Innovation and Education in the Digital Age: Reconciling the Roles of Pedagogy, Technology, and the Business of Learning

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***Abstract*—Terms such as "digital divide," normally understood to mean the gap in access between technologically disenfranchised populations and the information elite, take on a different resonance when the focus of university faculty, administrators, and an increasing number of potential students is on how education is to be conducted. This paper discusses the pedagogical, technological, and business trends that together affect the direction of innovation in virtual education. A discussion is presented on how traditional higher education (campus-based, lecture-bound, and faculty-driven) can benefit from the explosion of opportunities born of technological innovation and development by adopting changes in operational models—both administrative and pedagogical. Also addressed are the scope of services that comprise the engagement of information technology in academic environments necessary to fulfill evolving charters and missions that respond to current trends and future demands of educational innovations in the digital age where education and business—in their operational models and management styles—are moving toward complementary, even comparable strategies.**

***Index Terms*—Asynchronous learning network (ALN), e-learning, information and communication technology (ICT), multimedia technology, pedagogy.**

I. Introduction

ACADEMICS will agree or reluctantly admit that change in higher education, particularly when issues of curricula and pedagogy are in question, is a hard-fought battle, rarely won by innovators. Yet, like most institutions, traditional higher education finds itself acclimating to change via pressures of the marketplace. Nowhere is the tension between academic tradition and marketplace demand more obvious than in the debates about and developments in open, distance, and virtual education. With the rapid and dramatic advances in digital technologies, the proliferation of Internet-savvy global populations and the enduring belief that the road to success is paved with degrees, certification, and workforce readiness training, the fact that virtual education remains the source of disdain and puzzlement for so many educators and institutions at the postsecondary level may be met with a sense of incredulity by enthusiasts of technology, but for academic traditionalists, resistance to absorbing education with technology is a matter of fact. Nevertheless, educational institutions, particularly those comprising higher education in the developed world, now find themselves reviewing, reassessing, and revising operational strategies and mission statements as the bandwidth of the Information Highway attempts to co-opt the space retained by the overseers of ivy and ivory.

Education in the 21st century can be thought of as a significant thread of e-commerce. Education is a multibillion dollar industry that is poised to grow and exploit new global markets via the Internet, the distribution mechanism and the arena in which software applications that address the gamut of educational and training needs engage millions of people every day. For some institutions, businesses, and government agencies, education is becoming the nexus of innovative activity, e-commerce, and the Internet. "The size of the potential market for distance education, both in the U.S. and abroad, is attracting large investments by businesses and venture capitalists." Writing in *Syllabus*, Von Holzen estimates that "more than $4 billion would be invested in for-profit educational companies in 2000, growing to $15 billion by 2002." Von Holzen also predicts that, "much of that funding will find its way to distance education programs" (quoted in [11, p. 96]). "According to Internet Data Corporation [10], which follows more than 200 electronic-learning companies, the e-learning market will grow from $550 million in 1998 to $11.4 billion in 2003" [11, p. 96]. P. Stokes of Eduventures.com, an education industry market research firm, writes that, "Investors are pouring ever larger sums of start-up capital into education businesses ... during the 1990s education businesses received some $6 billion in private equity investments—with $2.6 billion coming during 1999 alone. Internet education businesses are receiving a greater and greater share of the investment pie. ... During the first five months of 2000, the share for e-learning private investment reached 57%, amounting to $841 million of the $1.5 billion invested" [35, p. 5].

This paper discusses the administrative/managerial, pedagogical and technical trends that, together, affect the direction of innovation in virtual education. A review of relevant, recent research literature in these trends results in the authors taking the position that traditional higher education—campus-based, lecture-bound and faculty-driven—will fail to benefit significantly from the explosion of opportunities borne of technological innovation and development unless it reduces its resistance to change as it pertains to operational models—both administrative and pedagogical—embraces publishers and software developers as partners, and fully funds the entire scope of services that comprise the engagement of information technology in academic environments necessary to fulfill a revised set of charters and missions that address current trends and future demands.

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II. Macro Trends and Practices in Virtual Education

With the expansion of instructional technologies throughout all sectors of the education community, research into the appropriateness, effectiveness, and modalities of learning via information and communication technology (ICT) continues to grow. Relevant journals such as the *Journal of Asynchronous Learning Environments*, *Educational Technology & Society*, and *The American Journal of Distance Education* publish the results of experiments, case studies and meta-analyses that discuss theories supporting virtual learning, assess the pros and cons of conducting courses via the Internet, as well as describe the deployment of instructional technologies in a classroom. Key issues addressed in the literature include the role and importance of communication between teachers and students [7], [41], learning styles [20], [22], [42], comparisons and contrasts of outcomes between classroom-based and web-based instruction [12], [19], [23], [27], [33], [39], [40], evaluation of online environments [5], [38], general impacts and challenges of distance education [24], [29], [30], [37], implementation of virtual learning [7], [8], [13], [16], [33], peer and faculty collaboration [31], [36], historical overviews [25], [30], quantitative and qualitative evaluations [12], [15], [40], genre-specific analyses [1], [2], [17], [18], and advances in digital technologies [4], [6], [21].

A study sponsored by the Commonwealth of Learning and published as *The Changing Faces of Virtual Education* [11], provides a comprehensive overview of the dominant issues that comprise virtual education. Briefly, these include access and demand created by the explosive growth in global population (estimated at over seven billion people by 2015), technological developments that affect the dramatic increase in the number of people worldwide using the Internet for education, the demands these populations will make on existing educational institutions, as well as the attendant changes in virtual instructional design and pedagogy that must occur should the increasing numbers of learners be attended to sufficiently and advantageously. The Internet is touted as the information infrastructure that will expand access to education—of all types and at all levels—to a global constituency. The following six trends were identified and discussed in [11]:

1) the development of community-based facilities to enable access to ICT appliances, connectivity, and educational resources;
2) new ways to develop and store content as "learning objects;"
3) a growing concern about how "quality" can be adequately ensured in a virtual education environment;
4) the development of new organizational models to facilitate virtual education processes;
5) the provision of learner support services using ICT;
6) the continuing evolution of ICT.

Naidoo cites Guttman (quoted in [11, p.11]) in finding that "two trillion dollars or one-twentieth of global gross domestic product is spent on education, 20% of which is being spent by the private sector." Internet users will top half a billion people by 2003 (quoted in [11, p. 13]) , and the ranks of virtual learners are expected to near 2.25 million in 2001 (quoted in [11, p. 12]) . Naidoo lists the need for education and training, the desire to bridge the digital divide, and the need for individually tailored education that notes a person's capability, potential and level of maturity in terms of his or her own learning process as the driving forces for innovative learning venues. A more sanguine view is offered by Thompson, who writes that students within the new paradigm "become clients, course material becomes a unit for delivery; academics are hired on a part-time or casual basis to deliver the units to the clients. . . . The university is reconstructed as a 'supply side mechanism' to advance the goals of economic rationalism and global reform" [37, p. 13]. Dede [8] suggests that universities employ a business collaboration model analogous to the "competition among cable television vendors to receive exclusive franchises from communities in the early 1980s. . .. Similarly, during today's much larger war in the information services industry, educators who have innovative alternatives to 'talking heads' instruction can find vendors happy to share the costs in exchange for help with the regulators, legislators, and judges who are determining which coalitions will manage the nation's information infrastructures."

Mass customization is the strategy that Hawkins [16], President of Educause, suggests in an effort to "develop viable organizational and business strategies" that address factors such as library access, faculty workload, and incentives to use nontraditional teaching methods, as well as ways to develop robust "faculty support structures." Management strategies such as defining articulation agreements on a course-specific level, financial aid to students registered for distributed learning courses, even the cost of such courses relative to on-campus sections need to be clarified. Hawkins reaches similar conclusions to those advocating institutional alliances to defray the costs generated by the manifold elements of virtual education: "Perhaps consortia and other alliances could allow many campuses to contribute substance, content and intellectual innovation to specific courses or areas of study. To think that all campuses can or should deliver their own delivery platforms is both inappropriate and unrealistic in this period of cost containment in higher education" [16].

While some will look toward ICTs to mitigate the need for growth in the number of faculty, instructors, and tutors so that it is commensurate with the increasing number of students, at least two issues stand in the way of technology filling the gap between learners and instructors. First, the current state of teaching materials available for Internet distribution, including the diversity of access of and to computing systems that interface with these learners, is far from standardized. Second, practitioners of virtual instruction and students involved in distributed learning overwhelmingly cite communication between instructor and student as their paramount need and concern, begging the questions: How does an institute of higher education meet the logistical demands of both its on-campus and virtual constituencies, and what technologies, systems and methods can be used to facilitate focused instruction and learning to an ever-increasing number of virtual students? General concerns regarding e-learning are that it "has the potential to undermine faculty status prerogatives, may lead to the loss of faculty jobs, threaten ownership of intellectual property and decrease personal contact with students, while at the same time requiring them to provide 24-hour access by

e-mail and to give prompt and clear responses to all queries" [11, p. 137]. Nevertheless, the significant amount of resources applied to virtual education attest to the fact that some of these concerns are strongly countered by the faculty enthusiasm to be part of these changes, as well as the corporate sector's heavy involvement in technology to support education.

Bates [11] posits that while "the main providers of network hardware . . . anticipate continued growth of 15% or more annually for the next five years, [suggesting] that access, bandwidth and applications will all continue to increase into the foreseeable future . . . the technical capacity has far exceeded the capacity of governments, commercial organizations and educational communities to respond fully to the opportunities and challenges this rapid change has brought" [11, pp. 29–30]. In-house corporate training and independent training contractors employ sophisticated communication and learning technologies to supply just-in-time education for knowledge workers [10], [11], [13], but few universities have the infrastructure, personnel, and mission to provide similar content and services to their students. For Bates,

> The Web and the Internet . . . require a fundamental rethinking of teaching practice. Students no longer are required to be at a set time and a set place to learn. Teachers are no longer the gatekeepers of knowledge. At the same time, schools, colleges and universities play a much wider role than merely transmitting information from one generation to another. They have social and cultural roles as well. Education needs to match the needs of learners. Technology should be used only if and when it contributes to those needs [11, p. 42].

Bates also finds that "there are very few convincing research and evaluation studies that indicate clear educational benefits for such an investment" [11, p. 43], a claim echoed by numerous academic researchers.

In "What's the difference," Merisotis and Phipps [26] summarize the flaws in much of the research in virtual education. Key shortcomings of the research include:

1) much of the research does not control for extraneous variables and therefore cannot show cause and effect;
2) most of the studies do not use randomly selected subjects;
3) the validity and reliability of the instruments used to measure student outcomes and attitudes are questionable;
4) many studies do not adequately control for the feelings and attitudes of the students and faculty—what the educational research refers to as 'reactive effects.'

Gaps in the research include the following:

1) research has tended to emphasize student outcomes for individual courses rather than for total academic programs;
2) research does not take into account differences among students;
3) research does not adequately explain why the course dropout rates of distance learners are high;
4) research does not take into consideration how the different learning styles of students relate to the use of particular technologies;
5) research focuses mostly on the impact of individual technologies rather than on the interaction of multiple technologies;
6) research does not include a theoretical or conceptual framework;
7) research does not adequately address the effectiveness of digital 'libraries.'

Merisotis and Phipps conclude that,

> technology cannot replace the human factor in higher education . . . [and] technology is not nearly as important as other factors, such as learning tasks, learner characteristics, student motivation and the instructor. The irony is that most of the research on technology ends up addressing an activity that is fundamental to the academy, namely pedagogy—the art of teaching [26].

Moonen [27] of the University of Twente situates telelearning in a rudimentary production model in order to arrive at several general conclusions regarding assessment of technology-based learning. To make a case for telelearning, "one must determine the degree to which it is an efficient production activity that "can be distinguished [by four main parts]: input, process, output and outcome. [27, p. 68]." To do so, Moonen suggests using cost-benefit analysis to gauge quantitative factors and cost-effectiveness analysis to understand qualitative factors. "In the case of telelearning . . . the opportunity for direct contact through telecommunications facilities can lead to an enormous stream of messages, which will demand a huge time investment of teachers or tutors and therefore to an uncontrollable rise in costs" [27, p. 72].

Similarly, Machtmes and Asher find that "two-way interaction was . . . the best method of interaction between learners and instructors" [23, p. 27]. They conclude that there "does not appear to be a difference in achievement between distance and traditional learners." In [34], Smith and Dillon propose findings similar to Machtmes and Asher's. "The predominance of 'no significant difference' findings has led [researchers] to the conclusion that delivery system does not matter . . . The key to developing prescriptive theory lies in improving our understanding of the instructional 'efficiency' of both the media and the delivery systems used to mediate communication" [34, pp. 7–8] (see [42], as well). Like Moonen, the suggestion here is that institutions of higher education examine the cost-performance ratio of technology to learning. "Much of the evidence regarding the appropriate use of media and methods is speculative rather than prescriptive" [34, p. 12].

III. Pedagogical Trends

A two-year study "concerning the communication behaviors of students in a distance learning environment," led Wegner *et al.* [41] to find that "The convenience and familiarity of a single software package, containing all applicable communication technologies needed by students, had a positive effect on student communication patterns." They suggest that, "educational institutions [should] provide integrated instructional management systems as a platform for the delivery of course content and instructional communication" [41, p. 9]. In [40], Wegner *et al.* suggest that, "Instruction on the Internet accentuates the

'student as worker' and the 'teacher as coach' paradigms.... Instructors respond to and accommodate learners in assisting them develop their own meaning for the material rather than interpreting the material for them" [40, p. 104]. For Bates, however, many "administrators lack both the vision to use [the Web] for strategic change and the willingness to reallocate sufficient resources to ensure success" [11, p. 34], intimating that the onus is on the administration of many university campuses to lower their inhibitions to employing web-centric pedagogy that drastically alters how teachers teach.

In an overview of studies concerning the negative effects of the "transactional distance" that occurs in distance education, Wheeler [42] summarizes a variety of pitfalls inherent in the deployment of virtual learning.

> Moore (1991) has identified a 'transactional distance' between learners and tutors, which he claims, amplifies any existing problems in understanding between the two. This instructional gap (Willis, 1993) may also result in mismatches between what the course author desires to communicate and the students' interpretations (Marsden, 1996), and between the intentions of tutors and the expectations of students (Moore, 1991). Lack of interaction between tutors and students and the perception of lack of tutor input into the learning process has been shown to have detrimental effects on some distance learners (Teven and McCroskey, 1996). Moreover, there is evidence to suggest that anxiety or psychological discomfort resulting from learning at a distance can increase rather than decrease as time goes by (Jegede and Kirkwood, 1994).

Wheeler's own study determines that " a psychological dimension to the separation also exists. . . . This gap can only be bridged effectively by sensitive and appropriate facilitative support skills on the part of the tutor." Wheeler also finds that "remote students expect a great deal more from their tutors than local students, most probably due to the psychological distance they perceive, " and, therefore, instructors "must concentrate in particular on providing pedagogical support in the areas of explanation, direction and information giving."

Herein lies a fundamental conflict between the traditional classroom instruction modalities and champions of virtual education—whether the class is teacher-centric or technology-centric. In the traditional model, the teacher maintains control of the information flow, sets the learning outcomes and assesses the progress and success of students. It is safe to say that this *modus operandi* has been in place for at least 150 years. Carswell indicates that, "the Open University distance education model has been designed for adults studying part-time at home who are unlikely to have had recent formal education.... This "predominately paper-based system, while proving itself to be a reliable model within the U.K. ... lacks the desired flexibility and rapidity of communication important for sustaining distance students, especially outside the U.K. An Internet-based system seems an obvious solution; however it must prove itself secure, robust, scalable, and affordable in order to be an acceptable model for the university to adequately support a volume of distance education students" [7]. Moving to an Internet-based model would provide the following benefits for students:

1) faster and more flexible access to information;
2) faster registration and course enrollment;
3) faster turnaround of assignments, enabling faster remedial activity for learning;
4) improving ability to submit assignments from anywhere—geography is not a barrier;
5) increased interaction with tutor and fellow students;
6) more time to reflect on learning difficulties during the interactions;
7) diminished time barriers to communication;
8) more supportive student-centered learning,
9) reduced barriers of remoteness. [7, p.17]

One of the biggest challenges will be acquiring and using resources to operate both physical and online degree programs simultaneously, particularly when initial indications are that the students who take these courses represent different markets. Training faculty to teach effectively in both environments, maintaining dedicated equipment, and ensuring adequate technical support likely will be both time-consuming and expensive.

Arbaugh's [2] summary of a student satisfaction survey of an Internet-based MBA course reflects the following similar concerns:

1) flexibility of the medium and ability to develop an interactive course environment play a larger role in determining student satisfaction than the ease of use or frequency with which the medium can be used;
2) pedagogical approaches may be more important than the technology in determining the effectiveness of [Internet-based] courses;
3) another challenge for educators will be to create methods to develop courses that can meet the needs of both the subject matter and the medium;
4) management educators will need to ensure that they stay current in their skills to integrate advances in technology into their virtual classrooms.

Other researchers add to the traditional versus technological debate by examining how learning styles are affected by computer-based education. Leuthold [20], for example, administered a Gregorc learning-style delineator test to identify the basic learning style (concrete or abstract, sequential or random) of students in an undergraduate economics course. "According to the results, students with sequential learning styles used computer-based instruction techniques more frequently and prefer them to traditional instructional techniques when compared with students whose learning styles are random." For Joy and Garcia [4], "[T]he question for ALN (asynchronous learning networks) practitioners ought to be: 'What combination of instructional strategies and delivery media will best produce the desired learning outcome for the intended audience?'" [4, p. 33]. One of the main concerns of traditionalists in education regarding instructional technology and distance learning in general is the quality of education that can be obtained outside of the classroom setting. "Much of the literature in the field of instructional technology purports to have found no significant difference in learning effectiveness between technology-based and conventional delivery media" [4, p. 33].

In [3], Barajas and Owen warn that "Although VLE might be triggered by socio-economic factors, these processes will only mean an education and training improvement if we consider those elements related to the teaching (pedagogic effectiveness) and institutional sphere (institutional restructuring, resistance to change, etc.). Furthermore, if we do not respond to the academic, linguistic, and cultural diversity of today's world, we are taking the risk of creating systems of low social, pedagogical and economic efficiency. This is the reason why the situation needs a holistic perspective of study and discussion" [3, p. 39].

An ongoing subquestion in the arena of "media comparison research is ... whether media alone influence learning outcomes." Clark argues that media per se do not influence learning. Rather, "learning is caused by the instructional methods embedded in the media presentation." Kozma, on the other hand, posits that "media and methods are inextricably interconnected. ...both media and methods are part of the instructional design" (quoted in [19, p. 35]). In the end, however, Joy and Garcia suggest that "ALN practitioners ... adhere to their time-tested instructional design strategies, regardless of the medium they choose" [19, p. 38]. In other words, let experience be your guide.

Andriole [1], CTO and Senior VP for Technology Strategy at CIGNA Corporation, argues that, "the best path to an effective asynchronous learning network (ALN)-based course is through a requirements-driven discipline that recognizes the uniqueness of ALN-based delivery. The reason for the emphasis on requirements is simple: without reasonably accurate requirements, definitions and designs, we are likely to develop and deliver courses that might have elegant pedagogical features but little or no relationship to what students want or need" [1, p. 57]. Bell and Meyer [4] observe "little consistency in the overall quality of the educational experience implicit in each set of online course materials." In their survey, superior distance learning courses "feature access to resources that are comprehensive (in the context of a particular course) ... [they] are enriched with communication: real time communication elements, discussion forums, chat rooms, or desktop videoconferencing [and they] accommodated collaborative interchange among students." Their conclusion: "successful distance learning must be firmly based in communication and be used to enhance more traditional student-instructor interaction."

IV. Business Trends

Bates finds that "the development of alternative organizational and management structures for the new knowledge-based industries is also relevant to virtual education, which is not only dependent on an extensive and reliable ICT infrastructure, but also requires a post-industrial approach to organization and management" [11, pp. 30–31]. An estimated 160 million people are expected to be involved in higher education in the year 2025 [11, p. 31], and to service them, publishing houses are teaming with universities and education corporations to develop and distribute both new content and new delivery systems. The convenience and growing technological sophistication of virtual education, "is causing some traditional institutions to reassess how they organize, deliver and market their courses," according to P. J. Dirr, one of the Commonwealth report's authors [11, p. 109]. Moving away from the premise that tools, content and systems of education comprise "a self-contained process," the services that make up the virtual educational experience can be distributed to those entities that can best provide courseware, instruction and support.

For example, "Unext, a U.S. company, has established an e-university called Cardean that adapts its teaching materials from that of the universities of Columbia, Stanford, Chicago, Carnegie Mellon, and the London School of Economics. Degrees are awarded under the Cardean name, endorsed by the state of Illinois" [11]. Other prestigious colleges and universities, such as The London School of Economics, are creating digital knowledge warehouses by combining the holdings of notable libraries around the world. Fathom, launched in 2000, is "a global online library linking institutions such as the New York Public Library, the British Library, the Smithsonian, the Cambridge University Press, and the London School of Economics." Even governments are entering the academy. For example, "The U.K. government has put the Higher Education Funding Council for England (HEFCE) in charge of attempts to create an e-university with a budget of £400 million, half of which will be public sector money. The only human contact in the core program will be with 'navigators'—advisers who will help new students to select courses. Only those students who attend summer schools or pay for additional tutorial support will receive face-to-face tuition" [11, p. 32].

In yet another effort to expand life-long learning opportunities, "Oxford University is linking with Stanford, Yale and Princeton to create an online college for alumni. ... Cambridge is exploring virtual learning in its £83 million government-backed link-up with the Massachusetts Institute of Technology (MIT)." Other joint ventures include the University of British Columbia's (UBC) partnership with Monterrey Institute of Technology in Mexico, which since 1996 "has recruited students from more than 30 different countries. This program runs on a self-financing basis entirely from student fees. As a result of this experiment, UBC and Monterrey plan to offer a joint master's degree in educational technology in both Spanish and English on a global basis from January 2002" [11, p. 32].

The business/university alliance model calls on each entity to supply assets historically ascribed to them. "Businesses see the universities as sources of intellectual assets needed to develop distance education offerings. Universities recognize that the businesses are experienced in developing, distributing and marketing products to mass markets. Both sides are struggling to devise relationships that would draw on the strengths of each to create and deliver new products to meet the perceived needs of vast populations of adult learners" [11, p. 111]. However, Bates cautions that, "It is imperative that educational organizations, particularly virtual education institutions, realize that a content management system is a requirement for success in this milieu" [11, p. 58]. Given the parameters of these new content management systems as well as the limitations on time that the growing number of e-learners are experiencing, Andriole suggests that academic administrations "rethink how to move be-

yond a semester model for course delivery, as well as recalibrate faculty load based on contact hours" [1, p. 1].

The e-learning marketplace consists of portals, which are websites that aggregate educational content, lesson plans and other resources online. Examples of leaders in these services include Lightspan and EdGate.com. The corporate sector also contains content providers, education sites, and software companies which typically focus on branding a curriculum in a specific discipline, offering the sale or licensing of curriculum in the form of printed materials or CD-ROMs. At the forefront of the K-12 market are HighWired.com and FamilyEducation Company. Higher education is much more reluctant than primary and secondary education venues to outsource content, as the discussion of the pedagogical issues above makes clear. There are also companies that act as community sites, providing schools, classrooms or student clubs with online publishing tools and communication features such as chatrooms, message boards or e-mail. One trend within community sites is their inclusion of data management tools such as administrative and student information systems. Through tutoring, students benefit by being able to access help whenever and wherever it is needed. Leaders in this area includeTutor.com and eScore.com. Student information systems make it possible for teachers, parents, and students to interact with greater frequency and efficiency by making student records—such as grades or attendance data—and class projects available online [34].

V. Technological Trends

For J. Chambers, the CEO of Cisco, "the next big killer application for the Internet is going to be education—one that would make the pervasiveness of e-mail look like a rounding error" [11, p. 31]. How that application will manage the content millions of students' desire and demand is the focus of several research projects. One of the more significant areas of inquiry is a systematic tagging system for digital data, leading to content for courses becoming available via the Internet as learning objects. The learning object approach uses the

> underlying principle of Napster . . . the retrieval of music content from a distributed network of servers powered by a common metadata packaging scheme. In educational terms, the analogue would be the provision of access to instructional units, learning resources, assessment and accreditation mechanisms using a common packaging schema for the granular components of learning. Building an educational repository that provides access to learning object requires standards and structures that can facilitate object storage, retrieval and aggregation to suit the needs of learners or the pedagogical intentions of instructional developers [11, p. 48].

"Examples of collaborative sharing models based on learning object attributes are already visible in the public education space. The Multimedia Educational Resource for Learning and Online Teaching (MERLOT) is one example of a consortium approach to providing online resources for faculty and students" [11, p. 57]. Challenges ahead vary for different institutions with different histories and capabilities in distributed learning, and both research and teaching institutions that, over the years, have acquired "large stores of legacy content and learning resources" [11, p. 57]. Each institution has to identify content it considers to be valuable, create modules out of that content, then ascribe a metadata tagging system that "allows for efficient storage and retrieval. For most organizations, the move to a learning object model could be labor-intensive and expensive" [11, p. 57].

Porter finds that, "While the Web world focuses its attention on knowledge management, customer profiling, and e-business practices, many education institutions continue to automate traditional instructional and administrative practices. . . . Very few have considered that idea of component-based instructional units, 'learning objects,' and complementary business systems and student service models that have the potential to revolutionize instructional practice." Can educational institutions involved in or embarking on virtual learning programs meet the demands of "the masses in a convenient and user-driven manner," given the resistance to change these same institutions demonstrate through their

> hierarchical . . . organizational structure . . . their buildings, through their academic calendars, or even through their Web sites [?] Instead of identifying a learner's goal and then describing potential pathways to achievement, many institutions deal more with their own institutional requirements to qualify the learner to be enrolled. This position can be attributed in part to the historically autonomous nature of institutions of higher learning, where the power resides in the hands of the institution. Many see no real need to change, even in the face of increasing competition from the private sector such as the University of Phoenix, or from private-public partnerships such as Cardean University [11, pp. 47–48].

Content providers must consider the implications resulting from the development and implementation of "metadata standards to ensure that their databases and repositories for print, audio, video and computer-based materials are accessible both for internal and external purposes. It is also imperative that they have a plan for converting any analogue assets (primarily video) for use within a learning object economy" [11, p. 49]. This requires that all those involved in the development and distribution, not to mention the use of learning objects and databases agree "a protocol [and] the standards for locating and operating interactive platform-independent materials" [11, p. 50]. For Porter, "The key to understanding structured information is the concept of separating content from its presentation, which can be done using standard generalized markup language (SGML) or extensible markup language (XML). These are meta-languages that can be used to develop print or Web-based products that follow this separation" [11, p. 54]. "Instead of seeing content of course authoring as a standalone activity in an educational organization, the Web-centric trend is to see the operation of an educational organization as an integrated whole that can provide customized service to all of the organization's learners and clients . . . . To accomplish the goals outlined above means that instructional developers need to become familiar with learning object theory, metadata classification standards, instructional material packaging schemes, content management systems, authoring tools and instructional delivery tools" [11, p. 56–59].

Ongoing academic research also includes contributions to the "current debate about the role of hypertext and hypermedia [that] centers mainly around the use of hypertext as a cognitive tool for purposeful learning of complex material" [2]. Hutchings *et al.* claim that hypermedia offers users "greater learning control; improved access to multimedia learning materials; and a variety of new modalities of interaction for use with learning material." McKendree and Reader, however, argue that, "Simply having access to information or knowledge does not presuppose that learning takes place" (quoted in [22]). Jonassen posits that representing content architectures via a graphical user interface (GUI) will not help students map those structures to a useful degree (quoted in [22]). Barker states that, "if hypermedia material is to be educationally effective, considerable thought should be given to firstly the learning goals and activities that it must support; how the nature of the underlying knowledge corpus relates to these requirements; and how learners differ from each other. . . . The more deeply a learner processes information, the more likely it is that the person will remember material to be learned. Sternberg & Lubart (1991a) propose that there is a link between intellectual (or thinking style) and creativity" (quoted in [22]). Carswell *et al.* ask whether "the Internet supporting student needs or technology vanity?" [7, p. 7].

Peters [30] sets multimedia technology within the context of pedagogy, suggesting that, "When carrying out experiments with multimedia in a digital learning environment it may be advantageous if the teacher has an idea of other specific pedagogical functions which this method of intensified illustration can have" [30, p. 5]. Smith and Dillon [34] focus on "Branching [as] an attribute of media. . . . Individual learners can select or be directed to different instructional events depending upon interest, need, or competency level. Learners learn at different rates, and individual learners may process information differently. Therefore, learning efficiency can be increased if the instruction can be tailored to the individual requirements of the learner" [34, p. 18]. More generally, Bourne, *et al.* [5] list the "major paradigms currently in use in ALN: Use of computer conferencing for submission of homework, discussion of issues, help; On-line material that include syllabus, assignments, reading, problems, Interactive Learning Modules; Course management; Interaction with students; Audio clips of lectures; Video clips of lectures" *et al.* [5, p. 41]. They find that a "core issue is to determine when ALN is useful and when it is not. When students and instructors can meet together in small groups, are continuously accessible to each other in a face-to-face setting, and cost is not a concern, ALN would not likely be the instructional paradigm of choice. . . . However, as classes grow larger and as learners require access to leaning at different times and in different places, ALN appears to have clear advantages over the traditional learning model. . . . A wide variety of issues remain to be resolved that include how to: (1) impart the 'closeness' of an intense face-to-face interaction to ALN, (2) scale up ALN to support large numbers of learners participating asynchronously, (3) reduce the high level of effort required to create ALN courses and (4) create support tools that are intuitive and straightforward that faculty can use" [5, pp. 44–45]. Learning objects, when viewed from the perspective of corporate training and business education, are viewed enthusiastically. Ouellette [29] writes, "The ability to structure a distance learning course by assembling different elements to satisfy changing needs would go a long way toward meeting corporate requirements."

In a white paper published by the Department of Defense, [12] analysts agree that:

> A successful shareable courseware objects reference model (SCORM) must meet three primary criteria: It must support full articulation of guidelines that can be understood and implemented in the production of shareable courseware objects; It must be adopted, understood, and used by as wide a variety of stakeholders as possible (courseware developers, courseware tool developers, and courseware customers, for example); It must permit mapping of any stakeholder's model for instructional systems design and development into itself.

Judith Boettcher [42] concurs, finding that "the concept of a university course as an instructional unit will be weakened and replaced by the concept of 'knowledge clusters' that focus on developing competencies in specific disciplines."

In a white paper by Lotus Institute [21], the authors find that distributed learning provides beneficial training that can help bridge the gap between traditional higher education and commercial endeavors. Distributed learning "creates the foundation for organizational learning, an organization's only sustainable, long-term competitive advantage." Looking forward to a more widespread use of these technologies, these researchers find that "The huge growth in the installed base of networked and internetworked computers presents an opportunity now to create an electronic environment for learning any time and any place." Microsoft's Collaboration and Multimedia Group [6] has been working on the implementation of two widely-used application, Windows Media Player and NetMeeting, to create an environment in which "A distributed lecture video viewing system with shared VCR controls" could be merged with "A communication system for discussion around the video content" but among geographically dispersed participants [6, p. 140]. These software leaders concur that, "Online training is becoming a commonplace solution as marketing professionals strive to achieve the perfect work-life balance" [33].

VI. Technology Policy Issues for Education Leaders

For Stokes, "If there is a mandate to rethink the relationship between education and technology, it is not because technology—by itself—makes people smarter. Anyone who presents such an argument is simply hawking 'the new new thing.' The real reason to rethink education around the question of technology is that the technology is here—and it is embedded in our lives" [35, p. 2]. Many practitioners of virtual education believe they are offering "a more interactive education encouraging critical thinking, communication skills and flexibility for both students and teachers, compared with one-way mass media of the open universities" and more generally when compared to traditionally delivered education [11, p. 44]. However, Martin [24] finds that "Administrations are "cautious and slow to embrace new models," resulting in "a lack of coordinated infrastructure; senior leadership dilemmas;

and, double standards in funding models." He suggests that universities ally themselves with "community groups and corporations" [24, p. 1].

For all the technological advances that are and can be applied to education, there remains a wide gap between large numbers of potential users and innovators in content development and instructional techniques, and that gap is maintained by the "inertia and resistance on the part of tenured faculty, insufficient funding by their administrations, an unprepared cohort of students; a lack of clear policies regarding copyright and intellectual property, and the persistent questioning of virtual education's quality," according to the Commonwealth report authors [11, p. 117]. Hope finds that:

> In a disaggregated environment where the instructional design process and the provision of technical support and tutorial services may have been contracted out by the institution to commercial providers, it is no longer appropriate to rely solely upon the procedures of full-time faculty appointments, development and promotion to provide reliable indicators of overall academic quality . . . Benchmarks on a global scale must be agreed upon so that a 'global currency for higher education qualifications' based upon an evaluation of learning outcomes by reference to generally agreed standards of achievement at defined exit levels [11, pp. 126–27].

Wade and Power [39] suggest the following "General Requirements for WWW Based Instructional Design:"

1) the presentation of material should support a range of sensory experiences incorporating interactivity and multimedia elements;
2) students should be provided with the opportunity to experiment with the knowledge they have learned;
3) testing and checkpoints are important from the point of view of repetition and student retention;
4) educational software should motivate the student;
5) the learning environment should support the cognitive structures of the student;
6) facilities for synchronous communication and collaboration should be supported where possible;
7) a well-designed interface will enable the student to interact with the material without the complex intermediaries and will aid in the understanding of the knowledge domain and structure;
8) the development of a Tele-Educational course requires the support and cooperation of faculty and administration;
9) WWW-based educational courses must be integrated into a well understood and explicitly specified curriculum which includes clear objectives, content description, methods of teaching, student learning, student assessment and course evaluation [39, p. 244].

"Methods change but standards of quality endure," according to Hope. "The key areas affecting the quality of technology-mediated learning are common to all of the published benchmarks and guidelines and relate to: Institutional support; course development; teaching and learning; course structure; student support; faculty support; and evaluation and assessment" [11, pp. 132–133]. The Institute for Higher Education Policy (IHEP) report from 1999 acknowledges that "technology is not nearly as important as other factors, such as learning tasks, learner characteristics, student motivation, and the instructor"(quoted in [43, p. 93]). It also finds in the literature a conviction that faculty, who combine the roles of "content experts, learning process design experts, process implementation managers, motivators, mentors and interpreters" cannot be replaced by technology "without significant quality losses" (quoted in [43, p. 93]). "Policy-makers opting for technology-mediated learning solutions must factor in the cost of designing quality management systems which use the data collected as part of a constant quality improvement process" [36, p. 134]. Worley [43] concludes that, as learning moves off campus to the home and to the workplace, students will become sophisticated consumers in the educational marketplace, expecting the same "services, customization, and responsiveness" (quoted in [43, p. 97]) that they demand from other consumer products.

VII. Conclusion

It is often said that education follows technology. As the discussion of research and pedagogy trends would indicate, however, education, particularly research and experimentation in computer science and information systems, is fueling the technology that is increasing the proliferation of distributed learning via the Internet. As Stokes [35] suggests, the "time to rethink the relation between corporate, government and education institutions is now . . . Working together, policy leaders, administrators, teachers, students, parents, education entrepreneurs and investors can realize the potential for e-learning to substantially improve and expand the learning opportunities for children," opportunities that parallel the enormous expansion of educational technology in the corporate sector [35, p. 10–11]. As for the growth of for-profit higher education venues, this "is based less on advanced technology than on a reconceptualization of the entire enterprise of postsecondary education" [28].

Farrell offers that, "What we see emerging is a perception that virtual education is part of the broader e-commerce revolution . . .. The view that virtual education is essentially a 'business operation' may result in the adoption of more business-like management practices and lead to better management of public sector institutions" [11, p. 147]. Whether or not we will see fundamental definitions of educational endeavors and practices change as a result of the trends described above will depend largely upon the competition of vision statements held by the many players involved. Worley argues that, "institutions will design flexible, customized programs to meet their educational needs and lifestyles. Instead of focusing on traditional graduate and undergraduate degrees, these universities will emphasize certification, skill sets and modular degrees" [43].

As proponents of virtual education advance their agendas, administrations of traditional institutions of higher learning will be pressured to accommodate innovative faculty and technophiles eager to move with the quickening pace of two ever-increasing student constituencies: the technologically advanced traditional student, and the working adult. As both of these cohorts search for course content that will fulfill their immediate needs and longer term educational goals, traditional universities will struggle to re-

vise and renew curricula at a rate equal to if not faster than proprietary institutions and other innovative content providers develop and offer courseware to meet perceived needs. Academic administrations will again be pressured to reconsider important questions such as copyright, intellectual property, and their claims on faculty time. Farrell believes that:

> The growth of virtual education is tending to erode the historic distinctions that have existed within educational systems. Distinctions such as training and education, credit and noncredit, and formal and nonformal are much more difficult to sustain in an environment in which content is no longer linked to predefined programs and courses or to any particular mode of delivery. These distinctions are being further eroded by the development of competency-based assessment models, the assessment and accreditation of prior learning and the development of credit banking organizations with the authority to award credentials [11, p. 147].

Alliance between academics and courseware entrepreneurs is already in vogue, and as flexibility continues to be the watchword for education providers, advances such as learning objects and other technologies "that will optimize interoperability with other institutions and organizations in areas such as the creation of learning objects databases, information databases such as libraries, administrative systems and learner support strategies as well as the facilitation of interactions among learners and teachers" [11, p. 149], will continue to expand the scope of possibilities with which educational institutions will have to grapple [9]. Rayport's statement that, "No matter how often consultants and academics pretend that business is more science than art, every practitioner knows that business is almost all art, just as the genius of nearly every corporate strategy lies in its implementation" [32] applies to teaching faculty as well: every teacher comes to understand that successful imparting of information and skills lies in the ability to incorporate a variety of technologies that, directly or indirectly, help communication between student and teacher [14].

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