Distance Learning, an Enabling Approach in Academia/Industry Partnerships

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Abstract

Recent trends in the marketplace have a major influence on higher education and industry which are undergoing a process of significant transformation. Education needs to respond to major changes in the nature of students, a workforce that is older, increasingly diverse and frequently requiring updating of their skills to deal with the information age and rapidly changing business expectations. Shrinking budgets and scarce resources are other challenges faced by colleges and universities. Enrollment in colleges is also decreasing. Many colleges are exploring creative ways to increase enrollments. Innovative ways must also be developed by colleges and universities to be able to disseminate knowledge to non-traditional, non-resident students in multiple sites, businesses, and directly to learners in their own homes. Distance learning is becoming widely accepted as an approach to meet the challenge of delivering training to more citizens on many subjects with higher impact and effectiveness. This paper describes a corporate partnership with the University of St. Thomas in terms of lessons learned and benefits of many different approaches to distance learning undertaken by this university. Many issues need to be addressed for those who wish to be involved in distance learning. The important ones include the following:

- How is distance learning being used by businesses, and educational users?
- How should the distance learning faculty, program designers, system administrators and other participants be trained to maximize the effectiveness of the system?
- What technologies are best for the training applications? (digital satellite broadcasts, interactive video conferencing, audio conferencing, audio-graphic conferencing, computer conferencing, and so forth)
- What type of course content is appropriate for each type of technology?
- How should the distance learning Network be designed?

This paper will examine these issues to enhance our common understanding of distance learning initiative and describe St. Thomas's partnership efforts as an enabling approach for academic and industry cooperation.

Introduction

The global marketplace is rapidly changing with shorter product life-cycles and enhanced product realization. In this environment, corporations are experiencing greater pressure to train employees whose skills need to be kept current. Compared to international competitors, US corporations spend less in time and money to train workers. The current state of the US economy indicates a large labor shortage in many fields and it is predicted to continue for a significant period. It is imperative that a shrinking labor force must be multi-skilled and trained so that they can quickly adapt to changing market conditions. One of the ways to enhance the training process is the use of distance learning technology delivered via satellite communications. In this manner geographically dispersed workers in a corporation can be quickly trained in an effective manner. In this new classroom environment, time and distance are collapsed as students and instructor interact in a simulated, traditional classroom setting. The future training trends show great potential for desktop delivery of self-paced, individualized training when, where, and in as much depth as the student needs, to maintain current knowledge within and for the organization.

In the past 10-15 years, there have been great strides in products, technology, customer service, and in the skills and knowledge required by workers. As a result, US corporations must deal with the challenges of retraining its workforce to compete in a changing world economy. The American Society for Training and Development estimates that 55 million Americans, about 45

percent of the workforce currently employed, need to be retrained in the next decade in technical, executive management, supervisory, customer service and basic skills training. It is estimated that corporations have spent in excess of $30 billion in 1992 to train employees but that has not been sufficient to solve the problem.

Distance Learning Based Education in Universities and Businesses

During the past decade, smaller budgets and reduced level of Federal grants have been typical in US universities. Shrinking enrollments in universities have created excess capacities. A leading educator, John Naisbitt writes, "We have essentially the same education system we had for the industrial society and we are trying to use it to equip us for the information age." To effectively respond to these challenges, universities have to identify new approaches to disseminate knowledge to non-resident students, many of whom may be non-traditional.

In the past few years, there has been a noticeable surge in distance learning education offered by various educational institutions. Many universities and colleges have started different ways to reach out the non-traditional, many of whom are non-resident students. The University of Phoenix has started a graduate degree in computer science on the Internet. MIT is offering a graduate program in Logistics through Internet. The National Technological University (NTU) had been offering both undergraduate and graduate science and engineering programs for the past several years, broadcast to various remote sites across US, through the one way video and audio delivered via NTU satellite communication network. Since Fall 1996, the University of Wisconsin-Stout started a BS in Industrial Technology, which is a distance education program for adult students located in various parts of Wisconsin, using WONDERNET, a satellite communication network. For many years, the University of Minnesota has also been offering both degree and non-degree courses through their UNITE network to students in various corporations in the State of Minnesota.

Universities are also partnering with businesses in offering customized and regular courses to their employees through their distance education arrangement. An example of such partnership is the University of St. Thomas which has been working with companies such as Horton Corporation in offering in-house courses to their employees through their distance education network in the states of Minnesota, Wisconsin, and South Dakota. This program has stimulated additional distance learning activities using the company's video conferencing system, the University of St. Thomas distance learning system and the distance learning capabilities of the technical college system in a neighborhood state. Students from a wider range of companies began to participate as a result. The on-site and distance learning classes are complemented by on-campus classes. For some specialized courses, Horton flies students to St. Paul, Minnesota weekly from its South Dakota plant. Other students drive a distance of 100 miles from their plant in Webster, northwest Wisconsin.

Driving to St. Paul from Webster was the first "distance learning" technology used by Horton and the internal video-conferencing capability of Horton was the second. While these approaches are still in use, St. Thomas and Horton collaborated with the Wisconsin Indianhead Technical College (WITC) system to extend the availability of manufacturing classes to a broader geographic area in western Wisconsin, and to include other companies in the area. In the Spring of 1997, a course in manufacturing processes was offered to three sites in Wisconsin using a connection between St. Thomas and WITC. Classes were taught via real-time interactive video-conferencing. Three main needs were addressed during the developmental stages for distance learning: Cooperation between educational institutions, linkage of two dissimilar video-conferencing systems, and coordination of time and access for all locations. The University of St.

Thomas, Horton, and the WITC at New Richmond established a cooperative effort to deliver the classes and were presented with several opportunities in the process. The two video-conferencing systems were dissimilar and not compatible because the connection from our St. Paul room was 1.54 mbs and the capacity of the receiving equipment was just 384 kps. We also had to then connect this digital signal to the analog video network that WITC uses to connect their schools together. All partners also needed to coordinate demands for time and access to the outstation sites.

The following lessons were learned from using this system which apply to all our distance learning activities:

1. Physical distance among classrooms has no bearing on the dynamics of classroom or learning. There are advantages of classrooms being near each other. However, quality of sound is very important when all members of the class can hear anyone for greater interaction among students and the instructor to reduce the impact of physical distance.
2. Voice contact is comparatively more important than the small faces appearing on visual images on the screen.
3. More preparation required for the classes. The relevant material for the class session must be in the hands of the students at the beginning of the class. FAX machine in the classrooms distributes any additional information during the session.
4. A document camera is a useful tool. One can display explanatory samples, notes and drawings and also transmits overheads. It is quite useful for students' presentations. It allows students to present examples, notes, etc, without any special preparation.
5. Examinations require careful planning. Sending the material is easy, but getting it back in a timely manner is more difficult. Overnight Federal Express was found to be convenient.
6. Instructors have to be constantly aware of the fact that they are in a distant class to keep them actively involved in the class activities. Particularly, they need to be vigilant about questions directed to them.

In summary, our distance learning involvement has been very successful and end-of-term evaluations from students show they have been very satisfied with the classes. Thus we continue to offer distance learning classes and constantly try to improve our effectiveness.

Horton has continued to send students to classes in St. Paul campus and other locations in Minnesota where the University of St. Thomas offers courses. While students from Webster, Wisconsin usually drive to the twin cities, those from Britton, South Dakota usually are flown in the corporate plane to St. Paul. They arrive the afternoon of the class, and fly back to Britton the following day. This suggests Horton's commitment to continuing employee education.

To know the payoff from their investment in continuing education, Horton adopted the balanced scorecard approach covered in the Managerial accounting and performance measurement course offered in our Manufacturing Systems and Engineering curriculum. It measures four broad areas – financial, customer, internal business and innovation/learning. In the area of innovation/ learning, Horton breaks out education and training in the balanced scorecard. Education is measured as the total percent of employees involved in continuing education; training is measured by the number of hours of training completed per month. The company uses this measure as a leading indicator for expected financial performance in the future. Thus far, it is paying off.

AT&T's Center for Excellence in Distance Learning (CEDL) in Cincinnati, Ohio has been involved in various partnerships with universities in which nationally recognized experts research

problems in distance learning and develop creative solutions. It is also the showcase for AT&T teleconferencing and distance learning. It has been involved in the development of innovative applications utilizing cutting-edge telecommunications technologies. This center has developed a close partnership with Indiana University, to help create the Indiana University Center for Excellence in Education, as a showcase of how technologies of all forms will be used into the twenty-first century for educational delivery in a variety of environments. They have also developed an alliance with the Pennsylvania State University to connect the University's twenty-two campuses in Pennsylvania to enhance the University's delivery and support of distance education programs.

Training for Participants in Distance Learning System

Infrastructure training is important for the faculty members involved in distance learning to understand all the technical details they need to know in order to use the tools and infrastructure effectively. This will include how to operate specific telecommunications devices and software, as well as the policies and procedures put in place to ensure the infrastructure is used consistently among all parties thereby ensuring its effective usefulness.

In the televised teaching, instructors need to familiarize themselves with the distance learning classroom environment, the computer console and new teaching skills for such courses. Multi-media presentation tools need to be mastered to incorporate them in the class sessions effectively. Detailed organization of the class and planning of the presentation is essential to manage time and procedures established for course administration relative to student questions, distribution and retrieval of materials. New presentation skills need to be adopted such as responding to camera movement, cueing and speaking directly to the camera in a relaxed manner including changing the inflection or the tone of voice. Clothing worn by the instructor should be chosen in bright, bold colors, avoiding stripes, plaids and patterns which cause video interference. It is important to generate on-going student interaction at the remote sites with a premeditated strategies for stimulating discussion with them. Instructors need to become comfortable with the technological tools and through practice learn to be good time manager. It is important that the instructor is able to focus on students and modify the course delivery, both pace and content, to meet students' needs by beneficially using the technology.

The information technology support staff and system administrators will also need training. They need to be made conversant in the use of all the special tools for systems and network management to keep the distance learning system up and running smoothly.

Distance Learning System Design

In a typical distance learning system, specially designed hardware and software enable real-time interaction between an instructor at a host site, and students who are located at remote sites. There are various delivery technologies for distance learning to choose from: microwave, satellite, dedicated optical fiber, and coaxial cable (either analog or digital), switched digital services, local and wide area networks and the Internet. Equipment such as scanners, computer response devices, fax machines, videodisc, CD-ROM, etc are also utilized. It is ideal to use satellite communication if large number of students are to be served in widely dispersed receiving sites.

Program transmission is done via traditional, analog satellite signals, broadcasts audio, and video to multiple remote sites with return audio and two-way data communication over land phone lines. It is important to have high quality audio, without noise, feedback, distortion, or returning echo of a satellite transmission delay. Analog video transmission is converted to digital by video

compression which eliminates the redundant part of the analog signal. The digital signal does not degrade as it is transmitted and it also requires smaller bandwidth (compressed digital video can require as little as 128 kps, as opposed to uncompressed video which may require 45 mbs or more). A full integration of production, video, audio and control system is required for a total distance learning system.

Various configurations of communication technology are available and they are used in the applications described as follows:

Synchronous Mode:

1 way audio	Radio program
2 way audio	Telephone conferences, radio talk show
1 way audio / 1 way video	Television program and video tape distribution

Asynchronous or Virtual Classroom:

2 way audio / 1 way video	Distance learning transmitted over a high quality analog satellite to multiple sites over a vast area.
2 way audio / 2 way video	Video conferencing with compressed digital over telephone lines.

Communication Technologies for Distance Learning

One of the distance learning approaches widely used is a two way audio and one way video communication technology. Distance learning is transmitted in this way over a high quality analog satellite communication to multiple sites over a vast area. Technology is applied seamlessly. It is most transparent to instructors and students where the television quality image is maintained, and the two way question-answer process occurs without any interruption. Interaction is supported through computer based response equipment and communication technologies that enhance the feedback mechanism.
The multimedia on the desktop computer is a popular communication technology. This combines videoconferencing, which was once available only for groups through expensive private line connections, and data and voice transmission, which once required separate telephone lines. Older traditional group videoconferencing systems cost anywhere between $15,000 to $80,000; while desktop versions range from $2,000 to $5,000, and offer a range of additional advantages. They are less expensive to operate, they can be accessed at any time without reserving facilities, they do not need dedicated personnel for operation and maintenance, and they can be used by individuals. The low cost also makes videoconferencing affordable to smaller businesses. The principal advantage of desktop systems is their integration of videoconferencing, screen-sharing, real-time file transferring and updating and messaging (voice, fax and E-mail) capabilities. The technology exists today in almost every office in US to implement desktop multimedia services. They can be provided over private and public networks, generally requiring either two digital telephone lines – one for voice, the other for data and video – a digital line for data and an analog line for voice, or one Basic Rate ISDN line. With increased bandwidth, the capabilities will be further enhanced.

The ability to send and retrieve data, voice, images, and video from one desktop workstation to another is one of the greatest productivity enhancements yet offered to the universities and corporations. With such a network in place, desktop multimedia communications become even more powerful. Desktop teleconferencing can allow an entire “classroom” of students to watch, listen to, and interact with an instructor from around the world. Full motion video enables lectures, presentations, and product demonstrations to be stored for on-demand access by

customers, suppliers, or in-house use. Downloading video education seminars directly to the desktop will be as common as acquiring information through online services.

In the future, streaming video over digital data networks will allow real-time access to instruction at the employees' desktop. Digital video servers will store many hours of video and audio programming which can be accessed world-wide on a 24 hours / 7 day week basis by any employee.

Another exciting new technology which holds great promise for distance education is the digital versatile disc (DVD) which can hold as much as four hours of programming on a CD-ROM-sized disc. This will allow entire on-campus classes to be captured to disc and distributed rapidly to students throughout the corporation. Add a World Wide Web site for questions and answers and discussion and you have created a powerful, easily accessed virtual classroom.

Conclusion

Distance learning offers many benefits in the academia/industry partnership. Among the significant benefits to the alliance include: achieving efficiencies relative to saving time, availability to a large and flexible audience; enhanced quality due to interactivity between students and the instructor, capitalizing on remote experts in various locations, and more choices of quality programs; and achieving greater impact due to accessibility, flexibility and adaptability of the class offerings.

It is likely that in the next decade there will be a significant expansion in the distance learning education at a global level. Marketplace will have abundance of many training networks utilizing interactive telecommunications. In the future, training will be done more on desktop multi-media environment which will likely displace the distance learning classroom to remote sites training. The desktop multimedia training will be self paced with individualized modules which can be delivered when and where a student needs it.

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Biography

Sameer Kumar is a Professor in programs in Manufacturing Systems and Engineering at the University of St. Thomas. Prior to joining St. Thomas, he was a Professor of Industrial Engineering at the University of Wisconsin-Stout. He has worked in industry in various positions including research, engineering, manufacturing and information systems. He holds PE license, and CMfgE, CMfgT, and CPE certifications and has a Ph.D. in Industrial Engineering from the University of Minnesota. He also has Master's degrees in Mathematics, Computer Science and Industrial Engineering and Operations Research. Dr. Kumar has published a number of articles in various professional academic journals.

John Walker is an Adjunct Professor. He had a 5-year apprenticeship and a 2-year Journeyman in the UK prior to becoming a design engineer and subsequently a production engineer. His manufacturing experience is in the mechanical and electromechanical field. He was Production Manager of the Honeywell RLG Group. Recently he has been working as a Production Manager in a start-up company. Currently, consulting in the field of production flow and plant layout.

Jeffrey Jalkio is an Assistant Professor in programs in Manufacturing Systems and Engineering at the University of St. Thomas. Prior to joining St. Thomas, he was Vice President of Research and Development at Cyber Optics Corporation, Minneapolis. He has a Ph.D. in Electrical Engineering from the University of Minnesota. He also has Masters degree in Electrical Engineering besides BS in Electrical Engineering and Physics. Dr. Jalkio has published a number of articles in various professional academic journals and also holds several patents.

Dr. Robert A Rehn is a Director of Instructional Support Services at the University of St. Thomas for over 10 years. He is responsible for media related instructional activities at the University of St. Thomas and its educational partners.