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**PRE-CALCULUS: DISCOVER THE POWER OF WEB-ENHANCEMENT
WITHIN AN INTERACTIVE VIDEO COURSE**

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Introduction

As many U.S. colleges are facing overcrowding, Garrett College is gearing up to open its doors to the entire community. Though many people taking advantage of the distance learning opportunities can do so from their homes, the college is offering a series of courses in mathematics and other areas that require the use of compressed video technology and a knowledge of how to take advantage of the services offered on the Internet. The college is helping to create a new “global village”: one that stretches far beyond the farming community where educational news once traveled largely by word of mouth to newly identified educational sites where one can choose a course or program by the pointing of a mouse or the turning of a TV channel.

The Plan: GC²_{DL} Web-Enhanced Pre-Calculus

The plan to incorporate technology, web-based homework and cable communications to the home in a distance-learning Pre-Calculus course at Garrett College in Western Maryland, USA, was piloted in Spring 2001. The web-base Interactive TV course is offered **via cable** to the home, to dual enrolled remote site high school students (one class each at Northern and Southern Garrett High Schools), a college ready class on the main campus and a fiber optic MIDLN (Maryland Interactive Distance Learning Network) classroom at each of the four sites. These classrooms resemble TV studios where students communicate among studio sites in real time. Technological tools are available to aid teachers and students in content delivery. Computers with Internet access, symposiums, electronic whiteboards, graphic calculators, laptop computers, laser discs, document cameras, VCRs, and flatbed scanners illustrate some of the technology used in each classroom. Research has not yet indicated which technology tools actually make learning efficient. But as a practitioner, this instructor knows that appropriately selected technology can work together transparently and seamlessly to enhance classroom learning. Electronic learning environments in both

public and higher education settings are changing the current learning paradigm from that of information transfer to a new paradigm which actively engages the learner and uses technology to enhance learning for each individual. However, distance learning design concerns should always contain some basic considerations. Hart (1996) describes a survey of University of Hong Kong faculty members that investigated preferences for classroom features. There was little agreement on the “perfect” technology based classroom. Riley and Gallo (2000) conclude that the best technology solutions can’t be effective if the learning environment is not comfortable. Reflecting on current and expected changes in pedagogy and technology, Blackett and Stanfield (1994) advocate remembering three principles for general classroom planning: 1) plan for the full range of teaching methods, 2) plan for change and flexibility, and 3) focus on the exchange of ideas and acquisition of knowledge. Wilson (1993) reported the thoughts and projects of higher education professionals exploring the issue of high-tech classrooms. He discusses that distance learning (DL) inclusion in a schedule is an indication that industry and academia have welcomed technology as a method of making the training and education process more effective, efficient and immediate. According to Wilson, institutions and companies refusing to adopt technology as a part of their training strategies are now viewed as archaic and non-conformist.

Presentation of the Distance Learning Segment

The presentation team will provide participants with a multi-media slide show which will depict a panoramic view of the: 1) Verizon Fiber Optic MIDLN Classroom, 2) Interactive Video Network (IVN) Compressed Video Classroom, 3) High Speed Interactive Conference/Classroom, 4) The Multi-Media Mathematics Classrooms 1 and 2, 5) Mathematics Media Resource Center, and 6) other locations with high technology support for learning mathematics. The team will then show Pre-Calculus instructional support slide shows prepared by the instructional team using WordPerfect Presentations or Authorware.

Web-Enhanced Distance Learning, Assessment and Pre-Calculus

The GC²_{DL} College Algebra/Pre-Calculus course sequence is a web-enhanced college level multi-media distance learning mathematics course sequence offered for both high school and college level students simultaneously in different locations. The Garrett fiber-optic electronic classrooms (e-classrooms) were funded in part including all electronic equipment, by a grant from Bell Atlantic (1994) and upgraded by a Verizon grant (2002). Each classroom has the same color scheme and the same electronic support system which allows the teacher to control front and rear cameras, fax machines, VCRs, and document camera during classroom presentations. The purpose of the web-enhanced GC²_{DL} Pre-Calculus Course Project is to enable public school students to remain in the mathematics pipeline while in high school by providing a smooth transition into college level mathematics after the completion of Algebra II. Dual enrolled high school students receive a fifty percent reduction in college tuition which is an added incentive to take college level courses.

Placement testing (COMPASS or Accuplacer) is mandatory for all students entering the Community College System in Maryland. Garrett College requires the COMPASS (Computer-adaptive Placement Assessment and Support System) developed by ACT (ACT, 1994) and uses their national cut-off scores for placement.

The GC²_{DL} Web-enhanced Pre-Calculus course was designed by the Garrett College Mathematics Department Chair with assistance from Garrett College and Garrett County high school faculty. The web-enhancement was funded by a state WhyTech grant in 2001-2002. The structure of the course allows for traditional and non-traditional student enrollment. Students may take the course via cable or attend an e-classroom. A maximum of four e-classrooms can be connected for each teaching episode, allowing students to see and hear each other on TV monitors located in each classroom. The teacher identifies what needs to be learned and the student helps identify the means by which the learning occurs.

It is quite common for the drop/fail/withdrawal rate of traditional, college/university entry level mathematics courses to fluctuate between 40 and 60 percent. Since this Pre-Calculus course is primarily designed for the student not in the AP track at the high school, it is important that college algebra be a pre-requisite for this course. College level students, including adult learners who passed the placement test, can take the course with high school students. It is not the intent for the GC²_{DL} Web-enhanced Pre-Calculus course to replace mathematics courses offered in the high school curriculum. The Garrett Mathematics Department developed distance learning College Algebra for the fall semester and Pre-Calculus for the spring semester each year starting in Fall 1996. The new multi-media distance learning pilot of the GC²_{DL} began in Fall 1999 with the College Algebra course and continued through Spring 2000 for the Pre-Calculus course. The course will be offered as a web-enhanced course within a Blackboard management shell for the first time in Spring 2003.

The GC²_{DL} Web-enhanced Pre-Calculus course is designed as a college level course. The Department Chair is the instructor for the course and spends approximately one-fourth of the instructional time at each of the four sites. Three adjunct math faculty rotate to the other three sites. The team has trained and worked together for six years. The instructional goals and objectives meet the requirements of the college level course but also identify the Maryland Core Learning Goals, Content Standards and Bridge Goals associated with algebra and geometry in the state plan for Maryland. Any modifications to the GC²_{DL} Web-enhanced Pre-Calculus course are made at the college level although some high school teachers have input prior to the finalization of the course.

The GC²_{DL} Web-enhanced Pre-calculus course will consist of the following components:

Reading Assignments:

The GC²_{DL} Web-enhanced Pre-Calculus course uses the Addison Wesley, Algebra and Trigonometry 6th Edition textbook by Keedy, Bittinger, and Beecher (Chapters 6-11) for the skill portion. Other textbook options will be investigated as course development continues.

Mini Lecture/Problem-solving Activities:

The GC²_{DL} Web-enhanced Pre-Calculus course is using a series of mini-lectures, multi-media slide shows, CDs, videotapes, and problem-solving activities such as the mirror problem and the handshake problem created and used by the instructor since 1996. Well-scripted lectures are important since the course is viewed by Cable, Channel 99, subscribers.

Instructor E-mail, Web-based and Other Electronic Communications

The instructor will provide a web-site (blackboard.frostburg.edu) where students will access assignments, activities, and research information. Students will also communicate with the instructor via telephone (301-387-3045), e-mail (npriselac@garrettcollege.edu), and fax machines (office 301-387-3189) and campus (301-387-3055). The Math Center is open from 8:30 a.m. until 6:30 p.m. Monday thru Friday and by appointment on weekends.

Critical Thinking/Computer Homework Activities:

Students are instructed with a computer software package, Derive. The Derive introduction activity is offered during class time. A minimum of three selected laboratories are required as homework assignments: (a) Trigonometric Functions, (b) Symmetry, and (c) Functions.

Interactive Computer Activities with On-line Activity Sheets:

The Spring 2003 GC²_{DL} Web-enhanced Pre-Calculus course will use a newly generated instructive set of computer homework activities developed by a team of instructors at West Virginia University (WVU) for use in their web-based Pre-Calculus course. Students will use the *Mathwright* (freeware) software package for laboratory homework assignments. These laboratories will be used to develop mathematical reasoning skills. They will emphasize connections among numbers in tables, algebraic analysis, and graphs. Since many Garrett math students transfer to West Virginia University in a variety of engineering programs, Garrett formed a partnership with WVU to use the computer laboratories required on the WVU campus.

Homework Activities:

Homework assignments are posted on the web (blackboard.frostburg.edu). Assignments include a research paper and a 3-D project. Chapter tests from the book are graded as quizzes. Projects, laboratories, and research activities are all graded as homework assignments.

Tests:

Tests are given at the end of each chapter in a supervised setting. Students taking the course via cable must come to the campus to test. Students must obtain a 70% score on the departmental exit exam to successfully complete the course.

Grades:

The student grade will be determined by the instructor of record based on the exit exam. Averaging of tests, quizzes, projects, homework, and laboratories occur only if the exit exam is passed with a minimum 70% competency as defined in the course syllabus.

Summary

We must continue to research major factors in distance learning instruction that have an effect on satisfaction, teaching and learning. These factors include ergonomics, environmental conditions, faculty training, staff partnerships, seamless fusion of technologies and technology integration into the curriculum.

According to Coppola and Thomas (2000), among the expected changes in the world of higher education are: established standards of learning proficiency; a focus on what students really need to know; an individual learning plan for each learner; more instructional time; varied technology to help students master their learning goals; a better system of diagnosing learning difficulties and prescribing effective remedies, more individualized instruction for skills learning; a focus on lifelong learning; and more collaborative group learning. Teachers must become facilitators of learning rather than disseminators of knowledge.

The e-classroom designed by Verizon may seem like a large capital outlay but it is not much higher in cost than a typical instruction-based computer classroom to furnish and equip. The per room operational cost via a dedicated compressed video network with appropriate band-width has created a high cost factor which must be recognized.

In the last two decades of the 20th Century, educators have watched resources like computers, the Internet, and multi-media presentations change the method and practice of education at all levels. It stands to reason that the next decade will provide us with possibilities and challenges we cannot yet image. Presentations are going beyond basic multi-media slide shows. Attention is now directed toward assessment as we document how students learn, and how teachers teach. Keep that thought and reach out and touch the future.

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