REMOTE INFORMATION ORGANIZATION AND DECENTRALIZED EDUCATION

by

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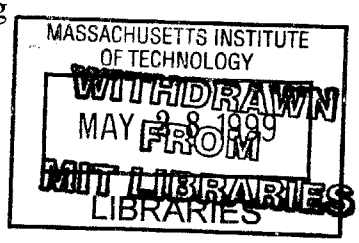

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Abstract
With an increasing volume and variety of information at the disposal of educators, content is best organized in remote fashion. Moreover, a centralized system that allows collaborative access to information is necessary. Education in general, and distance education in particular, is most effective when decentralized. Cultural and physical expectations always play an important part in the educational process. This allows local centers to more aptly anticipate student needs. In this thesis, I investigate the distance education market landscape in its historical form, its present form, and its potential future form. In addition to the law and policy affecting distance education, I examine theories for implementing relevant distance education methods. These principles are applied in an analytical case study to a specific, well-known university, one that exclusively offers distance education. The application of the principles results in the original contribution of a supply chain analysis. I seek to show, as a final point, that the best path for distance educators is one of remote information organization and decentralized education.

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Chapter 1: Introduction

Section 1.1: The State of Distance Education

The importance of human capital is widely recognized at present to be a critical element for national economic growth. Indeed, economic success in our era does seem to rely heavily not only on the length of education of the populace but on the quality and applicability of that education as well. Knowledge is not quite as important as the ability to constantly adapt the mental models that allow us to easily confront and absorb new systems of thought.

Analyzing this phenomenon along side the increasing spread and flexibility of telecommunications suggests some interesting possibilities. Content delivery can be more versatile through new mediums than through any of our traditional methods. Since we in addition need versatility to satisfy the demands of modern economies, we can turn to a new form of education – namely, distance education.

The change will be structural. It will go far below the surface of our organizations. Corporations already have understood this and have consequently implemented decentralized communication systems along with decentralized management. The academic community may soon feel the same changes upon them.

They certainly already sense the transitional state in which research funding exists. For example, MIT first gained its prominence in the 1940s mostly due to its involvement with the government (i.e., from its Radiation Laboratory work on radar during the second World War and contributions to other innovations). It gained a firm financial founding for decades thereafter due to the federal support that was encouraged by the Cold War. Many say that in 1989, as the Cold War ended, the prospects for funding irrevocably changed in character. In fact, federal funding for

university-based research is expected to decline by 20% in real dollar terms between 1997 and 2000.[1] Universities will be increasingly pressed to look to the private sector for funding. And the private sector will increasingly encourage forms of research that produce useful results for the money they pay.

This is important in that there is, by all indicators, a global shortage of professionals who are skilled in technology and management. Distance education is uniquely suited to access this widespread demand. Further, it represents a growth strategy for universities. Companies in the private sector have long known that they constantly face three choices: grow, evolve, or die. Increasingly, universities may face the same Darwinian paradigm. Luckily, they may also be well-suited to both grow in their reach and evolve in their educational delivery by employing distance education.

Even the very concept of a university campus can become malleable. With remote sites scattered across a large geographical expanse, a university can have more of a *campus environment* from which it delivers its instruction. These remote sites need not be core centers of learning. They can, for example, function as extensions to the university for special projects. Students may study abroad for a year and still maintain access to the university through technological means. They could even, while abroad, take courses in their home university; they could interact with their advisor; they could consult other professors; they could communicate with their peers. The presence of the university could be extended to allow the educational experience a form of existence locally or at a distance, centrally or with many coordinated nodes.

Section 1.2: Organization of this Thesis

The following chapter of this thesis, Chapter 2, covers the market history of distance education. It briefly reviews the state of the market in the recent past. It subsequently

[1] Larson, Richard C., "MIT Learning Networks: An Example of Technology-Enabled Education." MIT Council on Educational Technology, September, 1997.

describes at length the current state. Academic environments along with corporate environments are addressed. The various strategies of corporate players are presented. Finally, models for forecasting the future are offered.

Chapter 3 contains analysis of theories for implementation of distance education. The first half describes high-level, general theories. These are concerned primarily with the experience as a whole. The second half describes low-level theories -- specific issues of implementation. These address the particular concerns that a person implementing a distance education method would face.

Chapter 4 covers the legal and policy framework necessary for considering distance education schemes. Relevant legal issues are treated in a topical manner. Policy issues are subdivided into two categories: 1. Governmental; and 2. University. Prescribed areas of concern, and their possible variations, are offered.

Chapter 5 applies much of the theoretical presentation in the form of a case study. Open University, a distance education university based in the United Kingdom, is to date the largest educational institution of its kind. Its operations and structure are analyzed.

Chapter 6 expounds upon the supply chain in this market, describing it first in generic terms. It then proceeds to discuss the relevance of the supply chain with respect to specific examples in the distance learning environment, both academic and corporate.

Chapter 7 concludes the thesis. It amplifies on the importance of remote information organization and decentralized educational application within distance education systems. Drawing from the rest of the thesis, it presents original suggestions for the best approaches which governments and educational institutions can take. Finally, it suggests directions for the future of distance education.

Chapter 2: Market History and Development

Section 2.1: Past -- Market landscape in 1988

Before looking at the market today, we may benefit from hindsight. In other words, the market in the late 1980's could perhaps offer instructive contrast to our present efforts in distance education. There is also a telling difference between the development of the market in Europe and in the US.

One major difference between now and then in the US is that universities were already offering courses in pragmatic working skills. Corporations, despite a need to do so, did not. Further, there were few formal interactions between corporations and universities. There were no courses that were offered exclusively for certain companies on certain subjects.

Both universities and corporations did offer courses in instructional telecommunications systems, which were mostly managerial courses rather than for pragmatic skills.

The usage of computers was of course much less widespread, and this seemed to inhibit even the idea of integrating corporate educational needs with academic educational offerings. Some universities had general computer-based education courses, but these were scarce. More common were specialized computer-based education courses – namely, computer science – which were present in universities and corporations. This specialization, or lack of general usage, created a lack of computer usage for design and delivery of course content.

This picture of the American market landscape in the late 1980's, however, contrasts sharply with that in the United Kingdom (UK). The US market largely felt no impetus for sending its workers back to school because it was in a boom. Unemployment figures were low, making the demand for increasing one's

knowledge base minimal. The UK, on the other hand, was experiencing high unemployment at the time. Many older individuals felt the obsolescence of their professional skills and sought ways to gain new sets of skills. Distance education rose as a consequence. One piece of evidence is entire universities, massive in scope and presence, that gained prominence in this decade. The Open University is one example that is analyzed later in this thesis.

Section 2.2: Current

Section 2.2.1: Market Sectors (Customers)2

Section 2.2.1.1: Business Environments

Businesses around the world are struggling with two essential problems. First, they need the best 'human capital' to remain competitive, and making sure that their employees do not become obsolete requires constant and intensive attention. Second, they each want to unify their corporate visions and direction. In an era of global business, different divisions around the globe can very easily be making different decisions, perhaps against the interest of the larger organization, and can be developing the skills of their employees in fruitless directions. Experience has proven that focus is tantamount to success in business. To keep an organization focussed, it must have the same information base for its members.

Continuing training can support such a common information base. Here we list five salient components that it would serve: 1. New Product Introductions; 2. Job Skills Training; 3. Advanced Education in both technical and non-technical subjects; 4. Management development course; and 5. Customer Training.

Section 2.2.1.2: Academic Environments

Forward-looking academic groups must keep two things in mind. First, federal funding will most likely decrease in the future, with many academic projects anticipating support from private sectors. In other words, research to serve the needs of companies will probably become much more common.

Second, universities have some mandate, sometimes unwritten but still strong, to serve the needs of society. With the Baby Boom generation exiting the workforce, there might conceivably be a shortage of skilled workers. And those workers will be facing a much faster pace of obsolescence than has ever been seen before.

Third, the American cultural landscape is going to change tremendously in the next two decades. In California and Texas, Latinos will become the majority population, and the majority of these will be of the traditional age for college.[3] The population of African-Americans is similarly expected to swell. For the former, there will be an easily anticipated language barrier. For the latter, there will be a much more nebulous outcome, although many black communities in California have already instituted "Ebonics" courses. (Ebonics is a purported derivative of English, conflating the words ebony and phonics to signify its origin.) All in all, universities shall face unprecedented challenges to reach populations of different linguistic and cultural backgrounds.

Section 2.2.1.3: Work Force and Work Place

One salient factor to note is the obvious but crucial shift our economy has taken in recent decades. Specifically, there is a preponderance of services in our economy. This carries implications for the rate of obsolescence of job skills. Labor Department

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[2] Chute, Alan G., Dianne P. Thompson and Harvey D. Starin. "It's Time to Change the Way We Train!" CEDL, http://www.lucent.com/cedl/itstime.html, April 1998.

statistics in 1998 show that almost 70% of our gross national product is constituted by services.[4] With the rise of developing economies – which will presumably contribute more to manufacturing -- around the world, this statistic could increase in the future. Our problems with obsolescence would likewise increase, creating great needs for continuing education in order to provide workers with viable skills.

Corporations already realize the urgency. In 1993, they spent $48 billion for corporate education and training.[5] For the most part, though, they did not spend this money on distance education formats. And most of them have found that the results were disappointing. Universities have been educating people for centuries. If they can benefit at all from their own collective memories, they should be able to fulfill this role for industry with much greater skill.

Section 2.2.2: Market Scope (Corporate Programs)

Section 2.2.2.1: IBM

There are several corporate programs that offer distance education assistance to other corporations and universities. We choose to focus on a program from IBM, called Global Campus. It is well-known in the industry and serves as a representative example of other programs of its kind.

In general, IBM sends in teams of professionals to design and implement such plans. The people would have expertise in a variety of pertinent areas, such as server systems, PCs, Lotus Notes, Internet, educational methods and networking.

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[3] The Economist. "American's Latinos," 25 April 1998.
[4] Chute, Alan G., Dianne P. Thompson and Harvey D. Starin. "It's Time to Change the Way We Train!" CEDL, http://www.lucent.com/cedl/itstime.html, April 1998.

The IBM website describes the program "an education and business framework that helps colleges and universities use computer networks to redesign learning, teaching and administrative functions." For example, the University of Minnesota is currently in the process of establishing an online system for the management of student records, everything from grades to personal history. IBM collaborates with the University of Minnesota under the rubric of their Global Campus program.

Another large example of IBM's initiative, in fact the largest example, is the California State University System, which comprises 23 campuses and more than 330,000 students. The entire system subscribes to the Global Campus program. (There are 32 other universities who also participate.[6])

To get a more detailed idea of what the program offers, we may looks at its specific features.[7] IBM has an application that they call IBM InterConnect for Lotus Notes. It allows content hosting, in this case educational content, that is originally captured by Lotus Notes. In order to facilitate the usage of their InterConnect application, IBM also offers Lotus LearningSpace. This allows teachers and students to use Lotus Notes with the IBM application in order to engage in simultaneous learning sessions.

The other aspect that IBM offers, which is in fact an aspect that is most easily handled by outsourcing, is information management. For example, they compile, organize and structure a digital library of the multimedia learning material offered to a university. They allow the authorized participants of the program to access this material on demand. And they ensure adequate directory services for the information with their in house development of catalog functions and searching schemes.

Finally, IBM offers access to both their worldwide physical infrastructure as well as access, by purchase or lease, of necessary hardware, such laptop computers.

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[5] Chute, Alan G., Dianne P. Thompson and Harvey D. Starin. "It's Time to Change the Way We Train!" CEDL, http://www.lucent.com/cedl/itstime.html, April 1998.
[6] IBM website, http://204.146.49.251/igc/press.html
[7] IBM website, http://204.146.49.251/igc/press.html

Benefiting from this IBM program requires that you go through a two-part tariff. In Economics this term is used to describe a specialized form of pricing used to extract the maximum amount of consumer surplus given certain contexts. (Consumer surplus is the area bounded by the demand curve at the upper limit and the price of the product at the lower limit.) With a two-part tariff, the consumer pays once to gain the 'privilege' to access the company's products. Then the consumer must also pay for each individual product. Such is the case with IBM Global Campus, which requires an initial fee to join and individual subsequent fees for each of its components.

For this reason, the features for IBM Global Campus do not have to be purchased en toto. They can be bought in parts in order to create customized packages that serve the different needs of different customers.

IBM has other programs that use the two-part tariff strategy, such as their Higher Education Software Consortium. This is a group that offers the benefit of buying IBM educational products. In other words, accredited universities must first pay to join the Consortium. Then they can purchase IBM products for higher education.

Section 2.2.2.2: Microsoft

For almost everything Microsoft attempts to have a vision. Distance Education is no exception. According to their own public relations material, they have three basic components to their distance education goals: 1. Preparing students for lifelong learning; 2. Fostering an 'Anytime-Anywhere' learning environment; and 3. Creating 'Technology-Enabled' education.

Preparing for lifelong learning

The company cites research that the 15 million college students in America today will face a whole new style of career development. These students will be changing their career paths on the average seven times before retirement. How to best prepare them for such a tumultuous road? Clearly, there is no formalized area of knowledge that will serve them well throughout life. Rather, there is only the ability to acquire new knowledge that will prove vital. More than anything else, students must be taught how to learn. Colleges do seem to realize this need, as over 40% have some form of IT requirement in their curriculum. [8]

Anytime-Anywhere learning

To further this goal, universities must foster an environment in which the student can be learning constantly. They should have access to learning materials wherever they are on campus, no matter what the time of day. The importance of building such an environment, as allowing students to become acclimated to it, is to establish the proper pattern for future education. Students should be able to engage in a pattern of knowledge acquisition that continues seamlessly after college. [9]

Technology-Enabled Education

The crunch of continuing education is arguable already upon us. If we were to classify continuing education students as those being 25 or older, we would find that this group constitutes 40% of students currently in higher education. As these people are more likely to have obligations outside of school, they need to have ways to access education in a self-guided manner. Technology allows that. [10]

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[8] Microsoft Corporation. "Higher Education Solution Briefing Script." 3 April 1998.
[9] Microsoft Corporation. "Higher Education Solution Briefing Script." 3 April 1998.
[10] Microsoft Corporation. "Higher Education Solution Briefing Script." 3 April 1998.

Section 2.2.3: Market Scope (Software Makers)

There are a number of software products on the market, such as Lotus Notes and others. Here we cover just one, Microsoft Exchange, partially because we shall assume that it is representative of alternatives and partially because of its uniquely strong positioning within the market.

The Microsoft Corporation describes their product as a message platform. They tout it as scalable, reliable, and secure. Microsoft Exchange is useful to any business that requires a robust messaging and collaboration platform for applications such as electronic mail and forms, group scheduling, discussions, task management, document routing, and real-time conferencing should consider deploying Exchange.[11]

There are four main categories in which the features of Microsoft Exchange can be divided. They are as follows

1) Solid Messaging Foundation
2) Connectivity and Co-existence
3) Common, Familiar Tools for Collaboration
4) Management and Administration

Taken from the Microsoft website, the tables provide a schematic overview of these features. The first one describes the message foundation. It covers the core issues of scalability, reliability and security. It also describes performance issues and support services.[12]

Table 1: Messaging Foundation

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[11] Microsoft Corporation, http://www.microsoft.com/exchange/default.as, April 1998.
[12] Microsoft Corporation, http://www.microsoft.com/exchange/default.as, April 1998.

Messaging Foundation	
Scalability	
Feature	Benefit
Unlimited Message Store	Size limits on the information store are large enough such that the upper bound is set only by the hardware.
Backup Performance Improvements	Very large data stores require improved backup performance. MS Exchange offers an API (Application Programming Interface) for which output has been increased to 25 GB/hour.
Reliability	
Microsoft Cluster Server Support	Microsoft has a technology they call Cluster Server. It provides single-node fail-over support in the even of software or hardware failure.
Security	
Enhanced Security Management	For e-mail security, Key Management Server is offered as an integrated component of the MS Exchange server, bulk enrollment of users, and distribution of certificates and multiple password validation for administrators.
S/MIME	MS Exchange Server allows S/MIME-aware clients to send encrypted mail to one another. (The ability to send and receive S/MIME encrypted or digitally signed mail is dependent on an S/MIME-aware client.)
X.509 v3	MS Exchange accepts and understand X.509 certificates issued by an intranet certificate authority such as the Certificate Server in Internet Information Server 4.0 or an Internet certificate authority such as VeriSign.
Offline User Support	
"Change-only" Offline Address Book	The offline address book downloads only changed items rather than the entire address book, making downloads faster and less bandwidth intensive for remote users.
Multiple Organization Hosting	
Virtual Organization Support	Administrators can create virtual organizations in MS Exchange by creating multiple address containers within the Global Address List and

	preventing users from viewing any container other than their own. This allows multiple organizations to be hosted securely on a single server.

Enterprises often have a mix of mail systems and standards. Integrated connectivity is important in this context. Microsoft purports to offer it, as illustrated in the table below.[13]

Table 2: Connectivity

Connectivity	
Internet Support	
Feature	Benefit
Lotus Notes Connector	The Notes Connector enables Notes sites to seamlessly exchange email and synchronize directories with MS Exchange servers.
OfficeVision/VM (PROFS) Connector	The OfficeVision/VM connector enables email exchange between OfficeVision/VM systems and MS Exchange.
SNADS Connector	The SNADS connector enables email exchange between SNADS systems such as IBM OfficeVision/MVS or Fisher TAO and MS Exchange.
Client Family	
Outlook for Windows 3.x and Macintosh	MS Exchange includes versions of Microsoft Outlook™ desktop information manager for these listed OS". These versions of Outlook include the Outlook user interface and interoperability with the 32-bit Outlook scheduling environment.
Updated Forms Support	HTML forms, created using Visual InterDev™ Web development system, can be called directly from any Outlook client and launched directly in the default browser.
Outlook Web Access Enhancements	Outlook Web Access now includes calendar objects, allowing users to

[13] Microsoft Corporation, http://www.microsoft.com/exchange/default.as, April 1998.

	manage their individual calendar and participate in group scheduling.

Collaboration tools are what give such software utility. Microsoft asserts that their software has a superior collaboration environment and development environment. They state that the development environment should allow you to build applications that allow access to information via a common client such as a Web browser. The messaging platform itself should include value-added components such as real-time chat services and support for server-side, event-driven script.[14]

Table 3: Tools and Collaboration

Tools and Collaboration	
Collaboration	
Feature	Benefit
MS Exchange Scripting Agent	MS Exchange includes server-side scripting for creating event-driven agents, which can be used to create automated collaborative applications and simple workflow.
MS Exchange Chat Service	MS Exchange Chat Service enables real-time collaboration using any standard IRC or IRCX client.
Internet Locator Server Support	MS Exchange will include the Internet Locator Server, allowing users to do ILS lookups using the MS Exchange directory.
Development Tools	
Collaboration Data Objects (CDO) Enhancements	CDO is the object library used for Exchange ASP applications. By including objects for email, discussions, scheduling, and directory access, website developers can create Active Server Pages that make for easy access of information via a web browser.

[14] Microsoft Corporation, http://www.microsoft.com/exchange/default.as, April 1998.

Authoring Tools	Design Time Controls, included in Visual InterDev, serve as templates that make it easy for website developers to create Active Server Pages. Wizards, available on the web, allow website developers to create Active Server Pages without writing script or HTML using a web authoring tool.
Visual InterDev	MS Exchange includes a single-user copy of Visual InterDev for creating HTML forms and Exchange ASP applications.
ADSI	MS Exchange supports the Active Directory Services Interface, which customers can use in conjunction with LDAP to synchronize the MS Exchange directory with foreign LDAP directories. Customers can also use ADSI to begin writing MS Exchange applications that will integrate with and take advantage of the Active Directory in Windows NT Server 5.0.

The management and application of a platform is vital. Microsoft believes, perhaps somewhat to their benefit, that this translates into a need for the application to be tightly integrated with the Operating System (OS). The application should have a view of all servers in the network and an ability to connect to all those servers; there must be standard tools that come with the application to perform these tasks. Finally, least cost routing and dynamic rerouting, in order to easily manage the network activity, should also be provided. [15]

Table 4: Management

Management	
Feature	Benefit
Deleted Item Recovery	Deleted items or folders are "soft-deleted" and maintained on the server for a specified period of time. During this time, deleted items can be recovered by the end user, freeing the administrator up

[15] Microsoft Corporation, http://www.microsoft.com/exchange/default.as, April 1998.

	to do other tasks.
SNMP Support	The MADMAN MIB (RFC 1566) is supported for use with SNMP management consoles.
Address Space Scoping	Connectors can be selectively restricted for specific use on an organizational, site, or server basis.

Understanding a complicated application like MS Exchange is important to understand both the potential and the likely future of Distance Education. Collaborative virtual environments, a pivotal part of which is such application environments, will most likely form the foundation of advanced distance learning initiatives in the future.

Section 2.2.4: Market Scope (University Programs)

There are arguably three components for a good implementation strategy in a university: 1. An academic component; 2. An administrative component; and 3. An infrastructural component. The first one addresses teaching and learning and will be covered in greater depths in later sections of this thesis. The second one refers to access to institutional data and line-of-business applications. The third comprises the "digital nervous system" that governs and manages the entire institution.[16]

There are myriad distance learning programs in universities around the world. Generally, the brand name universities have centers and areas of research for distance learning. Lesser-known universities tend to offer fully accredited and fully scaled degree programs entirely through distance learning. Perhaps this is a form of creative competition. But whatever the intention, the result is that innovations, mostly theoretical, come from the laboratories and applications come mostly from the fully scaled programs.

[16] Microsoft Corporation. "Higher Education Solution Briefing Script." 3 April 1998.

To be more concrete, we can observe Stanford's mostly theoretical Learning Lab and their more pragmatic Stanford Online program. The theoretical character of the former can be sensed by reading the descriptive introduction that Stanford provides for the Learning Lab:

"Using method and technical services that directly support student learning activity – such as note-taking, discussion, composition and the creation of knowledge artifacts, we strive to capture student learning experience and store and retrieve it in a fashion that promotes re-use and discourages 'disposable learning' (just enough for the exam)."[17]

The latter offers continuing education through the Stanford Instructional Television Network (SITN), which has existed for 30 years. It is based in the School of Engineering. SITN is a part of the Stanford Center for Professional Development (SCPD).[18] It offers courses through its distance education framework, but it offers a full Masters degree only to corporate-sponsored students. Other students may take classes for credit but toward no degree. Stanford, as a 'brand-name' university, chooses to focus its efforts largely on theoretical pursuits. Other universities of lesser redoubt, such as Open University or Henley College of Management, both in the UK, avoid the theoretical aspects of distance learning and focus exclusively on offering real degrees.

Section 2.2.5: Market Scope (Other organizations)

The Public Broadcasting Service (PBS) engages in a distance learning project that they call Going The Distance (GTD). It is an effort to assist colleges in developing appropriate programs, with the goal that students in every state have the opportunity to earn their degrees remotely. PBS leverages its own television presence to complement the effort.

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[17] Stanford University website, http://learninglab.stanford.edu, April 1998.

The motivation behind GTD is that there is little national leadership for distance education programs. The GTD is meant to fill this void. It seeks to coordinate and encourage efforts for the implementation of distance education in campuses and television stations throughout the country. It has no specific educational endpoint that it may suggest or impose on these campuses and stations. Only the fostering of their activity within a distance learning paradigm is sought.

The GTD has had an impressive history since its inception in 1994. PBS describes each year as a phase, the series of which is shown in the table below.

Phase and Year	States	Colleges	Public Television Systems
I, 1994	Unrecorded	60	22
II, 1995	27	101	39
III, 1996	34	136	54
IV, 1997	37	175	60

Table 5: Evolution of the GTD program

The stated goal of the program is to reach all 50 states by the year 2000. Given the progress to date, it does indeed seem achievable.

Section 2.3: Forecasted Future

If there is one Grandfather for theoretical work in Distance Education, he is Alan G. Chute. In 1991 he and two of his colleges developed, among many other things, three models for forecasting.[19] They were made with several anticipated phenomena in mind. First, Chute asserts that in the future the workers entering the market will have less skill, on a comparative basis with the needs of the economy, than their

[18] Stanford University website, http://arum.stanford.edu, April 1998.

counterparts in the past. Second, several commentators, including Johnston and Packer in their book *Workforce 2000*, have pointed out that this trend will be magnified with the exit of the baby boomers from the workforce.[20] The result will be fewer workers who are less qualified.

These predicted scenarios serve as important impetuses to advancing distance education programs now. There will need to be systems with which large numbers of people can be reached, given their diverse demands for information and the heterogeneous environments in which they function. Real-time, on-demand knowledge transfer will become necessary. Most critically, in this age we suffer from a surfeit of information. We cannot simply open up information flows for continuing education and hope that untrained students will benefit from the sea of data they encounter. We must be able to craft information, make it pithy and dense. It must have no extraneous parts and must be delivered in the most efficient format possible.

Given our expectations and needs, how can we conceptualize how the future might look? We can use the three models developed by Chute and his colleagues. They are the Performance Support Model, the Knowledge Transfer Model and the Instructional Technology Model. Each are expounded upon below.

Section 2.3.1: Performance Support Model (PSM)

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[19] Chute, Alan G., Burton W. Hancock, and Lee B. Balthazar. "Distance Education Futures: Information Needs and Technology Options," CEDL, http://www.lucent.com/cedl/distance.html

[20] Johnston, W.B., and A.H. Packer (1987). *Workforce 2000.* Indianapolis, IN: Hudson Institute.

The Performance Support Model embodies the total strategy for applying a distance education effort. Both instructional methods and technological options are considered in it. [21]

There are three basic components: 1. Assessment Phase; 2. Prescription Phase; and 3. Technology Phase. Together these are illustrated in Figure 1.[22] The details of each are delineated below.

[21] Chute, Alan G., Burton W. Hancock, and Lee B. Balthazar. "Distance Education Futures: Information Needs and Technology Options," CEDL, http://www.lucent.com/cedl/distance.html

[22] http://www.lucent.com/cedl/images/model.gif

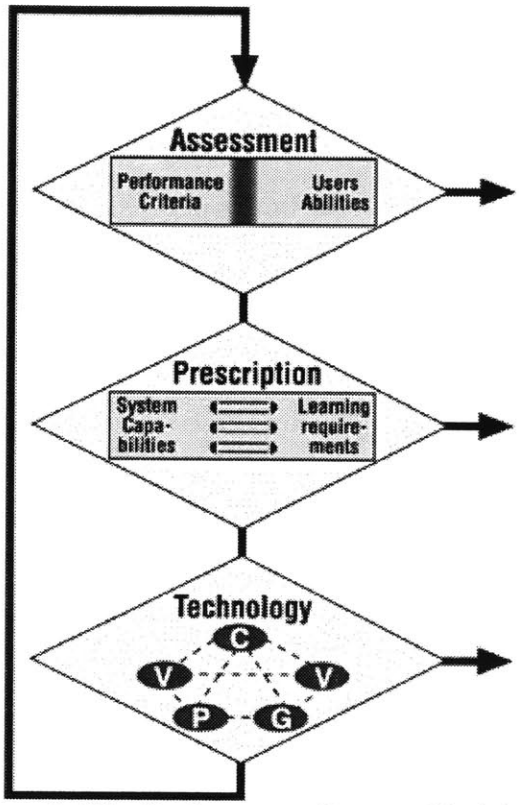

Figure 1: The Performance Support Model

Source: Chute, Alan G., Burton W. Hancock, and Lee B. Balthazar. "Distance Education Futures: Information Needs and Technology Options," CEDL, http://www.lucent.com/cedl/distance.html

Assessment Phase
Before beginning, criteria for performance are assessed for certain situations. The Assessment Phase comprises comparisons of user abilities with these criteria. Given the existence of a gap between the actual abilities and the desired abilities, as set by the previously established criteria, the educator should implement some form of additional support. The phase is repeated iteratively until acceptable performance is achieved.

Prescription Phase
In this phase, appropriate supports are evaluated given the requirements of the learning task. These requirements may be related to the psychology of the students, the technology available, or instructional capabilities. If the user does not received appropriate support at this stage, he or she should exit the PSM.

Technology Phase
Assuming that appropriate support mechanisms are found, one then proceeds to choose the right technological solution for information delivery. Selection criteria can be based on any number of the following factors: logistics (e.g., number of students involved, geographical dispersion, available resources), cost effectiveness (e.g., costs associated with technology, development, delivery, travel, personnel), and organizational culture (e.g., current technology use, emphasis on innovation, acceptance of change). [23]

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[23] Chute, Alan G., Burton W. Hancock, and Lee B. Balthazar. "Distance Education Futures: Information Needs and Technology Options," CEDL, http://www.lucent.com/cedl/distance.html

Section 2.3.2: Knowledge Transfer Model

The Knowledge Transfer Model illustrates the interaction of various media. It seeks to represent how information flow can be mediated. Often, these interactions are a result of technological combinations in a telecom network. [24] Figure 2 presents this model graphically.[25]

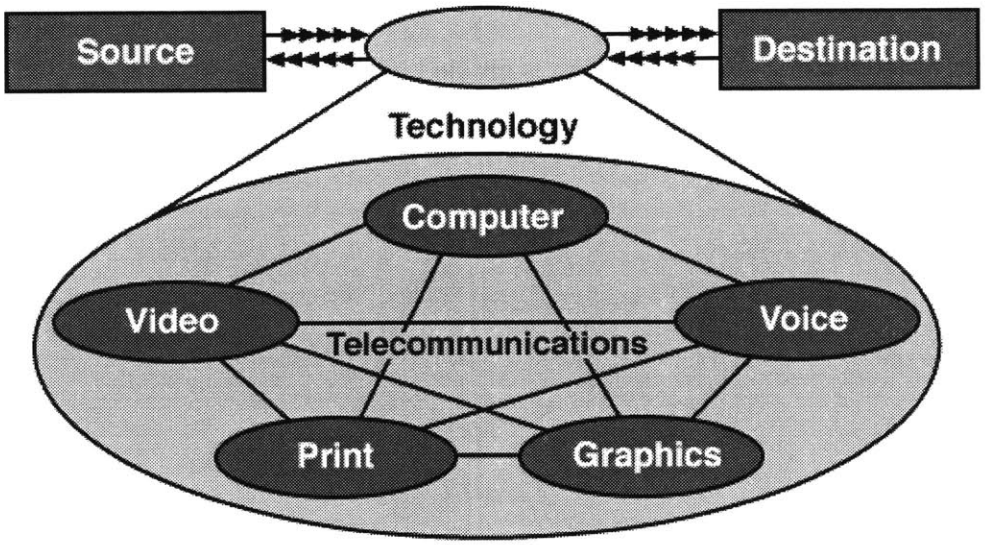

Figure 2. Knowledge Transfer Model

Figure 2: Knowledge Transfer Model

Source: http://www.lucent.com/cedl/images/ktm.gif

[24] Chute, Alan G., Burton W. Hancock, and Lee B. Balthazar. "Distance Education Futures: Information Needs and Technology Options," CEDL, http://www.lucent.com/cedl/distance.html

[25] http://www.lucent.com/cedl/images/ktm.gif

Section 2.3.3: Instructional Technology Model

Focussing on technology can also be a telling way to approach the progression of distance education. Technology for distance education in its most rudimentary form is simple, physical interaction. Perhaps the most advanced form is artificial intelligence. In between these two extremes, there are many gradations. Figure 3 shows the progression of technological components from classroom based education to learning on demand. The progression is divided into three stages.

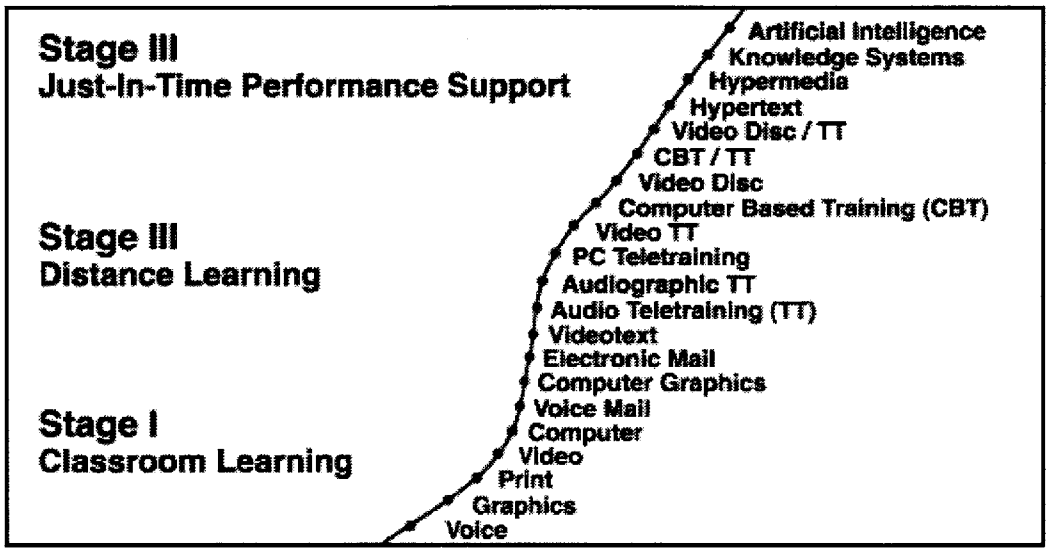

Figure 3: Instructional Technology Model

Source: Chute, Alan G., Burton W. Hancock, and Lee B. Balthazar. "Distance Education Futures: Information Needs and Technology Options," CEDL, http://www.lucent.com/cedl/distance.html

Stage I

At this level, the basic forms of technology exist. Things such as voice, graphics, print, voice mail, etc. are essentially enhancements or supplements to information delivery. They certainly do not supplant curriculums to any appreciable extent. For this reason, administrative of faculty changes are unnecessary.

Stage II

Here we see forms of technology like PCs and video teletraining. These technologies could conceivably be used to supplant entire curriculums. They constitute a technological foundation for distance education efforts. For this reason, they encourage change in the administration and employment of the educational organization. This fact, along with a lack of familiarity with technology, can produce resistance. Studies show, on the other hand, that although this is the environment in the initial stages of implementation, it changes once a full integration is achieved. At a point of full integration, there is a high level of acceptance among users.

Stage III

Currently, this stage comprises the most advanced form of options. Examples are multimedia, computer-based training, and artificial intelligence. There is little experience with full integration of these technologies, especially since some of them are perhaps not ready for easy use. They can potentially, however, offer learning experiences that are completely tailored to the time constraints

and content needs of individual students. They not only replace the curriculum of courses. They potentially replace the traditional educational process.[26]

[26] Chute, Alan G., Burton W. Hancock, and Lee B. Balthazar. "Distance Education Futures: Information Needs and Technology Options," CEDL, http://www.lucent.com/cedl/distance.html

One example of a culmination of the Stage III development of technology and the PSM is complete educational support software, generically called Performance Mangers (PM). One pertinent example is the C.O.M.M.A.N.D. software package, built on top of Lotus Notes, which is currently for use in the Civil and Environmental Engineering Department in MIT but can conceivably be extended to all of MIT, other universities, or even the general commercial marketplace.

Such software, in its best manifestation, minimizes direct human intervention. (Doing so simplifies the drudgery of adjusting the software manually to adapt for idiosyncratic situations.) In its more advanced forms, it can provide customized environments for each user, serving needs in ways that the user finds most effective at times he or she deems the most critical.

Chapter 3: Theories for Strategic Implementation

Section 3.1: High Level Theory

The question then arises as to how a distance learning system can best be implemented. To address this question fruitfully, we will first explore its details at a somewhat theoretical level, termed here High Level Theory. This material will be largely motivated by work done by IBM and, separately, by Alan Chute. Thereafter, we will detail the pragmatic concerns of implementation, termed low-level theory. In other words, once one understands the background and possibilities for implementation, how does one go about actually building a distance education system? Further, once the system is built, how can it be made to continuously function properly? These questions are addressed in turn.

Section 3.1.1: IBM's on-demand concept[27]

Section 3.1.1.2: Definition of On-Demand Learning

On-Demand Learning is the process of student learning when they need knowledge – namely, when they demand it. Its most distinguishing characteristic is its focus on the student. And from IBM's concept, it is something applied with multimedia servers and interconnected networks. The former allows the provisioning of courseware and educational materials, both of which can be modified by the educator. The latter allows flexible access for the student. The concept is nothing new, as illustrated in Figure 4 below. (One can see that this is quite a generic architecture.) It is just the first building block in IBM's approach to the market:[28]

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[27] IBM website, http://www.hied.ibm.com/odl, April 1998

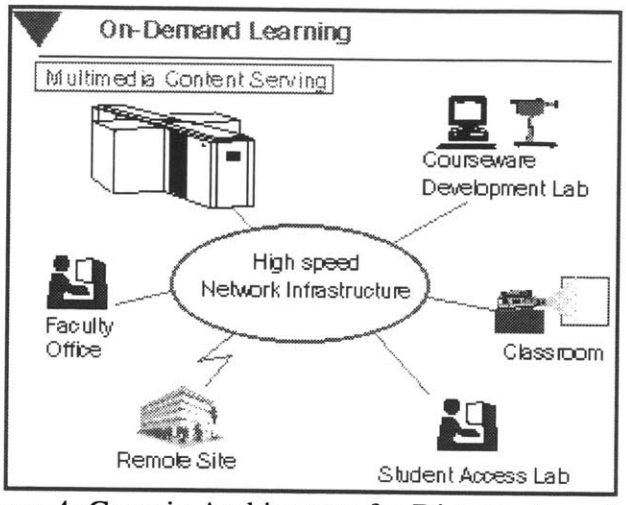

Figure 4: Generic Architecture for Distance Learning

[28] IBM website, http://www.hied.ibm.com/odl, April 1998

Section 3.1.1.2: Factors driving the need for change

Earlier in this thesis, we conveyed a general sense for the need for distance education. What, though, specifically drives the need? In the case of IBM's On-Demand learning concept, what factors give rise to an imperative for distance education. Four can be readily identified: 1. Technology Competency; 2. Reskilling; 3. Demographics; and 4. Increasing Demand.

Technology competency

The phrase technology literacy is arguably a misnomer. It implies that literacy in general is the ability to handle a fundamental task – reading. But technology literacy is the ability to employ an advanced skill. With the passage of time, this second implication is becoming more and more patently false. Having a rudimentary understanding of rudimentary technology is becoming as important as knowing how to read. (Imagine, for example, the limitations of someone who had not mastered the telephone, an obvious technological innovation.)

On-Demand Learning requires the usage of technology by definition. Students must access information using basic technological tools. And they must constantly augment their knowledge of appropriate technology in order to enhance their educational experience. Competent usage of technology is thus a strong motivation for the presence of such programs.

Reskilling

All knowledge is specific to its era. Newton's Laws, for example, had a different applicability in the 19th century than they do now. Their once universal character is now useless at the quantum level. They were thus created with the knowledge of

their own era as the fundamental backdrop. As new knowledge is acquired, it brings new eras with it.

Likewise, all knowledge has varying degrees of sensitivity to the passage of time. The building of good societies, as expounded by Plato, for example, endures the passage of time, with modification and alterations occurring only on its fringe. On the other hand, the form of a popular computer language, like C++, cannot withstand the winds of more than 10 years. In fact, after such a passage of time, the language changes so much that it typically changes its name. This is a recent phenomenon, and economically speaking, it is one of the educational challenges for productive individuals in our era.

In short, as time goes on, we will have a greater and greater need for reskilling. Technical degrees conferred today become obsolete after approximately five years.[29] Given this rapid rate of obsolescence, the American Society for Training and Development reports that by the year 2000 75 percent of the current workforce will need to be retrained just to remain economically viable.

Demographics

As the need for continuing education grows, so will the range of ages of students. This will naturally change the traditional culture of colleges, presumably even making colleges reflect the culture of the surrounding society more directly. The newcomers to the university experience will of course be people long past their teenage years. These people will have had already worked in industry, in many cases will have had families, and will have in general more obligations outside of college than their younger academic peers. To serve the needs of this population of students, universities must maximize the flexibility of their studies. Distance education is the answer to that challenge.

[29] IBM website, http://www.hied.ibm.com/odl, April 1998

Increasing Demand

Hong Kong has seven universities. Consequently, many students are forbidden the privilege of higher education, at least anywhere near their homeland. And yet the need for advanced education is no less in Hong Kong than anywhere else. Nor is Hong Kong alone in this dilemma. To serve the needs of societies around the world, many of which are in dire need of society-wide training but lack to resources or simply the space to provision it, distance education can work wonders.

Section 3.1.1.3: Modes of Instruction in On-Demand Learning Environments

On-Demand learning can be used to either enhance a lecture or replace a lecture. The benefits of each are various and greatly depend on the context of the teaching environment. One thing to keep in mind, however, is the benefit of using the lecture enhancement approach as a potential segue into lecture replacement. Many professors are accustomed to their old ways of teaching. They do not warm easily to new, experimental techniques. One way to encourage these professors to use more efficient approaches is to offer them a training system of sorts. Lecture enhancement includes the usage of technology but only as a complement to core methods. (Studies exist that assert there is an increase in productivity of organizations, at any rate, that use Information Technology[30], but there is controversy about the validity of this conclusion.) The instructor can incrementally incorporate technology as he or she sees fit. Eventually, the lecture can reach a level of technology usage at which the old, standard setting can be fully replaced.

Section 3.1.1.4: Content in an On-Demand Learning Environment

[30] Brynjolfsson, Erik and Lorin Hitt. "Paradox Lost? Firm-Level Evidence of High Returns to Information Systems Spending," MIT Sloan School, 1993.

There are three general forms of content provisioning, and they each have distinct impacts.[31] They are Linear Access, Linear Presentations, and Interactive Courseware.

Linear Access to content offers low function and provides low impact. A generic example is a group of students watching a vhs tape on television. They have linear access to the information, and their interaction with it is passive (low impact). The technology is straightforward, however, which makes it easy to provision (low function).

There certainly are other forms of linear access, from audio presentation to textual presentation to computer animation. The result is however generally the same in all cases. Four standard examples are as follows: Digital Video; Digital Audio; Graphics; and Text.

Linear or Interactive Presentations offer medium function and medium impact. With this form of content provisioning, there exists a presentation that has some low-level interactive capability. For example, a word document presented on computer to a group can be manipulated as the group desires. The presentation in this case is often used as a structured prop for oral communication. It can be navigated, abbreviated, even extended with verbal elaboration, or skipped altogether.

Interactive Courseware offers high function and high impact. Such an approach to content provisioning places potentially all of the control over the learning process on the student. Creative forms of learning, such as role-playing and exploratory learning, are facilitated by this type of content provisioning. The instructor is, strictly speaking, extraneous during the actual learning experience, although he or she could undoubtedly provide invaluable advice. (A vital note is that the instructor is probably still best suited to develop the content.)

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[31] IBM website, http://www.hied.ibm.com/odl/content.html, April 1998

Section 3.1.1.5: Technology Infrastructure

No matter what the content, the technology that transports it and displays it brings it to life. We must then pay attention to what generally is needed for technology infrastructure. In order to enable flexible access, high bandwidth networks, ubiquitous store and forward capabilities, and possibly real-time content, the provisioner must pay attention to the following: multimedia Servers; the network; multimedia clients; multimedia development equipment; and course and student management tools.

Multimedia Servers

With the present state of technology, multimedia servers are not ordinary servers. For regular servers act as a repository of information. Multimedia servers act as a repository for massive amounts of information, with the added liability of balancing between more important (i.e. frequently accessed) and less important (i.e. infrequently accessed) data. To illustrate, we need only look at video, an hour of which takes up, depending on resolution, at least 600 megabytes of space. When the server is connected to several clients, it must deliver the video to all those users simultaneously. This is managed in part by using multiple, physical hard drives. It is also managed by using advanced file management in the network operating system.

To protect against liability, archiving is necessary. (This is, however, not the main reason for archiving.) And to make sure that data of different importance is properly accessible, differential archiving must exist. More important data should be archived in the faster parts of storage; less important (infrequently accessed) data should be archived in lower speed, lower cost storage areas.

Network Infrastructure

Delivering multimedia poses a special challenge to the network infrastructure. To date, most critical network traffic has been text-based, or at the very least it has been

of the form that is not time sensitive. Multimedia files, like digital audio components, are very time sensitive. An appropriate network must be able to allow smooth and uninterrupted flow of traffic. The network must be able to prioritize data according to its criticality, such as with Asynchronous Transfer Mode (ATM). A multimedia network with latency and jitter is intolerable and, hence, nearly useless for real-time service delivery.

Even though DSL and bi-directional cable infrastructures promise high bandwidth, the total delivery of these systems are not yet market realities. This then raises the issue in the network of utilizing "store and forward" file management capabilities for less critical traffic and real-time delivery for the most critical traffic.

Multimedia Client Machines

Once the information is sent through the network it should reach the end user without any apparent difficulty. In other words, not only is the appropriate hardware and software necessary for the end user. An interface that makes all of the workings of the network transparent is also necessary. The end user, the student in this case, should not have to worry about the intricacies of network design. He or she is at the computer with one express purpose: to learn.

Multimedia Development Equipment

Areas of advanced theoretical research are important for increasing the quality of distance learning material. The Stanford Learning Lab, an example presented earlier in the thesis, is such a group. Most notable universities in fact do have at least some such program, and their contribution to the distance learning market is one of evolution. They help evolve the potential ways in which distance education may be conceived.

Course and Student Management Tools

Once again, interactive software tools are highly useful for the most advanced implementation of distance learning. The C.O.M.M.A.N.D. system in MIT is one impressive example of this. Features that are generally useful for any such system include the following: Student login, profiles and access controls; Results tracking and reporting; Course material cataloging and menuing; Customized front-ends for existing materials; Linking related reference materials; Student feedback mechanisms.

Section 3.1.2: Some Issues

Section 3.1.2.1: Quality[32]

How can a distance educator ensure quality of instruction when she may have the simultaneous and ultimate goal of removing herself from the educational process? After all, students that have a sense of independence and self-direction are important to the success of a distance education program. Further, our educational system does not seem to encourage such an attitude. This may be one reason for the extremely low completion rates of correspondence courses (35%).[33] Certain reports support this conclusion.[34]

There are theoretical approaches that can be used by the educator to approach this problem. Three are presented here: Service Model of Education; Stakeholder Analysis; and Different Methods of Evaluation.

The Service Model emphasizes a customer-service attitude. In other words, it comprises several techniques, all of which have the common core of paying close

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[32] Lucent Corporation, "Summary of Quality Issues in Distance Education," http://www.lucent.com, May 1998.
[33] Scott, Gary. "Distance Learning: All Schools Will Have a Distance Learning Component," http://www.lucent.com, May 1998.
[34] Scott, Gary. "Distance Learning: All Schools Will Have a Distance Learning Component," http://www.lucent.com, May 1998.

attention to the needs of the students. Quality assurance methods may be incorporated into the course. Support services may be offered. Or programs in which the students may offer pedagogical critique may be established. All fall under the service model rubric.

Stakeholder analysis focuses on all parties that have a vital interest in the functioning of the distance education program. This may include faculty, staff, students, content developers, and others. Under this model, these people offer a definition of quality, based on their needs and expectations. Their definition of quality can be used as a benchmark for further development.

The final approach, using different methods of evaluations, is an ex-post approach, as opposed to the ex-ante approaches that have been presented. Simply put, after the distance education program is established, different methods of evaluating its success can be employed. They can be qualitative, quantitative, standardized or diverse. Various methods would presumably yield more telling results, which could be used to improve future programs.

Section 3.1.2.2: Professional Development for Distance Educators[35]

If education itself is changing, then it must force a change in educators. We are confronted then with the challenge of enabling educators to develop their own skills accordingly. There are three basic goals: helping instructors identify life-long values in such training; assisting instructors in becoming more creative and better problem solvers; and stimulating curiosity and increasing enthusiasm.

Faculty commonly press three concerns with distance education: 1. Concerns about the effects on their job; 2. Concerns about the effect on class instruction; and 3. Concerns about the effect on student learning. Often, addressing this concerns by

[35] Lucent Corporation, "Professional Development for Distance Educators," http://www.lucent.com, May 1998.

simply describing the experiences of other people is ineffective. The best way to persuade faculty of the benefits of distance education is to get the technology into their hands. This is not enough, though. Their usage of the technology must be supported by a thoughtful and experienced Information Staff. Further, faculty concerns should be incorporated into the institutions distance education program on an iterative basis. In other words, the faculty should be offered a constant conduit for critiquing the program, and those critiques should be constantly incorporated.

The most important issue is incentive. The faculty must be given standards by which to measure their progress. They must be given the encouragement to experiment with technology and not be afraid of failure. They must be given the opportunity to benefit from formal peer recognition for the efforts to use distance education technologies. They must even sense potential monetary benefits for their attempts to evolve the learning process into something more productive for everyone.

Section 3.1.2.3: Needs of Distance Learners[36]

Throughout this thesis, the need for flexibility for distance learners is emphasized. Why do they need flexibility? Such learners most often have other obligations at home or in work. They are isolated from other learners, at a distance from potentially complementary material to the source material, and possibly oblivious to the goings-on of the administration. A flexible system can help such people, but more specifically a flexible system that addresses the following concerns is best: Advising Needs; Access Needs; Communication Needs; and Administrative Needs.

Cultural Contexts and Advising

Since distance education is a relatively new development in the eons-old history of education, it requires special care. The students who often partake in distance education likewise will have untraditional and perhaps unpredictable needs. Not only

will they have obligations outside of the school. They might also have the personal difficulty of returning to school after a lengthy hiatus.

Most important, and this is often overlooked, since distance education can stretch across national boundaries, it enables one organization to engage many different cultures simultaneously. The different norms of each culture must be considered in the educational process. This in fact raises a fascinating issue of cultural expectations. When international students come to MIT, for example, they are expected to conform at least in part to the cultural mores of the institution and its surrounding society. This is never questioned as unreasonable because it is a simple result of being in a country and respecting the ways of that country.

What if an institution – namely, one for distance education -- really has no country? Perhaps it has many centers of control, all equal, all inter-coordinated, spread out around the world. What is the set of applicable cultural practices? Most probably, there is none. Such an institution must master the art of customization, and it can partially do so through a legion of thoughtful advisors. These advisors would have a role that is distinct from that of traditional advisors in that they would require formal or previous experience in successfully engaging target cultures. It would not be just an advantage. It would be a necessity.

Access

Access to the materials for distance education refers not just to the ability to connect to an appropriate network infrastructure, although this is important and is covered earlier in this thesis. It also refers to the students' abilities to easily use the appropriate technology. They must experience no significant burden in accessing information. This process should be mostly mechanical. And since the educator cannot expect all students to have the proper set of pre-requisite skills at this time of transition, the educator must plan ahead to develop these skills in the students.

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[36] Lucent Corporation, "Needs of Distance Learners," http://www.lucent.com, May

Communication

A sense of community enhances the learning process. It can foster healthy competition, promote the exchange of ideas, and add to the diversity of the learning experience. Such a sense requires communication among the students, which is one component that can be easily overlooked in the effort to promote communication between the instructor and the students. Student interaction can be encouraged by the use of teleconferencing, computer bulletin boards on websites, occasional meetings in local centers, the organized formation of study teams (such as is done by most reputable business schools), and even social functions. The important point is that the student should feel at ease and benefit from more than just the planned educational experience.

Administration

The most traditional approach to administration is a unilateral one. The bureaucracy makes decisions without student review, and they implement them without student feedback. This is of course extreme and does not occur in most universities in such a form. But it could much more easily occur in a distance education environment, in which student review and feedback may be harder to collect. (It could possibly be easier with the use of electronic surveys.) The administration must understand the danger of compounding student frustration with obscurity of the organizational process. They must provide real and accessible channels for constant feedback.

Section 3.1.2.4: Student Attitudes toward distance learning[37]

There is ample research on the attitudes of students toward distance education. The results of the research can be broken up into four categories: 1. Attitude toward the

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[37] Lucent Corporation, "Student Attitudes Toward Distance Learning," http://www.lucent.com, May 1998.

technology; 2. Attitude toward distance education teaching methods; 3. Attitude toward student and teacher interaction; and 4. Attitude toward being a remote student

Students who are new to a technology tend to exhibit a reluctance to participate in the class at all.[38] Other studies show that as the students are encouraged to expose themselves to the technology, they naturally gain a familiarity and lose inhibition.[39]

Teachers are constantly judged by students. One judgment criteria that seems to always hold is the ability of the teacher to effectively use the technology. If the teacher integrates the technology skillfully into the presentation of material, especially in a useful way that the students may not have considered, the teacher is rewarded with the dedication of the students.

Studies have shown that student attitudes toward distance education vary considerably with the level of interaction between the teacher and the students.[40]

There is still discord over how much students actually learn in distance education formats as compared to traditional lecture formats. But there is a consensus that students themselves believe they learn as much or more with distance education.[41] In other words, when asked to assess the quality, efficiency, and effectiveness of their experiences with traditional education with their experiences with distance education, they on the whole believe that they had a more optimal, efficient and effective educational experience with distance learning processes.

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[38] Barron, D.D. 1987. Faculty and student perceptions of distance education using television. Journal of Education for Library and Information Science (27):257-271.
[39] Jones, T. 1992. IITS students' evaluation questionnaire for the fall semester of 1991. A summary report. Eric Document Reproduction Service ED 345 716.
[40] Barron, D.D. 1987. Faculty and student perceptions of distance education using television. Journal of Education for Library and Information Science (27):257-271.
[41] Jones, T. 1992. IITS students' evaluation questionnaire for the fall semester of 1991. A summary report. Eric Document Reproduction Service ED 345 716.

Section 3.2: What the implementer should focus on

Much of the preceding section focussed on material that is useful for an administrator of distance education or for an educator before he actually runs a distance education course. It was presented under the title High-Level theory. This section focuses on issues that directly concern the educator during the course. What are the pragmatic problems? How can the educator address them? How can the educator reduce them?

In general the educator should seek to gain a knowledge of student needs. The educator would presumably measure the performance of students and asses performance shortfalls. In order to do so, the educator could establish benchmarks against which to measure student achievement. But the students are only part of the picture. A well-functioning staff is also vital. To make sure that the staff supports and enhances the distance education apparatus, the educator must be cognizant of the psychological factors that the expected adjustment would require. In fact, this transition period is critical. It can be assessed -- for students, support staff, or teachers -- using formal methods that have already been created by distance educators. The Teletraining Adoption Process (TAP)[42] and the Teletraining Implementation Process (TIP)[43] are covered here. The former provides a theoretical framework by which one can structure the process of acclimation in distance education efforts. The latter provides a method for methodically approaching the setup of a form of distance education.

Teletraining Adoption Process (TAP)

With the adoption of teletraining, which is a subset of distance learning, one should expect a period of cautiousness and trial. Two concerns typically inhibit students and

[42] Chute, Alan G. "Strategies for Implementing A Teletraining System," International Teleconferencing Association Convention, 1991.
[43] Chute, Alan G. "Strategies for Implementing A Teletraining System," International Teleconferencing Association Convention, 1991.

teachers from quickly using the new process. First, they both wonder whether teletraining can be an effective medium for delivering quality training. Second, they question whether presenter and participants who are unfamiliar with the technological and procedural aspects of teletraining can use the medium effectively.

The job of the person in charge of facilitating the adoption process is to make the transition smoother. Researchers have identified numerous ways to achieve this[44]. One should look to distance learning as a way to revitalize and innovate existing training programs. In other words, it should be used as a type of enhancement. One should also consider using multi-level evaluations approaches. Each step in the path to full adoption will produce unique challenges. Paying due attention to the difficulties of incremental progress will greatly increase the ease of transition.

Another important point is that the technology should be kept transparent. Students and faculty should not have to be concerned, perhaps not even witness, the complexities and interrelationships of the applications, networks, transport mediums, data link controls, and physical hardware. Students and faculty should only be aware that they run an application and get a resulting educational experience. To make sure that this end can be easily achieved, one must make sure that one has trained instructors well and has determined technology needs at the design stage of development.

The person in charge of the adoption process can anticipate that the teachers and students will go through seven phases of concern as they struggle with the above issues[45]. They will be proceeding through the seven following stages, roughly in this order, as they attempt to incorporate the innovation into their educational routine: awareness of the process, which essentially means that they first consider it as a viable educational option; informational concerns about its usage, which means that

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[44] Chute, Alan G. and Herbert L. Bivens. "10 Tips for Implementing a Distance Learning Program," Lucent Technologies' Center for Excellence in Distance Learning, 1998, www.lucent.com.
[45] Chute, Alan G. "Strategies for Implementing A Teletraining System," International Teleconferencing Association Convention, 1991.

they are ready to explore the details of its interface; personal problems (often idiosyncratic) with its usage; management difficulties for the teachers, since this is a new process with new issues; consequences of the new project, which refers to both its educational impact and the image it creates vis-à-vis the teacher; the proper form of collaboration with other teachers and other students; and the ability to reiterate the entire effort. The importance of these gradiated steps is that the person in charge of the adoption anticipates each level of concern and prepares for each, specifically, in advance.

Teletraining Implementation Process (TIP)

The TIP occurs in tandem with the TAP. Whereas the latter is more concerned with the context of the distance learning issues, the former is more concerned with the technical hurdles. For this reason, its application is more methodical and predictable. One typically proceeds through six steps[46]: 1. Analyze the needs of the client; 2. Introduce teletraining as an appropriate delivery approach; 3. Provide a demonstration that teletraining can address a need; 4. Train staff to correctly implement the teletraining system; 5. Evaluate staff performance and the overall teletraining system; 6. Recommend system expansion and enhancements to address additional needs. The TIP will provide a set of guidelines for the technical division of a distance learning team. They should work closely with the team in charge of the TAP, usually with the intent of customizing their solutions to the needs of the TAP effort.

Below examples of media utilization techniques for teleconference presentations are described [47], [48].

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[46] Chute, Alan G. "Strategies for Implementing A Teletraining System," International Teleconferencing Association Convention, 1991.

[47] Hancock, Burton W., Alan G. Chute, Robert R. Raszkowski, and Kathy D. Austad. "Integration of Media Components for Successful Teleconferencing," Teleconferencing and Interactive Media Proceedings of the Sixth International Conference on Telecommunications, Madison, Wisconsin, May 1982.

Audience Attention

The two important points for audience attention are gaining attention and maintaining attention. To gain the attention of the audience, one may use alerting techniques such as voice cues, alerting sounds, visual changes in the environment, and essentially any stimuli that are directly related to the primary points. To maintain the attention of the audience, one should vary the message frequently by chunking certain complex ideas, concepts and skills and supporting them with other stimuli. The importance of using other stimuli is borne out in research that visual cues tend to hold the attention of students.[49]

And, of course, as every somnambulistic student knows, variance of speech is important. Pitch, tone and volume should all be varied in order to maintain the attention of students.

Section 3.3: Learning Strategies

There are four essential groups of learning strategies: 1. Concentration on Relevant Content; 2. Participation; 3. Concentration on Proper Organization of Content; and 4. Integration of Media for Structure.

In order to concentrate on relevant content, one should provide only vital information in a two-way video conference. Further, all important content in a video conference should be supported by aids, visual and otherwise. For the sake of participation, one should encourage participants to take an active role in their learning. One could also plan activities that involve the learners at the same location and that also enable interaction between participants at all locations. These activities must, however, enable the participants to demonstrate learning. They may be anything from

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[48] Also from Bivens, Herbert L. and Alan Chute. "Distance Learning Futures: Creating New Learning Environments and Developing New Pedagogical Skills," CEDL, 1998, http://www.lucent.com/cedl/icdeenv2.html

answering questions to extensive problem solving activities such as case studies, brainstorming, or simulations.

To give content a proper organizational form, one must structure the program material in a meaningful context to enable learning to occur. One could, for example, chunk complex ideas into simpler meaningful pieces and build upon them. Generally, organizing content into specific categories will help participants to learn the material better.

Finally, the integration of media for structure can be done was relevant content, tools for participation, and content organization is determined. One should then integrate the media in such a way that it previews the material, presents the material, and then reviews the material. Previewing the material means acquainting the participants with what they are about to learn. This provides an advanced framework for perceptual organization. Presenting the content is the core activity. All of the previous technologies and instructional methods may be employed. Reviewing the material means that you revise what was presented, possibly extending the analysis into potential future directions.

[49] Chute, Alan G. "Strategies for Implementing A Teletraining System," International Teleconferencing Association Convention, 1991.

Chapter 4: Legal and Policy Issues

Section 4.1: Legal Issues[50]

As with any new media, there are several unresolved legal aspects with distance education. Some issues however can be applied analogously from other media with relative ease. Whether one is a distance educator or a distance administrator, one must always consider the legal implications of delivering educational content in an entirely new format. To aid in this consideration, several pertinent topics are covered.

Copyright is one of the most important issues. Understanding its basic character is necessary for an understanding of its specific application to distance education.

The term copyright refers to a bundle of rights. This bundle is created and protected by federal statute.[51] A copyright covers original works in fixed or tangible medium. This includes the following: 1. literary works; 2. musical works, including any accompanying words; 3. dramatic works, including any accompanying music; 4. pantomimes and choreographic works; 5. pictorial, graphic, and sculptural works; 6. motion picture and other audiovisual works; 7. sound recordings; and 8. architectural works. For the purposes of this thesis, literary works, pictorial, graphic, and sound recordings are probably the most important. (As a point of further explanation, one cannot copyright an idea, procedure, process, system, method of operation, concept, principle, or discovery.[52])

A copyright is an exclusive right. It allows the author to sell, distribute, perform, display and license the original work or derivative works. Under current copyright

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[50] "Special Issues in Distance Learning," http://www.uncg.edu/cha/UNIVERSITY_COUNSEL/COPYRIGHT/Copyright_Forum/Special_Issues.html, April 1998

[51] 17 U.S.C. §101 et.seq.

[52] Balkin v. Wilson, 863 F.Supp. 523 (W.D. Mich. 1994).

law, a copyright need not be filed in order to be obtained. It is acquired once the work is fixed in form, a state that is clearly open to interpretation. Once this occurs, however, the copyright owner owns exclusive rights to the work for the duration of her life plus 50 years.[53]

The above describes the general aspects of copyright law. It also has specific application to distance education. A concept or idea for a course is not copyrightable. Course materials and outlines can be copyrighted. As mentioned above, recordings are copyrightable. This means that if a lecture or class discussion is recorded, it may be copyrighted.

A course is copyrighted first by simply completing the course materials. In order to have the ability to file suit against infringers, however, one must register the copyright. This may be done by copyrighting the course materials. Their copyrightability is dependent on their content and not on the form of transmission. Specifically, broadcast or transmission of a lecture or of course materials does not in and of itself strengthen copyright claims. Distinguish this with the effect from recording, such as on videotape.

Another issue, particularly with copyrightability, is joint-authorship. This comes up often in an academic setting, where collaborative efforts are common. Two important considerations for joint-authorship are presented: 1. Joint authors of a work are joint owners of the copyrights[54]; and 2. If the work is to be a collaborative effort between faculty, staff, students and/or other entities, there should be an agreement specifying each contributor's interest and rights.

The involvement of the University must also be considered. Certainly, they will have some legal guidelines that affect the status of the distance learning material. There

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http://www.uncg.edu/cha/UNIVERSITY_COUNSEL/COPYRIGHT/Copyright_Forum/copyright_basics.html

54 17 U.S.C. §201(a);

are several issues to keep in mind: 1. The University's Patent and Copyright Policy will have force; 2. Whether or not the course or any part of it is for consulting purposes is important; and 3. The issue of quality control is likely to be raised; there may exist legal guidelines for this.

Distance education materials tend to constitute novel expressions of information. For this reason, the legal status of those materials may not be clear. Multimedia and databases (i.e. compilations) have had a legal history that has only recently been clarified to the satisfaction of courts.

Copyright in each separate contribution to a collective work is distinct from copyright in the collective work as a whole. It vests initially in the author of the contribution. In the absence of an express transfer of the copyright or of any rights under it, the owner of copyright in the collective work is presumed to have acquired only the privilege of reproducing and distributing the contribution as part of that particular collective work, any revision of that collective work, and any later collective work in the same series.[55]

Section 4.2: Policy

There are two levels of policies to consider. One is for governments. The other is for universities. The former addresses the overarching educational needs of society. The latter addresses the specific issues that arise in a university environment. They are both covered in turn.

Section 4.2.1: Governments

Cross-state transmissions create a problem for state policy makers. Most likely, a uniform policy at least within the nation is necessary. For example, offering accreditation on a state-by-state basis constrains the placement of faculty, the versatility of the education and possibly even interactions with companies

participating in the curriculum. As of June 1997, only 25% of states allowed teachers with out-of-state certification to teach in-state.[56]

Of course, K-12 accreditation specifically for distance teaching, which embodies a significantly different dynamic than traditional teaching, hardly exists. As of June 1997, only one state required it.[57]

While the goal of uniform national policy represents an ultimate hope for optimizing coordination, a more realistic interim stage may occur with having uniform policy within each state; at least in this way separate educational institutions do not produce contradictory or overlapping policy guidelines. There are three entities that could fulfill this position at the state level: 1. Public Broadcasting Organizations sponsored by the state; 2. State Telecommunications Agencies; and 3. State Departments of Education.

Public Broadcasting Organizations have the advantage of in-house experts for both education and the appropriate technology for information delivery. They additionally have the facilities for information delivery already in place. Presumably, they even have their finger on the pulse of cutting-edge technologies, with plans to enhance their current systems with those technologies. They have the disadvantage of an already existing mandate, which typically ties them to programs that are not exclusively instructional.

State Telecommunications Agencies have the advantage that they have links with many different educational institutions. Indeed, they may have links with all the higher education institutions of the states. Some form of information organization is thus already in place. Their disadvantage is that they, just as in the past with other

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[55] 17 U.S.C. §201(c)
[56] University of West Florida website, "Distance Education Policy," htttp://www.uwf.edu/~pnorthru/de/Policy/, May 1998.
[5757] University of West Florida website, "Distance Education Policy," htttp://www.uwf.edu/~pnorthru/de/Policy/, May 1998.

issues, may find achieving statewide consensus for distance education policies difficult. Higher education institutions are typically protective of their independence, which is largely characterized by the institutional policies they adopt. Further, certain educational institutions may not easily accept being grouped with other institutions. There is, after all, some level of competition between different institutions. And some of them consider their "brand" name an important asset, one that would be affected by being lumped into a larger group.

The advantage of the State Departments of Education is that they tend to be already directly involved with telecommunications efforts.[58] They have, however, several disadvantages. School districts tend to individually make arrangements with higher education institutions in their district to receive distance education. This confounds the uniformity that a State Department of Education could provide. It also directly overlaps with their potential policy making authority. A school district will be concerned about satisfying its own unique needs; and making a policy tailored to its own district, with people they probably already know in the local higher education institutions, is highly natural. The state level department would be consistently challenged by this state of affairs.

Eventually, though, the discussion must be addressed at a federal level. Achieving statewide policy frameworks should be considered a transitional goal. It would be much more feasible, given the light exposure of distance education to the public at large. And it could conceivably motivate a larger national debate about integrating policies across state lines. We must keep in mind that there is an issue of positive network externalities here. As the cultural reach and geographical scope of distance learning increase, they will create exponential increases in the benefits that students receive. Learning environments will have boundaries defined only by content and not by geography or policy. In other words, only the subject will matter.

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[58] University of West Florida website, "Distance Education Policy," htttp://www.uwf.edu/~pnorthru/de/Policy/, May 1998.

Section 4.2.2: Universities

There are five clusters of policy tasks that a University considering distance education faces: 1. Scope, Quality and Centralized Programs; 2. Student Services; 3. Faculty Issues; 4. Tuition Fees and Student Enrollments; and 5. Technical Standards.[59]

A University must consider whether to participate in broader (i.e., regional or statewide) distance learning efforts. For example, it could cooperate with shared university centers with other institutions for information delivery. A University must also develop quality criteria by which its courses can be measured. These will be presumably different, at least in form, from the criteria used for traditional education courses. The University must further invoke a certain foundation of institution-wide guidelines for distance education. Each department can customize its own efforts. But students should be able to expect a common base.

Student services are crucial to making the distance education effort successful. The level of access that distance students have can be, for example, a variable issue. The University should decide whether these students should have comparable access as traditional students. Perhaps the form of distance learning is different enough that even framing the consideration in terms of equality is not legitimate. Further, shared student services should be centralized. Students should have the ability to use these services. In other words, they must be aware of them; they must be technologically literate enough to use them; and they must have the appropriate infrastructure and equipment to access them.

One vital issue for faculty is how the administration can encourage their involvement. Rewards of some form must be offered for the learning curve that faculty inevitably experience in their own attempts to implement distance education

methods. To aid them with their own learning, adequate training programs must exist. A clear and equitable policy governing intellectual property must also be in place, and its formulation should receive faculty input.

A University would need to consider whether the fees charged for distance education courses match those shared for traditional learning course. Student uptake (acceptance of the courses), and the public's general perception of quality, of distance education programs will be affected by their fee structure relative to the standard fee structure. Budgetary divisions are also important. Will the funding for a distance education curriculum come from a general pool of monies; or will it come from the fees levied for the courses themselves. Finally, a coordinated effort to keep track of student enrollment in an ultimately centralized fashion would be useful. This should happen regardless of the department or program in which the student registers. Only by way of initial, complete tracking can the state of the distance education effort be assessed.

Quality of course content and information is one important issue, as has already been discussed. But quality of technical operations is vital as well. The information delivery depends, after all, on the technology. Systems and hardware throughout the institute should be compatible. The same applies to services and procedures. The educational institution must further set some minimum usage standard for certain types of technologies that are considered indispensable. This new form of education is a mediated/enabled one; and there must be a baseline of implementation required.

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[59] Oregon State System of Higher Education, "Education Unbounded: A Vision of Public Higher Education Serving Oregon in the Year 2010," http://www.osshe.edu/dist-learn/dist-pol.htm, May 1998.

Chapter 5: Case Study

Section 5.1: Academic

The Open University, UK

The Open University (OU) is an enormous, somewhat decentralized university in the United Kingdom. It boasts a student population of 160,000, with many of its courses accessible across Europe. (It has a nominal presence in Hong Kong and Singapore as well.) To access far flung places, it establishes collaborative relationships with local partners. Such is the case for its Eastern European presence and its Asian presence.

In fact, the most impressive statistics that are somehow related to OU are related to size. Every year it administers exams in 90 countries, though this is clearly with the help of its collaborative local partners. It has a business school with an enrollment of 21,000 students. It has more students studying music than all other British institutions combined. The list goes on.

The question then arises as to what makes the OU so attractive. For one, it offers a level of flexibility in registration and provisioning of its courses that is not even partially matched by other respectable universities. Students can take single courses, a set of courses for custom-degree programs, or pre-specified degree programs; and they can do so in almost any country in the European Union (EU), no matter how many times they move. Students move in and out of the confines of the university, but they can always stay in its fold. It is truly 'open.'

The OU supports this structure with a unique provisioning for study. They term it Open Learning, which essentially embodies seven basic areas of support for distance

education: 1. Course Materials; 2. Radio and Television Programs; 3. Computing; 4. Residential Schools; 5. Teaching and Counseling Support; 6. Self-help study groups; and 7. Assessment.

Most of the course have materials that are specially written in the form of actual textbooks or sometimes workbooks. Assignments, broadcast notes, and other administrative items are also distributed. For science and technology courses, special kits for testing are distributed. And in certain circumstances, audio cassettes, video cassettes, and computer software are given to students. These offer support and continuity for OU's distance learning apparatus.

The OU offers four basic types of learning resources. First, Course Units are the workbooks customized for classes. They are written with the intent to guide the student through an interactive study program, with such features as specific learning targets and self-assessment questions.

Second, the OU's video are made by the BBC themselves. OU offers consultants to the BBC in the process. These videos offer a synopsis of relevant course material, case study material, an elucidation of potentially sticky problems, and virtual 'visits' to learning centers of interest, such as commercial laboratories related to the subject.

The audio cassettes offered by the OU have either background material or relevant debates. For the more technical or scientific classes, the OU offers specific software. For example, Biology classes are supported by software that provides three dimensional simulations.

Finally, there are study guides. These generally provide practical exercises and activities that allow the student to further progress with an independent study program. Study guides are offered for Arts, Sciences, Management, and for the act of studying itself.

One of OU's advantages is the prominence its size bestows. In order to reach a large audience, it must use a large network. Specifically, to reach its audience with its instructional material, it is left with only a few options for mediums. Its size has allowed it to establish a deal with BBC in which its radio and television programs are broadcasted on the national BBC networks. Thus, it is relieved of the burden of building and maintaining an infrastructure, and it avoids the unpredictability – not to mention unreliability – of the Internet. The OU demonstrates their lack of faith in other potential real time mediums in their policy for students outside of the UK: these same programs are sent to the students by cassette.

This is not to say that no OU courses are offered by the Internet. In fact on 1998 ten were delivered through the Internet, but this is out of over 300 total courses. The OU's stated goal is to increase this number, beyond the almost exclusively mathematical curriculum it now provisions, to other subjects (and in greater number) as well.

While conventional universities must worry about provisioning enough computing resources for the student body to use, the OU focuses on getting each student the appropriate level of private usage. In short, it subsidizes student rentals of computers for certain course tracks.

The OU still tries to realize the benefits of on-site education, even though it may do so in a patchy way. Through its Residential Schools, which are simply centralized physical locations where students go to study for short, intense periods, it often tries to achieve an educational experience that is simply impossible at a distance. (An example of such an educational activity is something that requires a physical demonstration and simultaneous participation of multiple students.) These courses are held at other universities during the summer session or at conference centers.

The OU tries to organize its instruction around a group concept, in which tutors act as points of mentorship and evaluators of performance for small groups. Each group is assigned a specific tutor. In some cases, group tutorials in centralized locations are held. Many of these policies, along with much of the administration, are determined by the Regional Centers of the OU. A map of the regional centers is shown below:

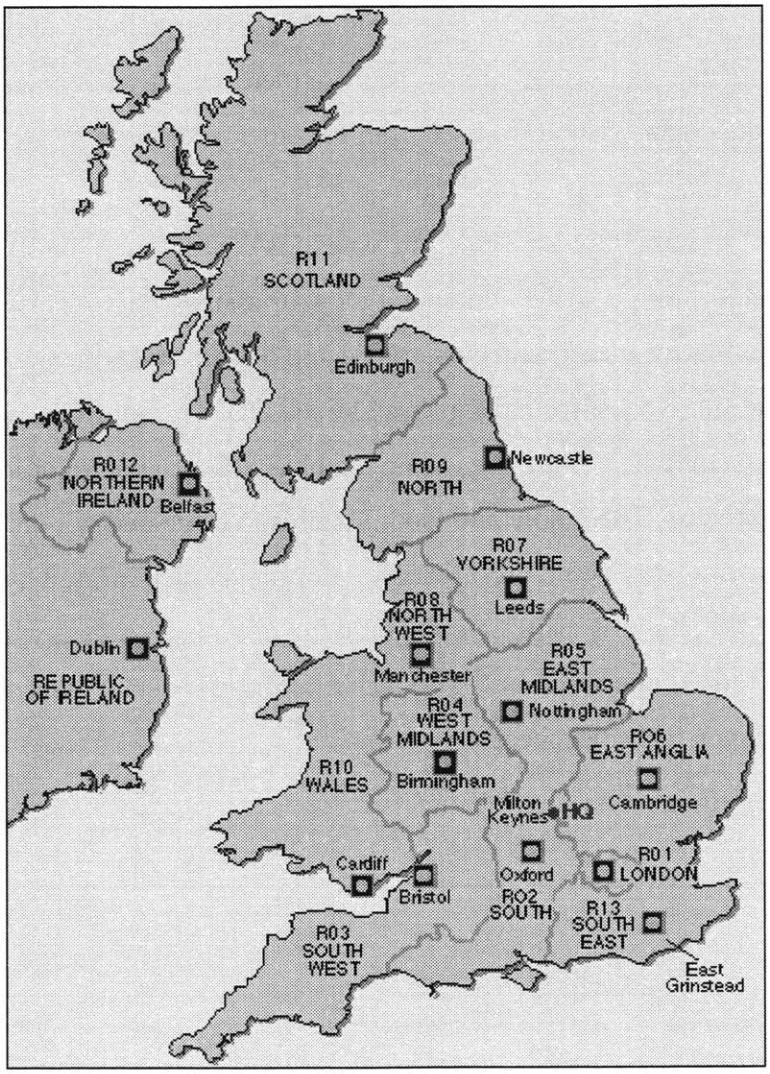

Figure 5: Open University Regional Centers

Student groups, termed self-help groups, are encouraged to form by the tutors of the individual groups. This is not by any means a formal mechanism used by the OU, but it does underline their largely unrestrictive approach to teaching.

There are two general forms of assessment for students, much like anywhere else. First, there are the final examinations. Second, there are the assignments during the duration of the course. The difference with the latter in the case of the OU is that assessment on assignments can be highly normative. The OU itself asserts on its website that "an important aspect of assessment is the teaching you [the student] get from your tutor through written comment on your assignments." This appears to mean that qualitative measurement is considered legitimate and real. Of course, there are more quantitative test forms employed by the OU, like multiple choice exams distributed by computer. But these are not emphasized as paramount in the educational process. The whole philosophy seems to be geared not only toward the part time student, who would presumably prefer the latitude offered by flexible grading schemes, but it is also geared toward the returning student, who is perhaps not ready to fully immerse himself into the critical and constant assessments of the traditional university atmosphere.

Chapter 6: Supply Chain Analysis

Section 6.1: Generic Supply Chain of Distance Education

The supply chain shown in Figure 6 describes the process of networked education, content development, production, distribution and management. It offers categories for the steps from the initial conception of educational ideas to the final acquisition of the materials by students. It is meant to serve as a theoretical supply chain, onto which specific scenarios for universities or corporations can be superimposed. There are several links in the chain that are not included, such as delivery of materials by carrier or subsidized rental of laptop computers. But these links are part of larger market environments. They do not exist solely for the purpose of distance education.

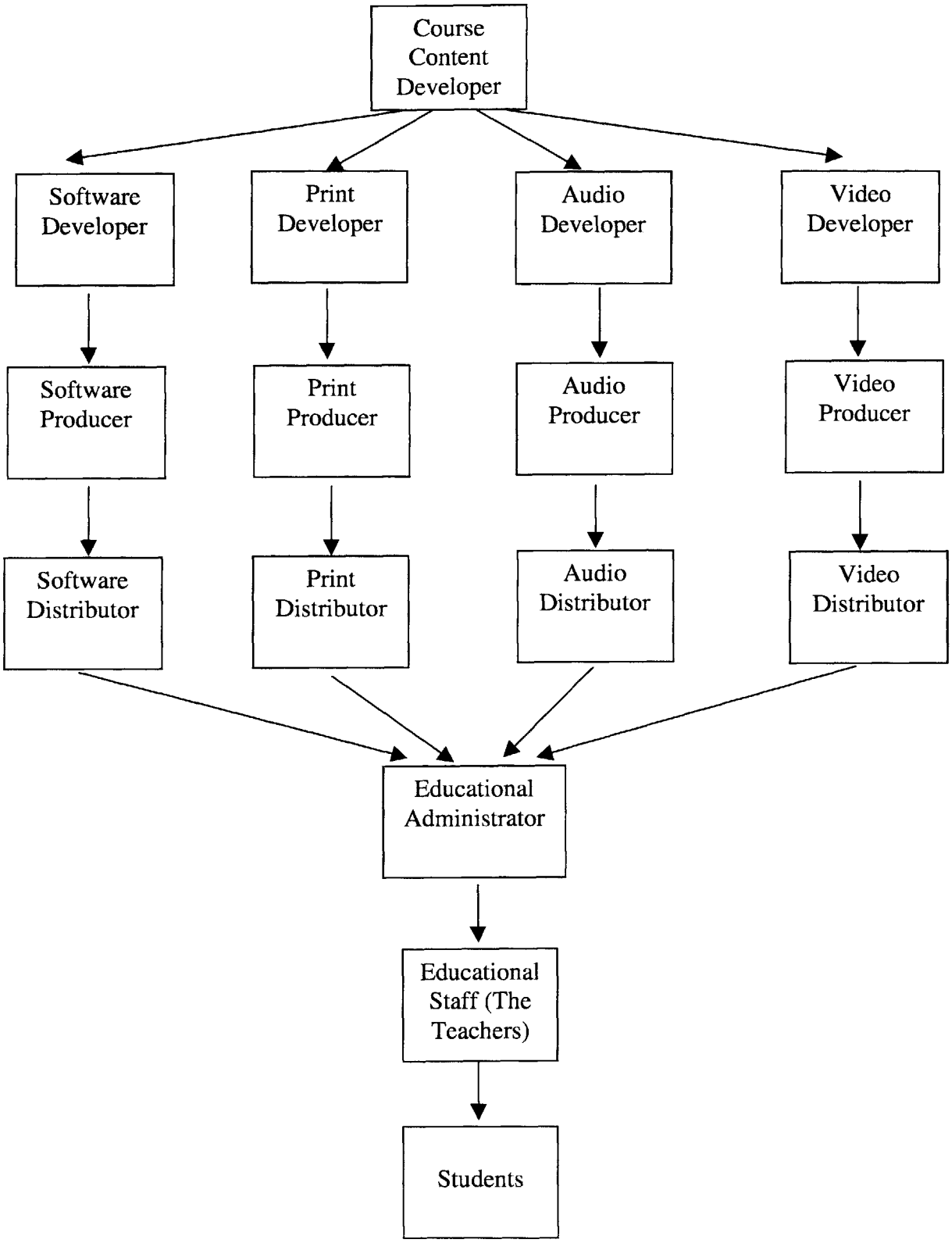

Figure 6: Distance Learning Supply Chain

Source: Sharifi, Husham S. "The State of Distance Education." MIT, 1998.

The Course Content Developer is the entity that actually conceives of the idea for a course, builds upon the initial conception in developing an intellectual structure, and continues iterations and evolution of the development until a cogent and viable curriculum is established. Although the Course Content Developer could certainly record the work, the group or person would use this record to pass on the material down the supply chain. The core of the work in this link of the supply chain is intellectual.

The Software Developer understands the needs, specific or general, of the Course Content Developer and constructs or customizes computer applications to meet these needs. The work at this stage is not original in the content it seeks to convey, which comes from the link before it. But it is unique in its expression of that content. This is the essence of application utility: how can it act as an interface for content in ways better than alternative interfaces? The successful Software Developer, who often starting from scratch builds the entire application, considers how he can maximize the functionality and utility of his software given the needs of the Course Content Developer.

The Audio, Print, and Video Developers are even more tightly bound by the needs upstream. They must make exactly what specific Course Content Providers want, such as an audio cassette on a specific subject for a specific length of time. They are not offered the latitude for versatility that the Software Developer enjoys. The potential for their product to have complementary utility for other Course Content Providers is less. A software package can be diverse and thus serve many different needs. Audio, print, and video become unwieldy as their sizes grow, which makes diversity an anathema. A pithy presentation and focus is the goal with these three.

The Software Distributor can be almost anyone. The question is simply who would like to handle the administrative process of getting the software to a place where it can reach the student. A university or company may decide that they wish to

distribute only by mail order or by the Internet from their own website. Or they may want to restrict the spread of the software, creating a potential economic "snob effect," to just the in-house students, like employees in a company. They may want to do exactly the opposite and tap the broadest possible consumer market; namely, they could make their software available via any regular commercial outlet (Internet sites, physical software stores, etc.).

For audio and video distribution there is an important dichotomy. Recorded audio and video have exactly the same mechanics as does software distribution. But live audio and video must have a supported physical network. The Internet can be used for distribution. With the increasing deployment of protocols that can offer quality guarantees, such RSVP (Resource Reservation Protocol) and RTP (Real Time Protocol), or of large private networks for that matter, this form of distribution shall become more realistic. In the business world, though, patience is rarely a virtue awarded by investors, at least not the type of patience that stretches over multiple years. Dependable, high-quality deployment currently can happen only on established network infrastructures. An example of this is covered later in the thesis in the description of how OU fits into the supply chain.

Print has the same mechanics of production as software distribution. It can be kept exclusive; it can be released to the world with the producer acting as distributor; or it can have its distribution outsourced to third parties.

The Educational Administrator acts as the collection point for most of these educational products. It would not, for example, touch video distribution after the video were given to a public broadcaster. The same of course applies to audio. And in different circumstances, with print media and software media being handed off to retailers, the Educational Administrator losses control over these as well. But many of the products remain in-house. More pertinently, all of the products in one form or another will presumably pass through the hands of the Educational Administrator. If for no other reason, this will happen in order to satisfy the specialized needs of

certain students, some of whom may not have access to any of the other forms of distribution or retail.

The teachers and faculty of some organization are the Educational Staff. They put the educational material to use, bringing to life the original course content with the resources they are given. Often, they may be the same people who developed the course content in the first place.

The Students complete the chain, with pertinent usage of the materials. They receive the result of everyone's' efforts, and, of course, they pay for it. The money they contribute is distributed back up the supply chain accordingly.

Section 6.2: The Supply Chain for Open University (OU)

The Open University develops all of its own initial content. It also develops its own software, all of which is only Windows (Microsoft Trademark) compatible. The BBC develops the audio and video content with OU consultation. The BBC distributes live audio and video over its own national networks. The OU distributes recorded audio and video, software, and printed material, all to its own Regional Centers. In some cases distribution is externalized to no one in particular. In other words, it is handled over the Internet.

The Regional Centers for the OU act as the Educational Administrators. They take the delivered and packaged content and allow students to access it. The Faculty (Educational Staff) use the material provided by the centres as part of the teaching effort. Students receive the total result.

Section 6.3: The Supply Chain for United Technologies Corporation (UTC)[60]

UTC has a full time group to handle the technical education of its employees. This group had experimented over the years with various potential forms of instruction. They tried sending students individually and independently to local universities. They tried bringing instructors into the company. They tried building their own universities in-house. They tried providing videotape broadcast. With all of these they were never satisfied.

Finally, they attempted to use Interactive Compressed Video (ICV) and found the results pleasing. They ultimately had professors from Boston University (BU) delivering courses to their employees onsite.

Given their history of being involved with educational efforts for their employees, UTC already had a sense of the material they needed taught. Much of the Course Content Development had already occurred by them. They also probably had a good idea of how they wanted the video presentation to occur, which fulfills the role of the Video Developer. Presumably, the BU professors completed this total effort. The distribution of the content was, as has been mentioned, by video. It was delivered by AT&T on their Global Business Video Services. From Boston, it was sent to various company locations in Connecticut and Maine. Notice that the Video Producer link in the chain is skipped, since the production happens in real-time in the form of a lecture.

The Educational Administrator capacity was filled both by the technical education group at UTC and by the pertinent staff at BU. Students would presumably liaison with corporate officials, however, for material to augment the interactive video lectures. And this material could be produced by BU or UTC, whatever form it may carry.

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[60] Lucent Technologies, Distance Learning Program, http://www.lucent.com/cedl/utc.html, 6 May 1998.

In this case, the Educational Staff role is clearly filled by the BU professors. The Students likewise are obvious, since they and their corporation are the motivating source for such a corporate distance education package.

Chapter 7: Conclusion

Section 7.1: Remote Information Organization and Decentralized Education

The distinguishing features of networked education are the separation of teacher and learner in space and perhaps time, the direct control of the learning experience by the learner, and the iterative nature of a nonlinear learning process.[61] The first aspect, particularly the spatial separation, seems to necessitate a customized approach based on localities. The case study in this thesis shows that regional centers with specialized focus can achieve a more effective educational delivery. It also shows that distance education is still fundamentally limited by the existence of appropriate infrastructure. The Open University (OU) can spread its presence successfully across the entire UK due to its collaboration with existing media entities, such as the BBC. But these entities must allow the broadcast of OU programs in other countries before the OU can spread its reach. So far this has not happened; and the OU is unable to successfully achieve full-scale, remote education delivery on its own. (They do, as was mentioned, deliver content by videocassette, but this does not meet the same gamut of needs as using televised broadcast as well.)

One reason is that they benefit from the informational infrastructure of a broadcast organization like BBC (as well as from the physical infrastructure). BBC has a deep knowledge base with which to help OU construct suitable programs. They have a deep technical base to use in understanding how certain content can realistically be represented. They even have marketing research that can be employed to present the OU programs in the most effective time and way.

Not surprisingly, OU has chosen to integrate themselves quite thoroughly with BBC. In fact, the integration of the OU with BBC has been so successful that one distance

educator, during an interview with the author of this thesis, admitted that he once thought the OU was an actual, entire division of the government.

This is both beneficial and limiting. It benefits the OU in allowing it to serve a broader public than it ever could on its own. It limits the OU, however, in achieving the full potential of distance education. Ideally, an institution engaging in distance education should have full flexibility in implementing their infrastructure solution. Transmission of information benefits educators the most when that transmission has a commodity character. By being locked in as a BBC customer, the OU is bound to the added value provided by BBC. They further are bound by BBC reach and penetration. (Both of which are undoubtedly impressive but still nothing like the Internet.) Distance education is best when the form of information delivery is decentralized. It places the control of access and usage of the information more squarely in the hands of the educator.

This point can be extended. Information organization is also better when decentralized. While BBC provides useful expertise, it cannot understand the mores, especially the educational mores, of a foreign culture as much as a native of that culture could. Advances in communications have utility since they allow us to disaggregate information organization into more effective subunits. The OU already has some organizational infrastructure to serve this purpose, with their regional centers. These centers, however, are merely extensions to the central OU administration. By giving them more autonomy, the OU could allow them to serve the needs of the local (or regional or national) community more effectively. Natives of the locality, or at least people who live there on a daily basis, would be much more adept at addressing student needs, which are after all the most crucial aspect of distance education.

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[61] Chavez, Humberto, and Simonetta Rodriguez. "Collaborative Software Engineering: Preliminary Requirements Analysis," MIT/CICESE, 10/97.

Section 7.2: The Role of Universities and Government

For some time, several Universities have existed as systems. The University of California is one example, with numerous campuses spread out across the state. Probably due to the historical difficulties of communication, however, the different branches of a university system where almost completely independent from each other. For the same reasons, even collaborative efforts were difficult to achieve.

Much of this has changed in recent time. Increasing ease of communication does not only relate to the facile transmission of information. It relates also to the increasingly sophisticated structuring and massaging of information masses. This latter aspect brings previously disparate parts of an organization together and allows previously centralized parts of an organization to move apart. For example, not long ago in the University of California system the libraries of each campus were for all practical purposes distinct. If one were, for example, on the Irvine campus and wanted to search the libraries of the Santa Barbara campus, one would need to submit a special request. After one to three days, that request would be physically mailed to Santa Barbara, where it would come up for processing after at least one day's delay. The librarians or their staff would search for the books and act accordingly, which consumed another daylong effort. Finally, they could send the book or a notification of no book back, which a lag time of one to three days. In short, the information on the books' availability or existence was separate enough to make information access an involved procedure. In this way the campuses were as separate from each other as if they were not part of the same university system.

Now there is a fully integrated database for the entire UC system. One simply searches the database, which is accessible from any UC campus, and locates the desired resources. There is, in essence, one big library system in the University of California. This is due to information organization. The delivery of materials is still limited by time of course; they are physically shipped around the state when requested by students and faculty. Obviously, this issue will become more easily resolved with further advances in telecommunications.

The best approach for universities is then to offer coordinated access to all pertinent information within the educational institution (or within whatever group of institutions the university deems fit). The UC library database is an example of this. At the same time, however, it should allow decentralized operations for each of its subunits. The UC campuses provide another great example of this, as they are initially built in regions that simply have a high number of primary and secondary school students in need of future, quality, public education. Each UC campus has a character that reflects the local culture; and each campus's student body is largely populated by locals. The UC system sets a baseline for quality maintenance and for certain operational procedures. Each campus is then bound to follow these baseline regulations at a minimum. They can add non-contradictory rules on top of them as they see fit, much as the states of the Union can with Federal law, but they cannot go below the baseline. This seems to represent a viable model for a distance education system, in which a central organization can ensure quality, efficiency, and ease of collaboration among its subunits while still allowing those subunits to customize their educational approach appropriately.

Governments should heed the same lesson. They must eventually establish a uniform baseline of regulations for distance education. A form of teacher accreditation accepted across state borders would allow distance education to come closer to realizing its full potential. When making their policies, particularly at the higher levels of government, policy wonks must consider that technology is inextricable from distance education. Any policy that prohibits or greatly inhibits the use of appropriate technology is destined to fail.

Other than establishing a baseline, the federal government should limit their involvement in development and application of content and structure. State governments are presumably more attuned to the needs of school districts. As long as their efforts can be easily shared by teachers and learners in other states, they should be able to tailor their approach to local tastes.

Reputable educational institutions have long served as *physical centers* of intellectual excellence. With the rise of distance education, the more successful ones may evolve into *virtual communities* of intellectual excellence. Certain technologies already allow us to create distinct boundaries and characters for virtual communities, making them ever more meaningful to human interaction. The trend will continue and amplify. Distance education will probably allow us to claim membership in communities larger than ever before; but it will probably also allow us to indulge in the myriad variations that make up our individual distinctiveness. The important point to emphasis, as one who promulgates distance learning methods, is that the learners in the method constitute the most vital part. The fact affects us all; for the best society is one in which all persons are, in a certain sense, lifelong learners.

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