Distance Education Technologies (DET): Assessment & Evaluation!

MOHAMMAD KHALID HAMZA
Lamar University
USA
khamza@gt.rr.com

QUTAIBAH MALLUHI
Jackson State University
USA

BASSEM A. ALHALABI
Florida Atlantic University
USA

The race is on to survive the competitive educational market which nearly everyone can now access with the click of a mouse. Many institutions are turning to DETs to tap into this market. The difficulty is evaluating the effectiveness of these tools and the education that is provided by them. Implementing a new DET is neither a simple matter nor a light decision-making burden. There is a great deal of hype surrounding DETs, and making an informed decision is not an easy task. Caution must be exercised, especially when contracting with a relatively new ".com" company.

This article presents the results of a survey of educational institutions and the DETs that they use, and it presents a framework for evaluating DETs and example evaluations of some of the most popular DETs.

In today's global educational market, there is a race to adopt the best and most effective distance education technologies (DET). These technologies are being used to supplement face-to-face instruction at all levels: elementary, secondary, undergraduate, and graduate. And since the birth of the fascinating world of the Internet, DET are being used as the primary mode of delivery for an increasing number of secondary (see, for example, the Florida Virtual School at: http://www.flvs.net/), undergraduate, and graduate schools: http://www.classesusa.com/featuredschools/fos/index.cfm

The swift move of DET is being pushed in part by the increasing number of home personal computers, flexible internet access through cable or DSL lines, and vendors' aggressive marketing plans. For example, we may note the following to illustrate our points:

1. The Massachusetts Institute of Technology recently announced a $100 million effort to make materials from nearly all of its classes available on the Web.

2. The University of North Texas once announced that it would pay royalties to faculty members who develop online courses.

3. Brandeis University, among others, started to offer an undergraduate concentration in internet studies.

4. The New York City Board of Education is spending over $900 million to develop web pages to supplement grade 4-12 education and provide computers and internet access to students and teachers (Charp, 2001).

5. The United States government has formed a web-based commission to develop policy recommendations for maximizing the educational use of the Internet in pre-K, elementary, middle, secondary, and post-secondary learning (see http://www.webcommission.org/).

The race is on to survive the competitive educational market, which nearly everyone can now access with the click of a mouse. Many institutions are turning to DETs to tap into this market. The difficulty is evaluating the effectiveness of these tools and the education that is provided by them. Implementing a new DET is neither a simple matter nor a light decision-making burden. There is a great deal of hype surrounding DETs, and making an informed decision is not an easy task. Caution must be exercised, especially

when contracting with a relatively new ".com" company—with the puzzled understanding of the immense losses many of those companies had endured in the past few years.

In view of that, this article presents: (a) the results of a survey of educational institutions and the DETs that they use, and (b) a framework for evaluating DETs and a sample evaluation of some of the most widely implemented technologies.

THE SURVEY

A short and informal three-question survey mailed to top information technology administrators, asked the following questions:

1. What DET(s) do you currently have employed at your institution?

2. How do you evaluate these DETs to assure performance effectiveness?

3. How well do you think these DETs have served your institution's needs—academic, administrative, and other?

The survey was e-mailed to 67 institutions of higher education in the United States of America (public and private) that are currently using distance education or a mix of DETs. Thirty-nine institutions responded to the survey. Seventy-six percent responded to the first question by listing the names of the different DETs they are currently using to deliver courses or academic programs. Sixty-nine percent responded that they lack the availability of any systematic tools in evaluating their DETs and expressed their doubtfulness and confusion when it comes to accurately evaluating these implemented DETs. Only fifty-three percent responded that current DETs do serve their institution's learning environments well and as expected. Such responses by the participants, seem to be based on the lack of DETs' consistent standardization (common user-interface features and options across multiple applications), lack of adequate and comprehensive integration (across a variety of applications and software tools), and lack of consistency in terms of software applications and user-interface common action sequences, terms, layouts, typography, and other important user features (Shneiderman, 1998). In addition, the gap between what the technology promised and what it actu-

ally did—once it was implemented and used—seemed to create disappointments and doubts about what many called "flashy promises offered by the technology developers." Moreover, many felt that most DETs did not pay much, if any, attention (from the user-interface design point of view), to the institution of human factors. Possibly such a perception was due to the lack of precise measurable objectives. For example, many of these technologies required much time to learn and master—by both the administrators of the technology and its users. Users (at all levels—novice or expert) simply found these technologies to be hard to learn or confusing. Speed of performance (length of time it takes to accomplish a task) was lengthy. Also, the lack of users' satisfaction—once they were able to experiment and use the system (Shneiderman, 1998; Hamza & Alhalabi, 1999), seemed to be a vital human factor many DETs did not pay attention to.

The research progressed as the authors further tried to explore the possibilities of meeting the following challenging objectives:

1. Lay the groundwork for future explorative research of the diverse and prolific DETs.

2. Identify different DETs for internet-based distance education.

3. Develop items and criteria for comparing and contrasting different technologies.

Based on intense year long research implemented by Jackson State University and led by one of the authors of this article, research synthesis and a systematic survey exploring massive net-based technologies took place (see Figure 1 and Table 1). Various DETs were identified (the most popular in terms of adoption and usability—such as WebCT), and later analyzed—from educational and technical standpoints (see sample Tables 2, 3, and 4). Detailed evaluation criteria were created based on the synthesis of software and product specifications, description, and examinations as provided by DET manufacturers for all examined DETs (see Tables 2, 3, and 4). While we feel this is a step forward in responding to the questions proposed in this article, please note that this research is still in its infancy, with much to explore and examine in the near future. The tables and the figures should work as conceptual models for evaluating potential DET opportunities, advantages, and disadvantages.
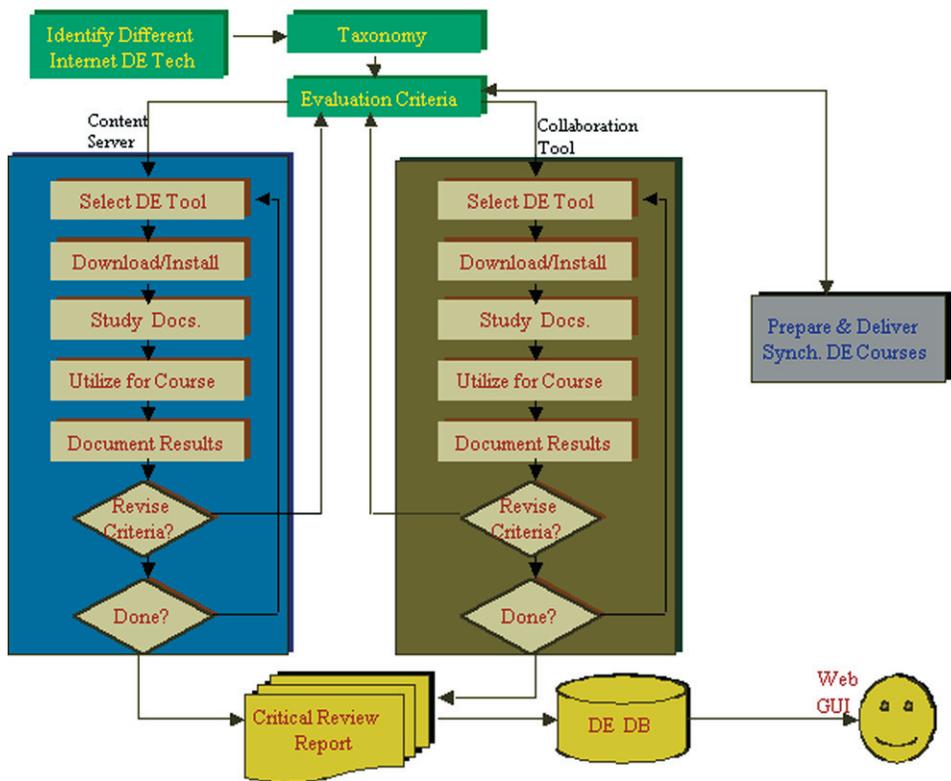
Figure 1. Evaluation activities

Table 1

URLs for Distance Education Tools

Alive e-Show	http://www.alive.com
BlackboardCourseInfo	http://www.blackboard.com
First Class	http://www.firstclass.com
HTML	http://www.w3.org/TR/REC-html40/
Java	http://www.java.sun.com/
JavaScript	http://developer.netscape.com/docs/manuals/ communicator/jsguide4/index.htm
JCE	http://snad.ncsl.nist.gov/madvtg/Java/Java.html
LearningSpace	http://www.lotus.com
MS NetMeeting	http://www.microsoft.com/windows/NetMeeting
Netscape Conference	http://www.help.netscape.com/faqs/conference.html
PageMill 2	http://www.adobe.com/products/pagemill/main.html
QuestionMark	http://www.questionmark.com
Real Servers	http://www.real.com
Tango	http://www.webwisdom.com/tangointeractive
ToolBookII	http://www.asymetrix.com/products/
TopClass	http://www.wbtsystems.com
WebBoard	http://www.webboard.com
Web Course in a Box	http://www.blackboard.com
WebCT	http://www.WebCT.com

Table 2
Comparison of Content Servers

		Web CT	Top Class	First Class	Web Board	Black Board
Administrator Tools						
Access Levels To log on with different level of authorization to perform different functions	Administrator					
	Access all utilities		√	√	√	√
	Create courses	√	√	√	√	
	Delete courses	√	√		√	√
	Enable & disable courses	√		√	√	
	Modify course content		√		√	√
	Initiate empty courses for designers	√	√	√	√	√
	Import & export courses/data		√	√	√	√
	Export raw data		√		√	√
	Manipulate course settings	√		√	√	
	Create classes		√	√	√	√
	Cerate user accounts	√		√	√	
	Create instructors	√	√	√	√	√
	Maintain system	√	√	√	√	√
	Designer					
	Design the look of the course	√	√	√	√	√
	Create quizzes	√	√		√	√
	Alter grades	√	√	√	√	√
	Adjust students accounts	√	√	√		√
	Control content of courses	√	√	√	√	√
	Instructor					
	Enroll students	√	√	√	√	√
	Monitor student progress	√	√			
	Create courses	√	√	√	√	√
	Create and customize classes	√	√			
	Grader					
	Grade	√				√
	Student					
	Access registered courses	√		√	√	
	Change password		√			√
	Customize appearance		√			√
	View grades	√				
	Post and broadcast messages	√	√	√		√

Table 2 (continued)

Comparison of Content Servers

Authentication Users' authentication to access the server	Single Course Access					
	Basic user name and password	√	√	√	√	√
	Log-in page	√	√		√	√
	System-wide Accounts					
	Access courses	√	√			
Course Management	Upload roster files					
	Create batch mode account	√	√			
	Backup Courses					
	Back up course contents	√	√			
System Platform Minimum Requirements for the Servers Software and hardware requirements. • OS • Processor • Speed in MHz • RAM in MB	**Window NT4/95 Web Server:** MS IIS 3.0/4.0 IE 2.0x Netscape Enterprise 2.0x	NT S 4.0 PII 266 MHz 128 MB		NT S 95 / 98 486 12 MB		
	Solaris Web Server: Apache 1.33	Solaris2.5.1 Sparc11 300 MHz 128 MB				
	LINUX Web Server: Apache 1.33	RedHat5.2 PII 266 MHz 128 MB				
	Mac OS Web Server: WebStar 3.0.1	OS8.1 PowerPC 200 MHz 128 MB		OS 7.1 PPC 040/030 32 MB		
Authoring Tools						
Select course components from a list	Add and edit different course components to the: Chat, calendar, course material, student's profile, and so forth…	√				
Batch mode content publishing	Accumulate multiple changes and publish immediately (avoid inconsistent state of the site due to partial modification)	√				
Criteria-based content publishing	Set time in advance so that users can access course, test , quizzes, on time	√	√			

Table 2 (continued)
Comparison of Content Servers

File management between station and server	Upload course contents, questions, assignments, and so forth., from the station.	√	√			
Multimedia content	Support audio and video file formats.	√	√			
Creating quizzes and exams	Create quizzes and exams	√	√			
Global page design	Reflect changes made to a particular web page to all the users of the server	√	√			
Customized icons	Change icon appearance	√	√	√		
Create content on CD-ROM	Publish course content on CD-ROM.	√				
Know HTML	Know HTML to design course content.	√	√			
Instructor Tools						
View courses	View all courses or a few courses.	own course only				
Hit count	Monitor number of times a course, home page, and so forth, has been visited.	√	√			
Time-spent statistics	Monitor time spent per student, per course, per exam, per quiz, and so forth.	√	√			
Chat room activity log	Monitor user requests handled by the content server.	√	√	√	√	
Database of questions	That creates and stores questions in a database to create quizzes and exams.	√	√			
Time limits for tests	Set duration and submission times of test, quizzes, and so forth.	√	√			
Automated test grading	Grade exams and quizzes taken by students.	automated correction, evaluation	√	√		
Course surveys	Generate online surveys to evaluate effectiveness of course, instructor, and so forth.	√	√			
Creating groups	Register students in groups for projects, presentations, and so forth.	√	√			

Table 2 (continued)
Comparison of Content Servers

Announcements	Post messages regarding exam dates, assignment due dates, presentation due dates, and so forth.	√	√	√	√	
Student Tools						
View grades	View grades of home-work, exams, and so forth.	√	√			
Compare grades to class summary	Compare grades with class average.	√	√			
Multiple quiz attempts	Attempt quiz more than one time.	√	√			
Create study guides and notes	Create important points.	√	√			
Resume capability	Resume a session from the point at which the session ended (e.g., trying to solve a questions and comeback to the same question later.)	√				
Search course material	Search glossary and full text of a course by using starting letter search or a keyword.	√	√	√		
Students view of all courses	View course for which student is registered and when did the student access the web course or pages.	√				
Communication Tools						
Chat	Interact online with other users.	√	√	√	√	
Bulletin board	Post messages regarding projects, assignments, etc., (administrator, instructor, or student)	√	√		√	
White Board	Draw sketches and send text online by multiple students.	√				
E-mail	Communicate online	√	√	√	√	

Web CT
General Overview
Based on the previous evaluation, WebCT tends to be one of the best content servers available in the market. It provides needed features required by the user. Apart from the features listed, it supports some important features that are quite noticeable. WebCT has a tool known as File manager, which arranges the course content in hierarchal order. The tool called overview helps to create an index on the content of the course. With the help of the index tool learners/users can directly jump to the course content.

Table 3

Collaboration Tools Comparison

		Net Meeting	LearnLinc	Conference	Tango II
Instructor Tools					
Instructor tools are the features of the program that allow an instructor to perform and control real-time instruction.	Slide Presentation	√	√		√
	Shared Application	√	√		
	White Board	√	√	√	
	Shared Browser	√	√	√	√
	Instructor's Control Features	√	√	√ also students	
Student Feed back Tools					
Tools available to a student, which allows him/her to interact with the instructor or other students.	Chat	√	√	√	√
	File transfer	√		√	
	Hand raising		√		√
	Yes/no button				√
	Others				Difficulty level
Audio and Video Communication Tools					
The tools provided by the application that allow student and instructor to communicate with each other verbally and or visually in real-time	Full-duplex audio	√	√	√	√
	Half-duplex audio	√	√	√	√
	Video	√	√		√ A/V are slow, discouraged
Security Tools					
The security tools are the features of the application that limit access to the collaborative session and its data.	Certificates	√			
	Passwords	√	√		
	Encryption	√	√		

Table 3 (continued)
Collaboration Tools Comparison

Marketplace Presence				
Presence and support	Support in the Marketplace	NetMeeting is widely supported in the marketplace.	A proprietary product but it supports or is supported by other products	no longer supported but still available as an add-in for Netscape 4.x	
	H323	NetMeeting adheres to this protocol	Not known at this time	Conference adheres to this protocol	
	T120	NetMeeting adheres to this protocol	Not known at this time	Documentation is not clear on protocol	
System Requirements				
System platform minimum requirements for the servers. **Software and hardware requirements.**	Processor	NT: P 90 MHz 95: P 133 MHz	P 133 MHz	PC-486 PowerMac	
	RAM	NT: 24 MB 95: 32 MB	32 MB	PC:4 MB MAC: 16 MB	
	Web Browser	IE 4.01	-	-	
	Modem	56 Kbps	28.8 Kbps	14.4 Kbps	
	Hard disk Space	4 MB	-	-	
	Sound Card	Required	Required	Required	

Table 4
Example Evaluation of NetMeeting

NetMeeting	
Instructor Tools	
Slide Presentation	Slide Presentation is very easy with NetMeeting since any program that created or presents slides can be shared where all users can see and manipulate the slides even if they don't have a copy of the program that created the slides. (Note the whiteboard allows the presentations of slides.)
Shared Application	NetMeeting has the ability to share the entire desktop including the host's computer operating system. Programs can be individually selected for sharing. When sharing feature is used other people can see the program. When you allow control, other people can both see and use the program. When a program is shared, its entire window is reflected to other computers in the conference. If part of that window is covered on the host computer then the other participants see a graphic pattern in the overlap area. Sharing can be selectively controlled—who has access to what programs.

Table 4 (continued)

Example Evaluation of NetMeeting

White Board	When one person runs the whiteboard, it appears on all screens. Everyone can draw and see what is on the whiteboard. The host can lock the contents of the whiteboard, so only he can draw on it. Each user can individually size and move the whiteboard running on their machine—although the contents of all whiteboards would be the same. The whiteboard allows the posting of a portion of the desktop or an entire window into the whiteboard. The whiteboard's contents can be saved and recalled later. The whiteboard also has a zoom function. The whiteboard allows the setup of a series of pages that the user can easily move between, insert other pages or delete pages. The whiteboard is supported by a number of drawing tools such as graphic tablets, and electronic boards.
Shared Browser	NetMeeting Supports this feature through its shared application tool.
Instructor's Control Features	NetMeeting gives the instructor total control of a meeting he hosts—he controls what programs are running and who can make modifications to or take control of any program. From actual experience it is a good idea for the instructor to strictly control the launching of applications so that only he can do so.

NetMeeting	
Student Feed back Tools	
Chat	Chat is very easy and straightforward. When one person in a meeting runs chat, a chat window appears on everyone's screen if they are using NetMeeting 3.0 or later. Chat files can be saved with the .htm file extension, and opened in an Internet browser. Chat files can be saved in a number of different formats—word-processing or spreadsheet. The chat window is fully customizable for each user. Chat also has a whisper function allowing the sending of private messages while in chat, simply choose the person's name from send list.
File transfer	The file transfer feature allows the sending of files in the background to any selected participant or group of participants. Participants have the ability to accept or reject the transferred files.
Hand raising	This feature is not supported by NetMeeting
Yes/no button	This feature is not supported by NetMeeting

Table 4 (continued)
Example Evaluation of NetMeeting

NetMeeting	
Audio Video Communication Tools	
Audio	NetMeeting only allows point-to-point audio. That is one person at a time. Multi-point audio or broadcast is only available through third party add-ons. OnLive!ACS 300 is a H.323 server that allows NetMeeting to have multi-point audio conferences.
Full-duplex audio	NetMeeting supports this feature
Half-duplex audio	NetMeeting supports this feature
Video	NetMeeting only allows point-to-point video, that is one person at a time. Multi-point video or broadcast is only available through third-party add-ons. A video snapshot can be placed on the whiteboard. The user has the option of choosing speed or video quality.

NetMeeting	
Security Tools	
Security	NetMeeting uses certificates for security, although these features don't have to be used. Security issues are a concern since NetMeeting can allow control of the host's computer's operating system. The host computer has control of who has access to what programs. Password protection is also a part of NetMeeting as encryption of communication except audio and video. User must have an account on NT machines to have remote access control (that is unattended access) but that is easily done, which is different from application sharing. Application sharing works the same on Win95, 98 as it does on NT.
Certificates	This feature is supported by NetMeeting
Passwords	This feature is supported by NetMeeting
Encryption	This feature is supported by NetMeeting

Table 4 (continued)

Example Evaluation of NetMeeting

NetMeeting	
System Requirements	
System Requirements	The following are the minimum system requirements to install and run Microsoft NetMeeting. • 90 megahertz (MHz) Pentium processor • 16 megabytes (MB) of RAM for Microsoft • Windows 95, Windows 98 • 24 megabytes (MB) of RAM for Microsoft Windows NT version 4.0 (Microsoft Windows NT 4.0 Service Pack 3 or later is required to enable sharing programs on Windows NT.) • Microsoft Internet Explorer version 4.01 or later • 28,800 bps or faster modem, integrated services digital network (ISDN), or local area network (LAN) connection (a fast Internet connection works best). • 4 MB of free hard disk space (an additional 10 MB is needed during installation only to accommodate the initial setup files). • Sound card with microphone and speakers (required for audio support). • To use the data, audio, and video features of NetMeeting, your computer must meet the following hardware requirements: • For Windows 95, a Pentium 90 processor with 16 MB of RAM (a Pentium 133 processor or better with at least 16 MB of RAM is recommended.) • For Windows NT, a Pentium 90 processor with 24 MB of RAM (a Pentium 133 processor or better with at least 32 MB of RAM is recommended.) • 4 MB of free hard disk space (an additional 10 MB is needed during installation only to accommodate the initial setup files.) • 56,000 bps or faster modem, ISDN, or LAN connection. • Sound card with microphone and speakers (sound card required for both audio and video support). • Video capture card or camera that provides a Video for Windows capture driver (required for video support).

NetMeeting	
Marketplace Presence	
Support in the Marketplace	NetMeeting is widely supported in the market-place. NetMeeting is supported by Databeam, Embrace, OnLive! ACS 300, MeetingPoint, MeetingPlace, and Placeware. At the high-end are products such as PictureTel and Encounter Family. Many more products support Netmeeting. Any major search engine will find ten's of thousands of web pages on NetMeeting.
H323	NetMeeting adheres to this protocol
T120	NetMeeting adheres to this protocol
NetMeeting	
Summary	
Microsoft NetMeeting is a collaboration tool that is suitable for synchronous distance education due to its features that allow live interaction between student and instructor. Is expandable and customizable through its SDK (Software Development Kit) and Add-ons. In addition, it adheres to industry standard protocols and is therefore supported by many industry third-party products. NetMeeting is an open product as opposed to a being a proprietary product. NetMeeting is widely available in the marketplace due to the fact it is included as part of Microsoft Internet Explorer 5, Windows 2000, Windows 98, and Microsoft PowerPoint.	

DET WEB ANATOMY

A general infrastructure of a DET Web environment (what is currently available in the market in the form of web tools, educational systems, and distance education modalities) is comprised of the following components: (a) a computer program, (b) a software application (collection of computer programs), or (c) the combination of software application and computing technologies (hardware and software). Thus, a DET web anatomy infrastructure—what makes any DET web-based environment valuable DET to an organization—is comprised of the following:

1. Collaboration tools: Commercial tools are most commonly used for synchronous exchange of information (Figure 2) by a large number of educational institutions and organizations in the United States, as well as the rest of the world. Synchronous delivery is provided by Microsoft *NetMeeting*, Java *Collaborative Environment*, *Tango*, Netscape *Collabra*, and the like.

DISTANCE EDUCATION MODALITIES

Asynchronous	Synchronous	Real-time: Asynch + Synch	Self-regulated
Computer mediated tools that enable senders and receivers communicate asynchronously via voice mail, e-mail, ftp, www, shared database, online threaded discussions, live chat and whiteboard. These DLTs free the sender and the receiver from constraints of time and place.	Computer mediated tools that allow senders and receivers to interact synchronously-- realtime, simultaneous access to information via state of the art DLTs (live chat, audio and video conference, virtual physical movements (such as hand raising), shared whiteboard, data and	Computer mediated tools that combine both DLTs based on the learning environment to be served. Many DLTs (such as live chat, whiteboard, Classpoint, and others) combine both modalities to better serve learning needs by the sender and the receiver	Computer mediated tools that empowers senders and receivers control the speed and the time of communication and information access. Usually self-regulated learning is associated with self-motivation and requires no collaboration with other learners or instructor

Figure 2. Comprehensive modality (Hamza, 2003)

2. Content authoring tools: Tend to be the most popular web authoring tools currently available in the market and used by a large number of educational institutions and organizations in the United States, as well as throughout the world. Examples of general web site creation tools include: (a) Adobe *GoLive*, (b) Adobe *PageMill*, (c) Claris *HomePage*, (d) Microsoft *FrontPage*, (e) *Dreamweaver*, (f) HTML, (g) Javascript, (h) Java, and so forth. Specialized web course development tools include: (a) CourseInfo, (b) Blackboard, and (c) WebCT. Multimedia authoring tools include: (a) lecorder, (b) Alive e-Show, and (c) Real Servers. Other systems developed by institutions (in-house built in systems) include Jackson State University's Grading System (JSUG), Syracuse University's Grading System, Florida Atlantic University's Distance Education Systems, and Automation scripts, and so forth.

3. Content servers: Content servers are software applications used to deliver and serve content authoring environments (e.g., *Learning Space*, *TopClass*, *WebCT*, *ToolBookII*, *Virtual-U*, *Web Course in a Box*, *First Class*, *WebBoard*, *QuestionMark*).

4. Supporting systems/protocols: Examples of standard protocols used by most net-based technologies include Mbone, RSVP, and Multicasting.

In the DETs examined in this study, the majority of components—the software tools and applications— when evaluated, tend to have commonly shared features and program limitations that offer better distance learning control, software manipulations, and user control.

The authors systematically surveyed and evaluated each selected DET. The evaluation process is illustrated in Figure 1. This process can be used by institutions to evaluate the capabilities of DETs and how well they fit each institution's needs. Tables 2, 3, and 4 show example evaluations of some of the more popular DETs.

Table 1 compares several of the most popular content servers. Space constraints do not permit inclusion of evaluations of other systems, so they are left to the reader as an exercise. Table 2 compares collaboration tools and Table 3 presents a sample evaluation of NetMeeting.

CONCLUSION

This article provides educators and IT professionals tools to evaluate Distance Education Tools. The evaluation techniques described will help the reader identify, examine, and implement DETs to better fit his or her organization's needs. Any of the tables can be an example of how a prospective DET can be examined to assure effective implementation of a costly technology. It is projected that the e-learning market (products and services) will grow from $2.2 billion in 2000 to about $11.4 billion by 2003 (Raths, 2001). With such a large increase in demand for DETs, the need to have the right tools to define the problem and offer a realistic and reasonable solution is a task that must be carefully undertaken by decision makers. We hope this article will be the start for such a challenging endeavor along the road to effective planning, examining, implementing, and evaluating of DETs.

References

Charp, S. (2001, March). The promise of the web. *T.H.E Journal, 28*(8). [Online]. Available: http://www.thejournal.com/magazine/vault/A3354.cfm

Hamza, M. K., & Alhalabi, B. (1999). Education and technology: Between chaos and order. First Monday, 4(3). [Online]. Available: http://firstmonday.dk/index.html

Raths, D. (2001, June 4). Will the web deliver? *InfoWorld*. [Online]. Available: http://www.infoworld.com/articles/ca/xml/00/06/05/000605catrain.xml

Shneiderman, B. (1998). *Designing the user interface* (3rd ed.). Boston: Addison-Wesley.