Teaching Engineering via PictureTel

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At Penn State New Kensington and Penn State McKeesport, a pilot lecture/problem-solving course in Strength of Materials **was** taught using distant learning techniques (via PictureTel). This paper shares experiences with improving instructional techniques using this new technology.

Technology has advanced dramatically during the past two decades. Computers and their applications are part of every aspect of our lives. They are embedded in the control systems of our cars, are used in the video phones new on the market, and they are used in the cash register at McDonald's. As new technologies become part of everyday experience, we must make them part of the educational experience. We need to put down our chalk and pick up a pointing device using current technology for communication and presentations. Development of the telescope propelled advances into outerspace. Development of the electron microscope propelled advances in interspace. Fiber optics and distant video-conferencing will move industries forward more rapidly. These technologies propel advances in instruction and learning for today's students.

The demographics of higher education are changing rapidly. Many non-traditional students are returning **to** our classrooms **to** learn and be retrained. Many corporations **are** in need of retraining for their employees, and students may **want to stay** at home and be retrained via distant education techniques. We must teach them with new processes for learning. Traditional students have grown up with television, computer games, and fast food restaurants. Development of new instructional presentation techniques needs to occur in order to keep up with the dramatic changes occurring all around us.

Distant learning and multimedia presentations can be offered at distant locations around the world. Tomorrow's students will be sitting at a computer terminal, and will be receiving instruction over fiber optic cables from universities that are thousand miles away. We, as faculty in the Commonwealth Education System of Penn State, are located at eighteen sites around the state. The concept of distant learning is increasingly present in our university and will become more prevalent in the future. Faculties need to be ready for these changes. We must learn to develop multimedia based teaching and its conversion to distant learning processes. These instructional processes are quickly encompassing the Eberly College of Science and the College of Engineering at Penn State. The faculty of the CES at Penn State are actively involved in this process.

The first step is understanding the capabilities of the tools available today. We will attempt to show the process for developing distant learning using PictureTel as part of the instructional delivery mode for a Strength of Materials lecture/problem-solving course. One advantage for this specific course was the laboratory component that was handled in the traditional method at each site, which allowed additional interaction with the students and any problems they may be having.

If distant learning is **to** take a viable place in the education of future students, it is absolutely necessary to develop effective methods of delivery without sacrificing quality. This paper briefly discusses the following topics which are some of the experiences from both the faculty and students **at two** distant sites using PictureTel instructional delivery methods.

I. General Considerations for Delivery of Informs tion
II. Equipment and mode selected
III. Developing Proper Instructional Methods
IV. Instructional Motivation
V. Evaluations for Improvements
VI. In-class experiences
VII. Summary "

I. General Considerations for Delivery of Information: Colleges and universities around the world are being asked to deliver more for less cost. Downsizing cost effective techni ques, distant learning, multimedia presentations, home based education, are all part of our life style today. The authors believe consideration needs to be given to the learning curve of all these changes coming so rapidly. Are students as well, better-off, or worse with these new techniques. Is distant learning another way for universities to teach under prescribed sections with a single faculty and a couple of interactive computer based delivery systems.

The costs of PictureTel units or equivalent is not minimal. Costs of each end could reach 30 thousand dollars before instruction starts. So the concept of lowering initial costs are exaggerated, but long term savings need to be determined. Compressed video today, as PictureTel, is going to be outdated very quickly. Better delivery systems at a lower cost are just around the corner. Today's faculty is the vanguard of instructors needing to develop acceptable instructional techniques using the equipment available today. As distant learning capabilities are constantly improving, costs are decreasing. Initial equipment costs, even though critical, will not stop the process. Most universities appear to want to absorb these costs today as they perceive them to eventually be cost savings down the road. They also view the purchases as essential to being current state-of-- art, and be able to capture the projected markets that will develop.

As the industrial/business base of our country changes from large corporate giants to the small and medium size upscale organizations, delivery of educational packages will become focused to those universities able to have prepared for these changes. Continuing education components of most universities see this as essential for their ability to deliver programs to a few people, at a variety of locations economically. Resident instruction will be close behind, particularly at those universities/colleges dispersed around regional or statewide locations. Penn State is a university that has 18-24 remote locations offering resident instruction. It has over 100+ locations focusing on continuing education, within Pennsylvania alone.

II. Equipment and mode selected: The equipment used to instruct the course is present PictureTel units. At each location a monitor, camera, and document reader with separate camera was available. The control of the system was up to the individual faculty at the sending site. The receiving site had a technician on hand for start-up and trouble shooting.

III. Developing Proper Instructional Methods: The lectures were initially taught using a typical black/white board with additional instructional notes in handout form. Predeveloped diagrams and/or detailed information was best delivered using the reader board with its separate camera. Initial adjustments were necessary in order to allow the time delayed video reception site to see lecture notes presented on a board without a hand shadow blocking part of the presentation.

IV. **Instructional Motivation:** As this and other courses are developed, multimedia interactive computer presentations should enhance the delivery of materials at distant locations. This however, is an entire additional series of processes that need to be presented separately. As faculty become more in tune with distant learning capabilities, instructional techniques will improve and learning motivation will surely follow.

The integration of distant learning techniques into the curriculum should be accomplished in a way that does not distract from the effectiveness of traditional instructional techniques. It needs to be done by implementing appropriate workshops for instructors to learn and develop good delivery techniques. The trial and error method used in this class should be eliminated. Proper preparation in the systems being used should be considered essential for the best results. These costs must be considered as part of total costs for universities in order to contract distant learning delivery between any two locations. Even though total initial costs are already high, quality instruction must be considered as part of the total package. To minimize any short comings in

instructional effectiveness, the instructor chose to concentrate on improving instructional techniques. This was done as part of delivering traditional topics using distant learning equipment for a course in Strength of Materials.

Some initial thoughts on startup and maintaining quality in the course. Allow time in the beginning to develop proper techniques using the equipment and lecture board information. Do some actual board work and camera control so you may understand the feedback as reached at a distant site. Video tape and review the end product of your presentations. Begin to envision how multimedia techniques could be integrated into the lectures. Think about having interactive responses other than verbal, from distant locations as part of the course work. Open up concepts that allow students to communicate with you through available email or world wide web site activity. Tests could be developed and delivered over email or interactive computers, responding immediately from site to site. These ideas will offer additional communications between faculty and students with an expanded - format of connection, and would allow even one on one communication. As additional ideas are developed students will gain a better understanding of the future capabilities of this or similar equipment. This is essential as they may will be using these processes soon after graduation in the cyberspace world of the future.

V. Evaluations for Improvements: A student survey was distributed to the students a few months after taking the course. This was done to eliminate possible reactionary considerations to personalities, or being required to take a course by this method. Student attitude was considered essential to having a successful pilot program. A high degree of student interest and enthusiasm for a course is extremely important in motivating students to learn. Although enthusiasm is difficult to evaluate, a series of questions were asked which deals with student attitude toward distant learning. It is our belief that if a student believes he/she is being given appropriate instruction and if possible better than typical, more enthusiasm and learning take place. In particular the questions attempted to measure the students perceptions of whether this instructional delivery mode was as effective as traditional methods. The questions attempted to measure the students perception of distant learning instruction in relation to future courses taught this way. Was the delivery system appropriate for the type of course taught in content and did the instructional method help or hinder there concepts of the course material presented.

VI. In-class experiences: As stated previously, initial preparation is an utmost necessity before teaching a course using PictureTel. This preparation must include the development of a positive attitude in order to successfully manage any distractions that can and will occur during the teaching of the course.

Students taking a course via PictureTel for the first time will have many fears and apprehensions. The instructor must eliminate these as soon as possible, and by no means, allow any distractions that may occur to inflame these fears. A positive attitude is a must, emphasizing through actions as well as words, that the class will indeed accomplish everything that previous classes(e.g. without PictureTel) had achieved. And even more critical is that continuos hard work will overcome any apprehension.

A student survey was conducted several months after the completion of the Strength of Materials course. In order to obtain additional feedback, student evaluations were also taken two weeks prior to the completion of the semester. A maj or concern of the students was their perception, actual or not, that more could have been accomplished in the course without PictureTel. However, exam scores were higher on average than those from previous semesters. The same amount of material was presented and discussed during the course. Both of these tend to suggest that the perception was in all probability not correct.

Why did these students appear to perform better and accomplish more with PictureTel? Apparently the students responded well to a positive attitude that was maintained throughout the semester. The students accepted more responsibility for their learning and worked harder so as to "not to miss out on anything." Attendance was almost 100% at both site locations. The result ended with students having better performance and greater accomplishments.

VII. Summary: Students attitudes, theirs fears and apprehensions, is a critical issue in teaching a course via PictureTel. The initial assumption was verified b y the evaluations taken during the semester and the survey taken several months after the completion of the course. Thus, preparation for teaching a course by distant learning techniques, must involve the critical issue of student attitude.

The development of distant learning techniques and proper preparation for lectures is time consuming. However, once beyond the flat part of the learning curve, changes, revisions, or the addition of new material is easily accomplished. We have found some students to initially rejector dislike the delivery process without a physical being present in front of them. After initial adjustments students were able to accept the time delayed images without much of a problem. It should be noted that the instructor was able to be present, at each location site approximately half the time. Contact of the individual making presentations over the video is a strong factor in the success of any distant learning instruction. The presence of the instructor at the distant site is essential for positive relationships between faculty and students. A minimum suggested site visit would be at the beginning, middle, and near the end of a course being delivered,. Any less and students may begin to feel alienated from the instruction process.

The introduction of distant learning into any curriculum should be done with proper instructional development in mind. Teaching methods, additional instructional tools, multimedia presentations, interactive student feedback, and new projects need to be created using distant learning(via PictureTel) methods. This is essential in order for students to learn topical information in an easier format than traditional instructional techniques. The new instructional environment with multimedia and distant learning capabilities offers education tremendous versatility for innovation and creative instruction. To expand PictureTel from a delivery tool to part of a complete instructional method needs to be a major consideration for any university wishing to remain current and ahead of the competition.

As new colleagues move into the profession, they may bring with them an increased measure of facility with distant learning and related multimedia capabilities. Many of them will already know the value of multimedia presentations and distant learning instruction since they have been exposed to these styles as part of their education. Since they know the value of these tools, they will develop multimedia presentations and deliver them through distant learning modes readily.

Therefore, as the current faculty teaching during the beginning of these developments, we must all begin to realize the importance of these new techniques and how to deliver them appropriately with quality. The better it will be for the students we teach and the universities for which we work.

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