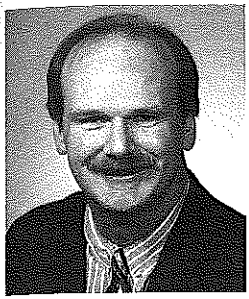

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Transforming University Outreach: Integrated Technology Systems Design for the Twenty-first Century

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University outreach is at a crossroads and will require nothing less than a fundamental restructuring that expands its capacity to respond quickly and cost effectively to a client-centered, market-driven educational environment. Higher education has become a market commodity in which customers (students) approach their choices similarly to purchasing any other service or product in our society. This article presents an Integrated Technology Systems Design (ITSD) framework that provides a competitive strategy for universities to harness the vast array of technological tools available to compete in this environment. Applied examples of the ITSD framework and recommendations for implementing ITSD are presented.

As corporate universities, cable companies, the telecos, and the publishing companies mobilize for these emerging markets, higher education must transform itself to respond to market demands using a variety of delivery systems that can be mobilized rapidly and cost effectively. And while universities debate educational philosophy, financial models, academic policies, and service-region boundaries that are approaching obsolescence, our competitors plan for the new "education-on-demand" market where client demands, rather than the university, will drive programming (Mathews 1995; Mawby; Olcott 1997; Walshok 1996). The author advocates that the strengths of ITSD are its competitive-deployment strategies and posits that ITSD creates the catalyst for faculty and support personnel in the distance-learning enterprise to critically examine how the synergistic blending of technologies operates in pedagogically effective ways. The author concludes that either we change or we will be driven out of the educational market. The choice is ours.

Introduction

During the last decade, the proliferation of advanced telecommunications systems has transformed the capacity of colleges and universities to expand their outreach programs for serving extended student markets (Duning, Van Kekerix, and Zaborowski 1993). Despite some initial successes, however, the use of technology to expand the scope of university outreach has remained a secondary mission for most colleges and universities. Moreover, the range of available new low-tech, high-touch systems has remained on the periphery as continued adherence to video-based systems dominate institutional outreach programs (Hardy and Olcott 1995).

Today, institutions are taking a hard look at the viability of allocating major resources for video-based systems that require substantial capital investments as well as resources earmarked for upgrading, maintenance, and human-resource development. Without underscoring the effectiveness of video-based systems in many sectors of education, government, and industry for enhancing access to training and educational programs, access in and of itself is an insufficient measure to justify expenditures in technology unless it is accompanied by simultaneous pedagogical transformation. Comparable academic achievement between campus-based and distance learners, while important, is also inadequate for measuring the pedagogical impact of technology unless one analyzes the quality and structure of learning via technology.

. . . either we change or we will be driven out of the educational market. The choice is ours.

Consequently, once the access and instructional-quality factors are removed from the equation, technology has not transformed the teaching and learning process and has fallen well short of earlier expectations. The challenge for the twenty-first century university is to harness the potential of technology, video or otherwise, to transform the teaching-learning experience and develop integrated technology instructional systems that are grounded in pedagogy and human learning theory. It is illuminating that despite the euphoric impact of "slick" technology applications, most advocates of these technologies are confounded when asked to explain how these systems enhance teaching and improve learning. This is the fundamental question for all educators using technology.

The purpose of this paper is to present a framework for designing outreach instruction via integrated technology systems design. More precisely, the framework will demonstrate how to blend technology applications into the organization and design of instruction. From a practical perspective, this framework provides multi-media technology options that take into consideration the

economic, pedagogical, and time factors faced by institutions, their faculty, and their extended students. Through careful assessment of available technologies, institutions can create the optimum technology mix to serve the diverse needs of both faculty and students.

The Rationale for An Integrated Technology Systems Approach

The range of educational technologies has grown to unprecedented levels during the mid-1990s. Today, institutions can choose from among a vast continuum of technology options within the video, audio, computer, and print categories. These include satellite, compressed video, fiber optics, cable, videotapes, audio teleconferencing, audiographics, audiotapes, fax, voice mail, computer-based training, print, and of course the Internet and World Wide Web (Olcott 1993). Some of these applications have emerged as primary delivery media while others have assumed support roles.

And yet, this expanded technology base for institutions has been eclipsed by a reliance on one primary delivery system. For the majority of institutions, instructional television has dominated the technology agenda; institutional advocacy for ITV emanates not from pedagogical considerations, but rather from the substantial investments of money and personnel used to create and maintain the system. Of course, these institutions will be the first to suggest that ITV, more than any other technology, approximates the teaching-learning process in the regular classroom. This rationale, however, is based upon a very tentative assumption: That what goes on the in the regular classroom should, in all cases, be emulated via technology.

It is illuminating that despite the euphoric impact of "slick" technology applications, most advocates of these technologies are confounded when asked to explain how these systems enhance teaching and improve learning.

A condemnation of past uses of technology or the motivations for their selection, regardless of the technology, is counter-productive and moves us no closer to harnessing the power of technology in the classroom. The point is, however, that we must transcend these issues and strive to leverage technology applications that are based upon effective teaching and learning paradigms, the positive attributes of a particular technology, the diverse learning styles and needs of our students, and cost and logistical issues for deploying a range of delivery technologies.

Despite the rhetoric, no one technology has this pedagogical capacity. In fact, if practitioners and technocrats are honest with themselves, they would acknowledge that we know very little about transforming particular technologies into optimum learning tools nor about aligning multimedia applications with the predisposed learning styles of our students. In sum, the bells and whistles of technology have fallen silent and will only be reawakened by a renewed commitment to technology applications that place the teaching-learning process first and foremost.

Integrated Technology System Design (ITSD) approaches that blend the best teaching-learning attributes of multiple technologies teaching are within our grasp. We need only to explore their uses and adapt them to our instructional approaches. This framework can be both pedagogically and economically effective for institutional outreach programs.

Integrated Technology Systems Design: From Macro to Micro Applications

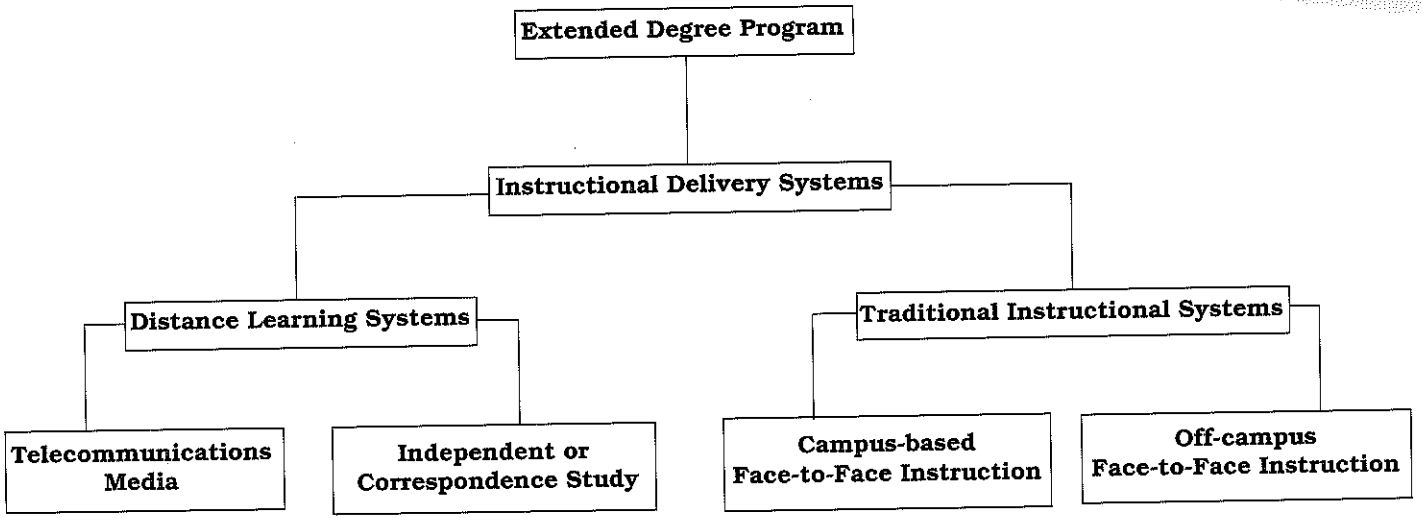
To understand the potential of Integrated Technology Systems Design at the course level, one must understand the macro view of technology systems design. Figure 1 (Olcott 1991) presents an instructional framework for blending traditional instructional delivery systems with distance-learning delivery systems for institutions to deliver an extended degree program.

Figure 2 (Olcott 1992) expands this framework to an interinstitutional framework where multiple institutions integrate traditional and distance-learning delivery systems to deliver an extended-degree program. The advantages of these approaches are threefold. First, they provide institutions an expanded range of delivery options for delivering off-campus courses and programs. Second, they eliminate dependency on a single system for delivering an entire degree program by integrating exemplary traditional and distance-learning systems. Third, the interinstitutional approach is predicated on sharing fiscal and human resources, thereby relieving individual institutions from the responsibility for the total cost of program delivery (Olcott 1991, 1992, 1996).

Many policy and fiscal issues must be resolved when applying the integrated institutional and interinstitutional approaches (Olcott 1991, 1992; Olcott and Wright 1995). The point is, however, that combining traditional and distance-learning approaches expands the instructional options for institutions in designing their outreach programs. More importantly, this instructional-delivery continuum is expanded further if this approach is applied at the course (micro) level, whereby individual course design blends various delivery systems, traditional and distance, into a cohesive learning package for faculty and students.

Outreach is not an either-or proposition when assessing whether to employ traditional or distance-learning systems. Rather, it is a synergistic process of harnessing the diverse potential of multiple

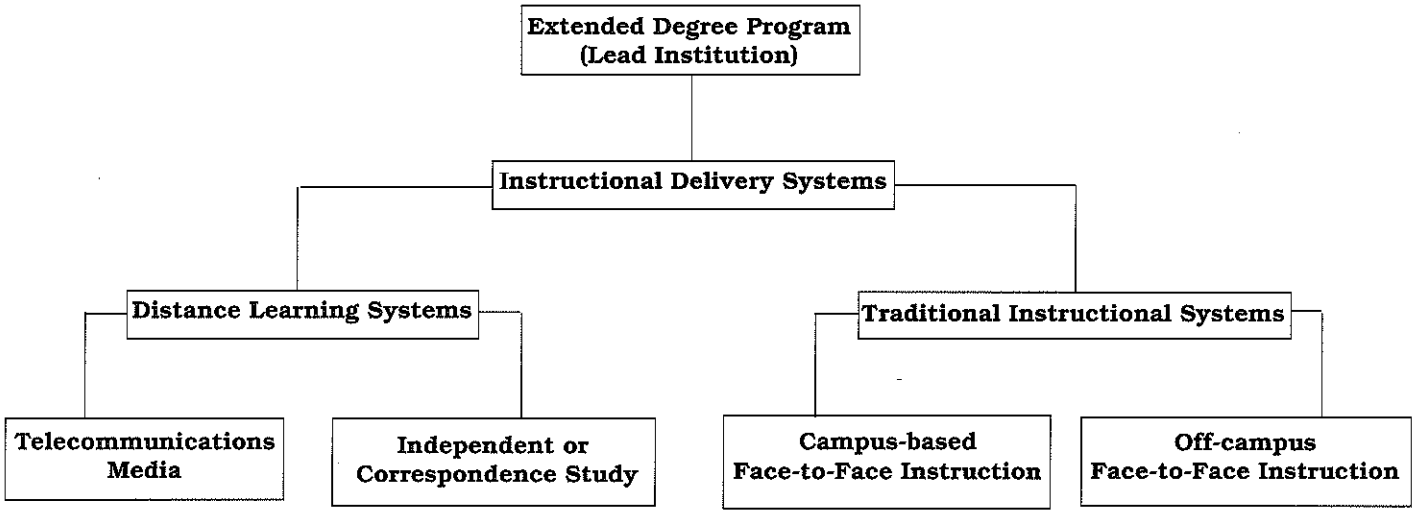
Figure 1
An Integrated Instructional Framework for Extended Degree Programs



Notes:

1. **Telecommunications media: Satellite, microwave, ITFS, fiber optics, computer, audio teleconferencing, cable, etc.**
2. **Campus-based face-to-face instruction: Designed to meet degree residency requirements**
3. **Off-campus face-to-face instruction: Instruction at satellite campus or other off-campus location**
4. **Transfer coursework from an accredited institution may apply toward degree requirements**
5. **Off-campus face-to-face also may be classified as a distance-learning instructional system**

Figure 2
An Integrated Instructional Framework for Interinstitutional Extended Degree Programs



Notes:

1. **Telecommunications media: Satellite, microwave, ITFS, fiber optics, etc.**
2. **Independent/Correspondence study (includes telecourses)**
3. **Campus-based face-to-face instruction: Designed to meet degree residency requirements**
4. **Off-campus face-to-face instruction: Instruction at satellite campus or other designated location**
5. **Transfer coursework from accredited institution may apply toward degree requirements**

delivery systems, maximizing their teaching-learning attributes, and implementing them in financially sound, pedagogically effective ways. Conversely, institutions that *arbitrarily* assign preferential (or popular) delivery systems, traditional and distance, only will create a instructional mosaic devoid of pedagogical considerations.

The institutional macro approaches to integrated technology systems design described above are designed for the incremental adoption of distance-learning systems to expand university outreach. Institutions that recognize the broad continuum of available instructional options will strategically position themselves in the educational marketplace of the twenty-first century. Moreover, they will expand their capacity to foster inter-organizational partnerships with business, government, and other postsecondary institutions to thrive in a highly competitive educational environment (Mawby 1996; Olcott 1997).

The Technology Landscape: Selection Criteria for Integrated Systems Design

Figure 3 (Olcott 1995) provides a summary of selection factors for the most common technologies used in distance-learning instruction. They are not intended to be all inclusive. The importance of Figure 3 is that it gives practitioners a basic framework of factors to consider when designing integrated instructional-delivery systems at the course and program level. A detailed examination follows.

Video-Based Systems

In general, video-based systems have unlimited geographical capacity to reach isolated audiences, and approximate the traditional face-to-face classroom, yet are comparably expensive to audio and computer-based systems. If capital costs are considered, video systems easily run into millions of dollars depending on the technology (Duning, Van Kekerix, and Zaborowski 1993).

For example, codecs for statewide compressed video networks range from $40,000 to $80,000. Satellite uplinks can cost anywhere from $300,000 to $800,000, and production studios and control rooms can easily run over one million dollars. If one takes into account satellite transponder costs, procurement, and maintenance for satellite receive dishes, the total cost scenario rises sharply (Duning, Van Kekerix, and Zaborowski 1993; Kelleher and Cross 1985).

Video-based distance learning is also labor and time intensive (Moore 1992). Course development, technical production, faculty training, and administrative and student support services require considerable resources and planning time. Many institutions that have invested in video-based networks are now perplexed by the rapid entry of other institutions into the distance-learning marketplace using lower-end technologies such as the Internet and the World Wide Web. In fact, many video-based networks, after investing significant resources in designing their networks, raise the

Figure 3
Technology Media Matrix Selection Factors

Delivery System	Cost	Geographical Capacity	Quality	Training Required	Number of Students	Support Technologies	Real Time Interaction	Asynchronous Interaction	Client Receptivity	Number of Sites
Digital Satellite	High	Worldwide	Excellent	-Faculty -Technicians -Site Coordinators	200 +	AT E-mail Fax RVT Print Computer	Yes Low	Yes Low	Excellent	50
Compressed Video	Low-Moderate	Regional and State	Good	-Faculty -Technicians -Site Coordinators	30	AT E-mail Fax RAT Print RVT Computer	Yes Low-Moderate	Yes Low	Good	6-8
ITFS	Low-Moderate	20-30 miles Line of site	Good	-Faculty -Technicians -Site Coordinators	30	At E-mail Fax RAT Print Computer	Yes	Yes Low	Good	4-5
Audio Conferencing	Low	Worldwide	Good	-Faculty -Technicians -Site Coordinators	40-50	VT E-mail Fax RVT	Yes High	Yes Moderate	Good	8-10
Voice Mail	Low	Worldwide	N/A	User	N/A	N/A	No	Yes	N/A	N/A
Fax	Low	Worldwide	N/A	User	N/A	N/A	Yes	Yes		Same as number of Students
CBT	Low	Worldwide	Good	-Faculty -Students -Site Coordinators	15-20	AT RVT Print RAT Fax	Yes High	Yes Moderate	Good	10
Internet/ Web	Low	Worldwide	Moderate	-User -Faculty	20	AT RVT Print RAT Fax	Yes MOD	Yes High	Moderate	20
Print	Low	Worldwide	Good	-Faculty -Students	20-30	RVT RAT Fax Audio E-mail Voicemail	No Low	Yes Moderate -High	Good	20-30

AT = Audio Teleconferencing VT = Video Teleconferencing RVT = Recorded Video Tape RAT = Recorded Audio Tape N/A = Non Applicable

question: How do we justify these investments when lower-end, cost-effective technologies may do the job? In sum, video can be an effective distance learning delivery system but will face considerable competition from lower-end, cost-effective technologies in the future.

Audio-Based Systems

Hardy and Olcott (1995) contend that audio teleconferencing is a cost-effective, flexible, easy-to-use, and portable technology that can be pedagogically effective for distance teaching. Its major limitation is the lack of a video component. Effective audio teleconferencing requires faculty to devise innovative communication strategies in their teaching to facilitate participation by students. The cost of most audio-based systems is minimal compared to higher education computer and video technologies (Hardy and Olcott 1995).

Audio systems also include voice mail and audiographics technologies. Voice mail can be an excellent communication venue for distance students to contact the instructor in asynchronous modes. Audiographics combine the live audio link in concert with graphics adding the visual component to the instructional process (Gilcher and Johnstone 1989). The importance of the audio component in both video and audio distance-learning systems is often overlooked. However, without high-quality audio, the distance-learning process can break down. Distance students have been known to walk out of class when the audio goes out even when using high-end video systems. Conversely, creative faculty can keep students interested if the audio system is operating, even if the video signal is lost.

Audio-based systems when combined with print, fax, videotapes, and the Internet can provide high-quality instruction that is cost effective and easy to use by faculty and students. Some distance learning programs will integrate cable broadcasts into audio-based courses to provide a video instructional component which is accessible and convenient for the adult learner (Burge and Howard 1990; Hardy and Olcott 1995; Moore 1994).

Pedagogically, audio teleconferencing is particularly effective for content discussions where students come prepared to examine major topics (Hardy and Olcott 1995). The mobility of this technology has allowed faculty to teach from the campus, a hotel room, and even from their car (Moore 1994). With the absence of a video component, faculty must employ strategies that engage students in dialogue. Faculty must learn the names of students at distance sites, encourage student-to-student interaction, and strategically use other technologies to support the instructional process. This scenario of combining technologies reflects the practical application of Integrated Technology Systems Design (ITSD), the primary theme of this article, and one that will be revisited later in the article.

Computer-Based Systems

The Internet and World Wide Web have created a variety of unique applications for education. One is reminded that the Internet

was developed originally as a communication medium rather than an instructional tool. Today, colleges and universities across the globe are using the Internet as an instructional medium in synchronous and asynchronous modes. Computer-Based Training is also a prevalent delivery system in which students complete an on-line instructional training program via the computer. CBT Training programs can be relatively expensive depending on the level of the training program and complexity of the program (Duning, Van Kekerix, and Zaborowski 1993).

The Internet is also emerging as the medium of choice to provide on-line student services to distance students. Many colleges and universities provide academic advising, library, registration, admissions, and financial aid access via the Internet. This trend is likely to increase due to the low cost of Internet access. Moreover, Web-based instruction has become the tool for designing innovative computer-based instruction and information services to students and faculty alike.

This abbreviated summary of the technology landscape accentuates the unlimited capacity for colleges and universities to combine technologies into effective, low-cost instructional systems. In the past, selecting the optimum technology mix has functioned as an either-or proposition (Hardy, Abbiatti, and Ashcroft 1995). Today, the technology continuum expands options for distance-learning applications. The challenge for the future is to develop technology combinations that enhance teaching and improve learning. This is the essence of Integrated Technology Systems Design (ITSD).

Empowering University Outreach: A Framework for ITSD

It is important to recognize that the ITSD framework is a comprehensive instructional approach based upon pedagogical, economic, logistical, and practical-use factors. ITSD advocates the synergistic deployment of technology mixes that expand the range of options for institutions to use in their outreach programs. ITSD is not synonymous with multi-media models that are usually self-contained despite their use of various media. To the contrary, ITSD is a framework based on creating integrated system approaches that maximize the technology arsenal available to universities.

This article previously discussed macro approaches of combining traditional and distance-learning systems for delivering extended and interinstitutional degree programs to distance learners. ITSD moves education from the macro to the micro where individual courses can harness the range of available technologies into innovative course packages. The following represents some applications of ITSD at the course level based on a 16-week semester timeline:

PROGRAM	ITSD APPLICATION
Extension Agent Leadership Training	Internet and audiotapes for introductory content

	through first three weeks supplemented by print materials. Independent study for Weeks 4-8 with intermittent use of fax, voicemail, and Internet for communication and assignments. Satellite or audio teleconferencing during Week 9 as a synthesis session where all extension training sites participate in review and summary discussions. Weeks 10-14 instructor facilitates a listserve where extension agents participate in on-line case-study discussions. Weeks 15-16 are small-group assignments at each site with designated facilitators. Weeks 17 & 18 are used for competency-based assessment at county extension offices for agents to demonstrate minimal performance standards. Agents would select from alternative assessment options for demonstrating competencies.
Statewide Teacher Inservice Course	Weeks 1, 4, 7, 10, 13, and 16 via satellite, compressed-video or fiber network. Question: Is it necessary to teach the entire course via live-interactive video? Is it cost effective? Does video guarantee "only" instructional quality? The answer to all these questions is clear and compelling no. Weeks 2, 3, 5, 6, 8, 9, 11, 12, 14, and 15 delivered via audio-teleconferencing. Print materials used to

	supplement video and audio sessions and small-group work with designated facilitators used for synthesizing and applying content. Completion of assignments using both traditional hard copy submitted to instructor and the Internet. Communication with the instructor via the Internet, voicemail, telephone, and fax. Competency-based assessment approaches used during Weeks 17 & 18 for course evaluation.
Eight Week Corporate Training	Live-interactive video for Weeks 1 & 2. Internet for Weeks 3 - 8. Supplemented by print, audio tapes, fax, and voice mail. Computer-based training software for performance assessment during Weeks 9 & 10. Repeat sequence 1-8 above for Weeks 11-18.

These ITSD scenarios demonstrate the vast array of options institutions can use in designing their distance learning instructional approaches. Moreover, from a pedagogical perspective, it requires intense analyses to align various technology applications with appropriate instructional goals and strategies, as well as student needs. Video is probably not the best choice for small-group work any more than the Internet is for oral-competency assessment.

Nonetheless, the inherent complexity of effectively applying ITSD forces faculty and support personnel (e.g., instructional designers, production technicians, continuing educators, and others) to address the fundamental pedagogical question demanded of all educators: What constitutes the best mix of instructional strategies (and, by extension, mix of technologies) to enhance teaching and improve learning? To date, the research employing multiple technologies in course and program design does not provide answers to this question.

ITSD serves as a catalyst to leverage a vast continuum of available distance-learning technologies and applications that, when expanded to institutional and interinstitutional degree programs,

create real opportunities for improving instruction, sharing resources, providing adult distance students multiple course options, and providing efficient and cost-effective applications of technology resources. Most importantly, it mobilizes and expand an institution's outreach capacity consistent with institutional mission and the needs of geographically isolated distance students.

Recommendations for Implementing ITSD

1. Conduct an inventory of existing technology systems. Are they cost effective? Do they demonstrate high instructional quality? Assess whether resource (human and fiscal) allocations could be expanded to include a range of other technologies.

2. Apply hypothetical application of ITSD to existing outreach programs to assess pedagogical, economical, logistical, and practical delivery factors. How can other technologies be integrated into these programs effectively without diminishing the quality of the program?

3. Assess and modify institutional policies that are barriers to asychronous delivery modes. Many institutions require minimum seat time or clock hours which are difficult to assess when students are using the Internet, the World Wide Web, and independent study. Competency-based assessment, to a large extent, can resolve this issue by focusing on students demonstrating minimum competencies that are not based on time on task but rather on performance and content mastery.

4. Develop a comprehensive ITSD faculty training program that provides faculty with the knowledge and skills to design instruction utilizing multiple technologies. Instructional designers, continuing-education specialists, and technical personnel who comprise the faculty member's design team also should receive this training. Invite campus faculty who are experts in the field of human learning and instruction to assist in the development of the training program. Remember, ITSD is about teaching and learning rather than about technology.

Summary

Integrated Technology Systems Design (ITSD) is first and foremost an outreach-deployment strategy for colleges and universities to harness the arsenal of technologies available to deliver extended educational and training programs. At present, ITSD is not a pedagogical or theoretical model for distance learning, although the combining of instruction-delivery technologies holds promise for the development of new pedagogical models to enhance teaching and improve learning.

The strength of ITSD is that it creates the catalyst for faculty and support personnel in the distance-learning enterprise to critically examine how the synergistic blending of technologies operates in pedagogically effective ways. Empirical research using ITSD is still in its infancy, partially because the Internet and World Wide Web did not exist until recently, and partially because the field had not

evolved to the point where lower-end technologies had reached a level of acceptance as viable teaching systems. Today, the technology landscape has undergone major transformations and what has emerged is a range of technological options inconceivable even five years ago. The question is whether we take advantage of these tools before our competitors do.

From a practical perspective, ITSD is also a competitive strategy for institutions to expand their capacity to operate in an "education-on-demand" market environment (Votruba 1996).

For university outreach to be successful in this environment, institutions must learn to operate more like a business while at the same time preserving the best of the traditional academic enterprise (Olcott 1997). This transformation will require an expediency for change by colleges and universities, a legacy which higher education has yet to adopt. Higher education has become a market commodity in which customers (students) approach their choices similarly to purchasing any other service or product in our society. This is a difficult concept for us to accept despite its legitimacy in a client-centered, market-driven environment.

On the technological front, we are seeing the emergence of virtual universities that, like our corporate university competitors, are mobilizing for a future where learning will take place in the classroom, the workplace, and the home (Dede 1996; Olcott 1997; Western Governors Association 1996). Students will access education simultaneously in all these settings through a variety of delivery systems — and teaching and learning as well as student services — that will be available online.

As for our competitors, one only need look at recent corporate mergers among telecommunications giants to grasp the potential of home-based learning via cable, telephone, CD-ROM, and the Internet. Even the publishing companies will be key players in this market by virtue of the copyright and intellectual property control they exert over mediated, on-line resources (Olcott 1997; The Telecommunications Act 1996).

In summary, university outreach is at a crossroads and will require nothing less that a fundamental restructuring that expands its capacity to respond quickly and cost effectively to a client-driven market (Mathews 1996; Noam 1995; Votruba 1996; Olcott 1997). Integrated Technology Systems Design (ITSD) provides a competitive strategy for universities to harness the vast array of technological tools available to compete in this environment. The choice is ours . . . change or be driven out of the educational market. ■

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