks. Experimental participants will prepare electronically over the Web using learning packages prepared by private "vendor training partners". For half of the experimental participants, the preparation will be self-paced and facilitated in much the same manner as for the general education and IT exams. However, the other half will prepare via electronic instruction on the Web, i.e., by meeting regularly scheduled classes on the Web with a live or taped instructor and opportunities to interact with the class albeit asynchronously. All vendor certification examinations will also be administered at Sylvan Technology Centers.

Note: The balance of this paper will address activities directed to the College□s Associate in Science in Computer Information Systems degree programs which requires 30 credits hours in the arts and sciences component (general education) and 30 credit hours in the technical component comprising core requirements and electives.

Experimental Design

This project is designed for students to complete the program of study at Regents College for the Associate Degree in Computer Information Systems (CIS). Since Regents College is an assessment and evaluation institution offering no instruction, students pursuing this program may collect credits in a totally traditional fashion, e.g., by taking courses that fulfill the Regents College degree requirements but in traditional classroom environment

The entire curriculum at Regents College can also be completed entirely by examinations of three types--general education, information technology, and vendor certification—which map onto the specific degree requirements. These examinations were chosen because they all have been evaluated for college credit by ACE or Regents College and they are all administered through a recognized national network of examining centers.

Student participants will be selected from a population of students who have already completed 30 credits (15 in general education and 15 in the technology component) at a traditional college for the Associate's degree in CIS. This is approximately the halfway point of a nominal two-year program of study. The remaining 30 credits required would also be equally divided between general education and technology.

Two groups of participants will be selected: the control group would continue into the second year of study in the traditional classroom mode completing 30 credits by passing 10 courses; students in the experimental group will complete all of the remaining 30 credits by passing 10 examinations. In each group, three credits will be earned through courses or examinations that satisfy vendor certification requirements. The content materials for the two programs of study will be matched.

All students will remain on the campus of their current residence. Examination preparation for the experimental group will be self-paced but enhanced by written and electronic (audio and video) materials plus facilitation on the Internet, i.e., Web-enabled. Tutorial assistance will be provided for all students, but only the traditional students will receive instructional assistance.

Program Plan

A   SET-UP AND PREPARATION   Month 1 – 6

Assemble the project team and meet with Advisory Council and external evaluator.
Develop all elements and instruments of assessment and evaluation plan.
Develop examination preparation materials and delivery systems for examination group.
Solidify logistics and infrastructure for all delivery venues.
Screen and select program participants.
Finalize curricula for classroom and examination modes.

B   PRE-PROGRAM ACTIVITIES   Month 7 – 8

Conduct focus group meetings and interviews with program participants.
Conduct preliminary testing and evaluation.
Collect data and information for program implementation.
Provide supplemental preparation, including coursework, to standardize starting point
for all participants.

C   PROGRAM CONDUCT , PART I   Month 9 – 12

Requirement	Classroom	Exam type	Exam type (alt)
Gen Ed	Soc Sci elective	Soc Sci	Amer Dream

		(CLEP)	(RC)
Gen Ed	Soc Sci elective	"	"
IT (Architec)	IT course	(ICCP)	(RC IT)
IT (Data Struc)	IT course	(ICCP)	(RC IT)
IT elective	Vendor cert course	CompTIA exam	Novell exam

D   MID-PROGRAM ADJUSTMENTS Month 13

E   PROGRAM CONDUCT, PART II   Month 14 – 17

Requirement	Classroom	Exam type	Exam type (alt)
Gen Ed	Phys Sci elective	Nat Sci (CLEP)	Anat & Phys (RC)
Gen Ed	Phys Sci elective	"	"
IT (HL Lang)	IT course	(ICCP)	(RC IT)
IT (Sys Analy)	IT course	(ICCP)	(RC IT)
IT elective	Vendor cert course	Microsoft exam	Novell exam

F   POST-PROGRAM DATA COLLECTION   Month 18

G   EVALUATION SUMMARY   Month 19 – 24

Evaluation and Assessment

Evaluation and assessment are at the heart of the virtual university model that Regents College represents. The Regents College Outcomes Assessment Framework[4] is concerned with outcomes, inputs, and the educational environment and is committed to being capable of measuring progress toward making programs relevant and attractive to students and connected to the broader community. At Regents College, the most important and challenging aspect of being a virtual institution is assuring quality through measuring outcomes, i.e., **assessment.** In addition to recognition of academic validations by other institutions, assessment takes place in two formats: individualized (special and portfolio assessment); and specialized (written proficiency and performance examinations). The attention to assessment and academic outcome measurement is at the heart of the curriculum both in general education and in specific programs. The tools of assessment and benchmark processes are in constant review to maintain the integrity of the assessment process. The overall quality assurance framework includes validations by the American Council on Education (ACE), national accreditation bodies (like ABET), and special

certifying and credentialing agencies.

In this project, evaluation instruments will be developed to determine the efficacy of this design. Quantitative measures of client performance on exams and courses will be developed as well as survey instruments to measure program effectiveness qualitatively. Statistical and other analyses will determine meaningful tests of the project☐s hypotheses. In the end, definitive statements about this innovative approach to educational delivery should emerge.

Summary

Enumerating its key objectives can summarize this project: (1) demonstrate viability of computer-based learning and assessment for professional certification and degree completion; (2) provide technical education through means neutral to the diversity of client base; (3) offer potential solutions to employment needs in information technology; (4) develop model to bridge the "digital divide" between computer haves and have-nots; (5) create a replicable model of computer based distance education. The overall objective is to validate the virtual university as embodied in the Regents College model as the leader in innovative technical education for the 21st century.

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