

The Technology Bases of Delivery Systems

SUBJECT: Assignment #2: The Technology Bases of Delivery Systems

COURSE: MCTE 661 — Advanced Instructional Delivery Systems

Textbooks: • Beyond Calculation: The Next Fifty Years of Computing
Denning & Metcalfe (1997)

- Learning Networks: A Field Guide to
Teaching and Learning Online
Harisim, Hiltz, Teles & Turoff (HHiTT) (1995)

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Due date: February 5, 1998 (date extended, permission of Professor)

Actual submission date: February 12, 1998

Abstract

This summary paper addresses a small portion of the ever-expanding technology bases of instructional delivery systems. One of the most important issues in keeping abreast of this turbulent arena is that the forces that drive the Information Age — the hardware, the software and thousands of small, scientific "jots and tittles" — are also the only media that offer a ghost of a chance for keeping people informed. With vast amounts of information available through current technologies, it is impossible to *absolutely* provide identification of key references to support the ever-growing knowledge base or the expanding world of physical technologies — the software and hardware methods and means are constantly evolving. In the world of instructional design, one of the most important elements for a successful learning network is careful attention to the DESIGN. This paper will explore some facets of the rapidly changing technological elements in learning environments.

The Technology Bases Of Delivery Systems

Delivery Systems: Introducing The Magnitude Of Emerging Technologies

"Wherever people are found waiting for something, that activity is a candidate to be made more efficient by the application of digital technology," was the truth-laden statement made by Peter J. Denning and Robert M. Metcalfe, in their book, Beyond Calculation: The Next Fifty Years of Computing. (238). If given enough consideration, this theory might apply to *all* necessities and desires of human life! While others might read this statement and envision long lines at the bank or supermarket, for this writer, it has strong indicators for the arena of education and learning. It stirs memories of echoes of hundreds of voices in a student-littered hallway of the university's registrar's office, waiting for the axe to fall when one finally heads the line, only to find that the needed-for-timely-graduation course has closed. This, indeed, is an activity in need of the improvements made possible by digital technology! In fact, most university registration processes have, for several years, benefited from recent electronic delivery systems.

When we begin to study delivery systems, it becomes clear that one of the most essential elements of the system is the software component. It also becomes clear that the fundamental quality of a computer program is in its ability for purveying its informational content. In order for a software to be successful, this content must be reproduced and widely disbursed. The predominant overlying reasons for such a distribution process for software is governed by humans and it is based on the value that it offers to humans. (Denning & Metcalfe, 236). In the example of university registration, for example, it has already been widely proven on hundreds of campuses that digital reinforcement is a valuable tool in this rather mundane, but necessary, college activity! It has been proposed that there are three ways in which digital entities will earn their ground in the upcoming technological century — "by allocating resources more efficiently, by moving information to the places and times where it is needed, and by having a globalizing

influence on human beings." (237). This is a topic of extreme contemporary urgency in the evolving methods of delivery systems, beginning perhaps with the essential needs of the learning community.

The technology bases of delivery systems has become harder to define with each emerging moment of history. The fine line between what is hard-edged and mechanical begins to overlap the thought-processing elements — the "idea-ware" — the creative impulse of software. Somewhere in the interim of design and neural pathways lies the hazy and even fear-provoking zone of topics such as artificial life, where computer programs uncannily begin to produce creatures of their own kind. This will become an increasingly important aspect of our delivery systems. The rapid growth of the Internet is thrilling in its own right. The World Wide Web, which is a set of faculties traveling the Internet, offers an effective combination of software and hardware for delivering information. What is not so apparent is the growth of "intelligent elements" in even our current systems. (51). "The hardware, software, and especially networking growth are building upon themselves." (51). Literally, the bond between computer and human has overlapped previous eras of science fiction, where a fantastic breed has now become commonplace. The computerized age has brought us learning as it has never before been experienced. Offerings for instructional delivery abound and increase daily. It is a delight and a burden to attempt to keep pace with the components of delivery systems.

Regarding delivery systems for instructional purposes, it is exhilarating to herald recent advances in such exciting platforms as Virtual Reality, *WebTV*, video-conferencing, and chip technology. There is a strong connection in the world of instructional (and ALL) delivery systems, between the machinery (hardware, connection systems, etc.) and the "idea-ware" (software, Internet applications, etc.). When knowledge or skills are embedded in software or databases, these become attainable and usable by many different human-based or machine-based operations. This flexibility of organizational means is increased. "Computer-based information commodities include hardware, software, and databases in varying combination. Concrete examples are personal computers, electronic spreadsheets, word processing packages, specialized

programs, Internet browsers, CD-ROM databases, and online services." (216). The important factor to realize here is that the knowledge and skills embedded within our tools also "learn" from their activities.

The final outcome of our cooperative efforts — in fact, our almost Cyborg-like efforts — is that the machine has become an extension of our selves. We greatly enhance our abilities, one to another. "[W]e have a positive feedback cycle with the Web growing in scope *because of the Web*. Not only do we have the tight loop, with the *Web being the means of improving the Web*, but each iteration brings in more participants and their contributions. The result is very rapid growth, or *hypergrowth*." (50). No previous method of learning delivery has ever provided this tremendous capability. As users, we have become quite used to the easy interface of the Web, in which various hypergrowth events seem to miraculously appear just in the nick of time and out of nowhere. A closer perusal shows that these miracles were preceded by things like VisiCalc, WAIS, FTP, Telnet and Gopher. (51). Each territory of the digital time zone has harbored what appeared to be "a miracle deliverer."

All of these elements make up our current digital delivery systems. The parts cannot be divided from the whole. This intertwining will magnify as methods of delivery are improved. It is beyond any doubt that the subject of necessity-based means of information dispersal — geared toward economics as well as education — is of paramount importance to those interested or immersed in distance learning. The ironic twist to that statement is that, most probably, *all* learners will soon become distance learners, to one degree or another. Demographics as well as statistics showing rapid and superior growth, will place that demand on the learning community.

Developing Systems And Solutions: Glaring Lessons Of History

In presenting the magnitude of these emerging technologies, we also begin to explore the manners in which one can attempt to research and learn in order to remain "cutting-edge." In fact, this becomes a built-in benefit of the exploration, for, while searching for a solution, one inevitably finds also the *creator* of the solution. This locale, in today's times and methods, is

usually the referenced website (or other communications means) of the creator — and it becomes a mighty tool in the search for a solution. These sites, collectively, are the Internet "holding tanks." They contain the latest in the development of systems and solutions, straight "from the mouth" of those who are developing them. Care should be taken to establish that these knowledge-banks have a history, that they've provided a base for reliability, and that they will most likely continue to provide their informational services.

In an ever-changing, sometimes by-the-minute field, it must be acknowledged that even the information services most soundly rooted often have been known to "take a dive" — literally overnight. Highly respected software and hardware companies, looked to by their users for support and information, constantly close their doors. This has left huge gaps in the information flow, if not for the overall effectiveness of technologies, then at least for consolidated groups who then must turn to other means of solving information slack. The demanding question is defined by the word, *availability*. It is time to begin to establish, in this writing, a list of terms that will aid in aptly describing future instructional delivery systems. *Availability* is a good place to start.

If we are to believe that "[r]esearch is not the goal but the means," (Denning & Metcalfe, 259) then we can begin to put the puzzle together. In the digital learning environment, searching for what is needed is not the goal. If the creator of something we seek no longer exists, the finer points of the new delivery systems raise their beckoning heads. Our new goal becomes utilizing the improved means, bypassing the absence of the original content provider, and finding new avenues for productivity — *this* is the newer goal. Within that process lies the essence of our new media, where the means and the final product are incrementally and drastically improved.

As users of these methods of delivery, it is certainly to be noticed that "[t]here are glaring lessons in every one of the failures and the successes. A central question is, Which companies will survive and lead the computer industry in the twenty-first century? If past is prologue, the names will continue to change as current heroes splatter and new heroes emerge. One would believe that the lessons of the past could moderate the failures in the future." (170). In other

words, this is the ideal environment for learning from our mistakes! Mistakes in structure, errors in strategy, and blunders in implementation . . . all of these prove to be excellent stages for rapid learning, concerning both the current and future visions for instruction and its delivery. Names become less important than the willingness to survive or even thrive in an unprecedented paradigm. As we count one loss, we open the door to several, perhaps millions, of new deliverers of that which we seek. Opportunities are unlimited, bound only by the current status of the hardware/software structure.

The world of electronic delivery systems is a tremendously unique environment. The Internet IS the final conveyer of delivery systems for all businesses or education. It is the bearer of the advertisement, it is the platform of the product, and it is the method of support and reference. This indefinable entity is the means of communication, and is quickly becoming the means of economic transferal. The Internet, to coin a phrase, is the "Great Leveler." For instructional purposes (or for economic or personal), all aspects of daily life are offered and received in like manner. The difficult scenario is keeping up with such tremendous rates of change! Because of this, instructional use of the technologies is identical in its complexity to all other areas of personal life or commerce — and as intricate — in seeking the *availability* of the *goal of information*.

Articulating the Challenge: The New Goal Is Resiliency

How is such a large and expanding environment to be understood by the users it is intended for? "The traditional approaches to system design posit that *there is a system being designed [emphasis by this author]*. We are adding to a complex system without any overall coordination. Once again, we've introduced major sources of complexity without the corresponding means to deal with it. We need to learn how. In a sense, the overwhelming scope of the problem contains the seeds of how to approach a solution." (52). We are again driven to think about the fact that this delivery system, somewhat hacked and pieced together, still holds within itself strategies for helping, fixing, or "growing" itself. We simply have to adopt a new

mind-set, one that is larger than what we now have, for understanding today's systems.

"Techniques that seemed sensible in a well-understood system just don't work. There is no single version of software to be updated." (Denning & Metcalfe, 52). Because the interface of current delivery systems is so efficient, because the Web is inviting and informative, many take for granted that the efforts are seamless, and that perhaps Netscape or Internet Explorer is the integrator of that seamlessness. Not so! Even current offerings of delivery have innumerable components that go much further than just one browsing software. Indeed, "there is no single version of software to be updated" that can expand the efficiency of delivery! What *appears to be*, just is *not* so. Yet, *efficiency* is definitely a necessary describing factor for an optimal delivery system.

In the online cradle of the Internet, all systems have the potential of becoming interconnected. (53). In development, the old objective was "bug-free." To keep pace with such rapid-fire advancements as recently experienced, a new goal must be resiliency. (56). "When we speak of software and delivery systems, the new adventure is not only to create singular, efficient programs, but to carefully give birth to self governing systems that interact. (53). There certainly is no limit to what can be done in designing such systems. The key word here is *design*. In the years leading up to the present array of delivery systems, things have gotten very complex! "We've been very unsuccessful in mastering the complexities of interactive systems, and these complexities continue to increase as we interconnect systems and add intelligent elements throughout the systems." (57).

Doggedly, almost, each step has been an attempt to narrow the technical requirements and specifications, resulting in many overlays of non-holistic, haphazard design. But, almost too late we see that system design in the chaotic world of interconnectivity requires resiliency. If ever there was a banner for the upcoming design era, it must be found in the word, *simplicity*. Innovation will continue to bring its surprises. One of these surely will be that we must learn — or *re-learn* — how to build resilient systems. Call it "getting back to basics" or just discovering

new simplicities; these will help to regenerate reliability in more well-structured systems. As in all of human history, innovation *will* continue to surprise us, (56, 57), in all of its *simplicity*.

In recent years, the pace of innovation has dramatically increased because almost everyone is trying to gain in speed. In the world of education, traditional universities and research centers are at an extreme disadvantage because they have always cloistered themselves against product-oriented innovation. Within the scope of delivery systems in general, those for instructional purposes are in a unique area. The innovations are happening because of economic and business concerns. The academic community is left behind because they do not have the same pressures as the work world, and therefore have been more reluctant to adopt change. Secondly, educational institutions risk being irrelevant, because they do not have, or perhaps do not wish to receive, sufficient feedback in keeping with the digital world around them. "We see more and more that real innovation comes from dynamic companies." (264). Very recent months have given us much hope, however, as many academic settings have realized the pertinence of the media and its distribution methods, and have begun to plan accordingly. They are learning . . . *resiliency*.

The ramifications that define future, improved delivery systems show us that nothing is isolated anymore. We are all dealing with life, *globally* — another excellent definitive word for delivery systems. We have all been thrust (some kicking and screaming) into a global arena. For the educational community, this has meant a gigantic leap into . . . Global Learning Networks. Again, those cloistered walls! This time, one can hear the echoes of shouts, of groans. The reason is, that in most commercial groups that have gone resolutely into networking, fundamental revisions have taken and are taking place in the organizational makeup. "Education around the world is becoming strongly networked, and we are beginning to see fundamental changes taking place in the organization of education too." (Harasim, et al., 268).

New delivery systems have partly done away with the geographical isolation and monopolistic posturing at the university and college level. Connectivity and collaboration are restructuring the image of student and teacher alike. "Networking ultimately will change the

character of education at all levels. Economically it will counteract monopolies and facilitate people accessing the educational services that best suit their needs." (269-270). Global networking will most decidedly affect the development and formation of new genres of computers. (Denning & Metcalfe, 21). This new era of delivery systems and their components will be a foundation for new levels of learning, unique *because* of the methods of delivery.

Hardware: Going From The "Merely Feasible" To . . . REAL TIME

As the pounding excitement over new methods escalates, one thought for the future and one of the most difficult tasks in trying to foretell the future of technology is to "distinguish between what will be commonplace from what may be merely feasible." (Denning & Metcalfe, 36). An additional interesting observation to this is that once one has established a compendium for his or her beliefs concerning fact and fiction, reality sets in with a new device — very much a miracle, no less — that he or she had previously placed in the category of "only feasible." Such are the everyday facts surrounding our search into instructional delivery systems. The element of surprise is our constant companion.

There are many that predict that the biggest transitions will arrive with changes in the user interface. We will go from windows, icons, mouse, and pull-down menus (WIMP) — to speech. Another enhancement to the user interface would be the addition of camera input of gestures of eye movements, to speech. (15). The careful reader will immediately notice that this harbors more than just technical hurdles, but that the outcome gives truer meaning to the phrases, "virtual reality" and "body language." Once we have experienced the addition of speech by placing computer power right in the middle of communications, we see this leads to the potential for speech recognition, transcribing, translating, and in-depth understanding. Already, speaker-independent recognition with limited vocabulary is fairly reliable and is being used with voice-response units for placing and directing telephone calls. This service, most times just an irritation while trying to glean information from bank or library, will be greatly expanded in the coming century. (41).

In a connected world, one with the capacity to deliver not just real-time events but also a form of "virtual reality," the use of the many video forms is likely to parallel trends in utilizing speech. This will take the form of graphics and the combination of virtual sets and scenes . . . video productions for the desktop that are actually taking place at digitally constructed locations. It will also take on the job of analyzing spaces and objects in dynamic scenes, such as architectural, military, or deep space. "Computers that can 'see' and operate in real time will enable surveillance with personal identification, identification of physical objects in space for mapping and virtual reality, robotic and other vehicular navigation, and artificial vision." (15). These advanced, tactile versions of delivery hold great promise for bringing sensation and life-like impact to the learning environment, regardless of health or handicap, or ability to enter a traditional classroom. Those who cannot see will receive a constructed ability to do so. Those who cannot maneuver on their own will have the reality of the learning experience come to them. Enhancements of current technologies such as sonar, radar, and global position sensing (GPS) devices, and radio data links will bring new portability and mobility applications. This might include robots, robotic vehicles, and self-driven appliances. (15). Again, we are faced with the fact that even in the educational arena, our machines have begun to meld with our knowledge and our being. Cyborg-like, the enhanced equipment of delivery systems is, increasingly, the extension of our selves.

The online environment is most proficient at giving daily additions to our base of knowledge. Every topic has an *hourly* update, it sometimes seems. Recently, the Food and Drug Administration approved a voice-activated, surgeon-controlled robotic arm that will probably pave the way for robots in the operating theater and robot-assisted heart surgery. Steve Wilson, vice president of *Computer Motion*, makers of the *AESOP 3000*, or *Automated Endoscopic System for Optimal Positioning*, predicts that soon, when a surgeon makes an order, it will be carried out by a robot.

The *AESOP 3000* is now the standard hardware in many knee and joint operations. It can maneuver and position an endoscope precisely, with an optical tube connected to a medical video

camera and a light source. Surgeons have been reluctant to go into the human chest cavity with even the smallest of endoscopes, cutters, and cauterizers, because the arteries are so small. The human hand is much less steady, however, than a robotic arm. "The *AESOP 3000* will now allow surgeons to perform minimally invasive heart surgery procedures with voice commands and see their progress on a computer or video monitor at 15 times the current magnification and resolution," Wilson said." (Koprowski, 1998). Components of future medical delivery systems, then, enhance the instructional situations of even the already highly educated. It is easy to project the uses for these technologies in instructional delivery in the medical arena.

The robots of science fiction have stepped off the pages of literature and come boldly into the learning place, leaving the realm of the "merely feasible" and leaping into the embodiment of a strong servant for humanity. "Merely feasible" has become magnificent *feasibility!*

In discussing delivery systems for instructional environments, storage issues must also be contemplated. The acronym DVD is short for *digital versatile disk* or *digital video disk*. This is a newcomer to the world of CD-ROM. It holds a minimum of 4.7GB (gigabytes), enough for a full-length movie. (Sandy Bay Software, Inc., 1998). It is the next-generation audio technology with seven times the storage capacity of a compact disc (CD). It also is one item among many that are helping to create a "melding of the media." In this case, DVD-Audio illustrates the ongoing convergence of PC and consumer technologies.

"The *DVD Forum's Audio Working Group* (trade group) announced a draft specification for DVD-Audio recently. Representatives of PC manufacturers, consumer electronics firms, and the music industry are collaborating to advance the technology. In the technical world, a specification precedes a standard, which insures that the industry manufactures *interoperable* products. (Oeler, 1998). This has brought us fully around to a word that is literally synonymous with "*interconnectivity*." *Interoperability* is a keystone, if not *the* keystone, to the creation of infrastructure." (Denning & Metcalfe, 37). The delivery systems of which we speak, whether they are the hardware (of delivery, of sound, of visuals) or the software (for organization, for content, for ideas), MUST be successfully interoperable to be successfully interconnected.

What are the deepest meanings to the educational community, for these advancements in delivery? It is becoming the era of the "virtual conference." Geography is no longer a barrier to dispersed groups of people who meet in cyberspace to share topics of common interest. Our digital networks are increasing as bandwidth and processing power increase. Our social and learning environments are sitting on the brink of including the realities of real-time audio and video, with concurrent translation into the native tongues of all participants. Currently, much time and energy is expended in moving people, for business, education or pleasure, through the air. Soon, much of that travel will be made by the information moving through wires, instead. (Denning & Metcalfe, 240).

Supporting Connectivity: The Bandwidth Saga Continues

"As the Internet continues to explode, the computer industry must develop new technology to handle increased bandwidth demands," said WorldCom chief operating officer John Sidgmore. Current projections show that bandwidth needs to double about 10 times a year. In the 21st century, the communications network will be built to support computer-to-computer connections, and not as much to support human interaction. The technology does not exist today to "grow" bandwidth at 1,000 percent per year. Innovation will be the key to finding a way to solve this problem. Although Internet growth is currently driven by new Internet subscribers, in the future, bandwidth requirements will be defined by commercial purposes that use new Internet technology, including streaming audio and video and other yet-undeveloped processes and delivery systems. (Wong, 1998).

One such system is currently being developed. Wireless technology offers a tremendous potential to totally change our communications infrastructure. There will be many issues and policy questions arising concerning the future allocation, or even *reallocation*, of wireless bandwidth. Truly *portable* and *mobile* computing would be possible with wireless networking, which undoubtedly solidifies its place in tomorrow's instructional delivery systems. (Denning & Metcalfe, 20).

Adding to our list of relevant terminology, which includes **availability, efficiency, simplicity, resiliency, globally, feasibility, interconnectivity and interoperability**, we now must include **mobility and portability**. These descriptions become linked together for strong purposes . . .

Is It Hardware Or Is It Soft? — Getting A New Sense Of Self As A Learner

Because desktop systems have not evolved cleanly, they have become a mass of often-competing hardware and software sub-systems. Engineers who eventually bring real-time features to the PC will have to deal with some strong, negative historical properties that have to do with improper design and roundabout solutions. Commitment to "evolving" current technologies into efficient systems runs deeply in the technical world. Computer scientists, for instance, at *Microsoft's* research center are working on bringing real-time capabilities to the Windows operating system — thereby enabling a single desktop PC to perform a certain wizardry with multiple, time-critical tasks such as speech recognition, animation, and video processing.

Michael B. Jones is a *Microsoft* researcher and expert in ensuring predictable response in an operating system. This is the cornerstone of real-time design — *predictability*. It is absolutely necessary for multiple events with real-time characteristics to begin to happen. Things like voice capture, playback, speech recognition, and video editing fall in the arena of *consumer real-time*, for it is the consumer who has created the demand. End-user applications will become more dynamic. Multimedia is somewhat like television, in that the user makes things work without understanding the content. Jones said that the real value of media is going to be when you can have *computers* not only making things work, but also understanding the content . . . a technology that is called "scene understanding." (Wolfe, 1998). The system described here has a distinct overlapping of the duties of hardware and software. It starts to become difficult to decipher which one performs which functions. We are, it appears, also dealing with a factor of *predictability* in our attempt to understand delivery systems.

Taking this idea a bit further, this predicted technology will provide instructional abilities along with an entertainment value. This is almost an inescapable fact, since audio and visual abilities almost always delight the senses and provide some level of entertainment. Take, for example, a scenario where two small dinosaurs *whirrr* across a tabletop, their infrared eyes locking in mortal toy combat. Somewhere in their construction and life of play and prey, they may also plant some seeds of curiosity for Science in their young creators. At least that is the goal of the *Media Laboratory* researchers at the *Massachusetts Institute of Technology*. Here, they work hard at play, and they design computer-driven construction tools. Children use the tools for investigation and entertainment. Dr. Mitchel Resnick, the leader of the research team, believes that if children help work on these projects, it gives them a new sense of themselves as learners.

A wide range of programmable toys has been developed. Some are yet in early stages and some are already available on the marketplace. Much of the research is financed by the *Lego Group*, and many of the toys are based on *Lego* building blocks. The *Media Lab's* new *Crickets* are tiny computers that can be hooked up to touch sensors, motors and light, and they can drive dinosaurs and other creations. *Crickets* communicate with desktop computers and with one another, through infrared light. The *Media Lab* group encourages children to build scientific instruments with *Crickets* and other toys, which are capable of making "sophisticated concepts, like feedback and control systems, child's play." Thus, the right set of tools and *curiosity*, enables even young children to test ideas and begin to develop an intuition about higher level concepts. (Freeman, 1998). It appears that *curiosity* is a fundamental defining factor for new levels of delivery systems.

Enhanced Television, A Digital Hybrid: Is It Destined For Education?

Denning and Metcalfe tell us that "[t]he 'network computer' (an inexpensive, stripped-down PC designed for accessing the Internet) or the 'information appliance' (a device for making a Web browser out of a TV set) will put the offerings of information markets within reach of

nearly everyone." (217). They also are quick to advise that the Internet will not, in the beginning, *replace* television, telephone, radio, and print media. Rather, it will imitate their capacities, broadening their existing capabilities. All during this time, traditional media will start to convey Internet traffic. "Eventually, the juxtaposition of these media in the Internet framework will lead to integration and mixing of functionality that would not otherwise be easily achieved . . .

Television broadcasts (or cable casts or satellite casts or net casts) will contain Internet content that can be displayed separately. Thus, during a conventional television program, Web pages will be sent that can be examined and interacted with independent of the TV program. Private discussion groups could be formed around particular programs, in real time, taking today's newsgroup discussions one step further." (40-41). It seems that upcoming delivery systems will be graced with high propensity toward *integration* and broad *functionality*. Upcoming? Astonishingly, this method of delivery has already arrived!

WebTV Plus Receiver, a combination of the best of broadcast television and the individualized medium of the Internet creates a new, synergistic medium of enhanced television and integrates television and the Internet for the consumer. This high level of hybrid technology requires no change to existing broadcast or Internet infrastructures. The *WebTV Plus Network* offers many advanced features that greatly assist Internet connectivity over regular telephone lines. Faster access to Web sites is achieved by methods of caching and transcoding. What does this new hybrid digital beast look like? Makers of *WebTV* say:

- The *WebTV Plus Receiver* is an extremely powerful Internet terminal that performs better than the typical computer in use today, and is less expensive.
- The image and information-processing capabilities transform the television into a high-end graphics browser for the Internet.
- A 176 MHz, 64-bit MIPS CPU provides 200 MIPS performance.
- Significant features include a 1.1 GByte internal hard disk drive, a 3D graphics engine, a 3-in-1 stereo tuner, printing capability that offers full support of HP-400 and -600 series DeskJet printers, and a 56K modem using *Rockwell K56* flex technology.

- TVML is a new content platform created by *WebTV Networks* and *Microsoft*, that enables this new medium to deliver integrated HTML and TV content, and promises to become as important to enhanced television as the Web and HTML have become to the Internet.
- The TVML specification defines the content platform as one that can deliver across a range of appliances and networks.
- It covers development and deployment of integrated content, and can be quickly adopted by content developers as it does not require special programming tools or equipment.
- Standard HTML files can be associated with existing TV programs.
- This method uses standard protocols to send HTML-based content to an Internet terminal, taking advantage of the *Vertical Blanking Interval (VBI)* of standard analog NTSC TV signal.
- Existing standard Internet protocols (TCP, IP and PPP) are used.
(WebTV, 1997).

It seems proper, at this point, to remind the reader of the terminology list that has been gathered in relation to our glance at delivery systems. We are presented with a system that takes advantage of the **availability** of existing sub-structures. It utilizes old and new technologies with **efficiency**. The beauty of its **simplicity** of design is shown in its **resiliency** toward garnishing use of existing standards, and having the ability to use all of this **globally**. It has a high **feasibility** factor, as many of the technical agents already exist. It relies highly on the **interoperability** and **interconnectivity** of existing telephony and other modes. Its simple design lends **mobility** and **portability** for taking the method into far and ranging locations. Its abilities for offering the best of television and the Internet invite intense **curiosity**. It promises **integration** of existing technology with newly devised technical means. It promises high **functionality** as an almost perfect delivery system for audio, visual, speech, and every other possible component necessary for a "virtual world."

Is it possible that *WebTV* has provided the very foundation for the next step in delivering instructional content, and, larger than that, content of all types?

Others have certainly caught the vision! *IntelaSync*, the company, has unveiled *IntelaSync*, the video technology, which will essentially add a pause button to real-time video! This will be licensed by TV, VCR, and other consumer electronics manufacturers. Depending on the functionalities of the television device, a viewer can pause a TV show while surfing to a Web site, looking at another channel, or taking care of a household situation. *IntelaSync* will be able to store incoming analog or digital TV signals for delayed viewing, depending on the available memory built into the device in way of a local hard disk, or built-in, hardware-based memory. The company expects that broadcast-equipped PCs, DVDs, set-top boxes, and plain old VCRs and TV sets will soon be offering this technology. (Wired, Inc., 1998). It seems that soon we will add the realism of "taking a break" while enjoying real-time as well as in real life!

Methods And Means: Pathways To Learning, Teaching, And Assessment

Macromedia, Inc. recently announced the addition of *Solis, Inc.* of San Mateo, California. *Solis* has been a leader in open, online learning management systems. It will become a part of *Macromedia's* Interactive Learning Division, which focuses on tool development and enterprise solutions for academic and corporate learning. *Macromedia* now offers the *Solis Pathway* line of products as *Macromedia Pathware*[™] — a Computer Managed Instruction (CMI) application, open standards-based, for training management in both a LAN intranet and Internet settings. This is an advanced system for administering all types of training, including instructor-led, computer-based, and distance learning. It also provides flexibility for managing and delivering content and training through all media from the Web to CD-ROM, LAN, or local hard drives. Open standards enable companies to choose their content, their delivery method, and a personalized management system, without concern about **interoperability**. "Headquartered in San Francisco, *Macromedia* is a leading provider of software products, each designed to help make creativity and interactivity more possible in the new technology **ecosystem**." (Macromedia® Inc., 1997). It seems fitting that the creator of the leading content and instructional software, the one most likely to utilize a "perfect" delivery system, sees itself as a purveyor of services within an

ecosystem. It gives imaginative and visual support to living, working and learning within the real-time of a virtual reality locale — after all, this will be our virtual classroom, and home, for many hours per day. Its ecosystem will require attention and care.

The Final Infrastructure For Education, For The Planet: A Network Paradigm

No one can tell what the final infrastructure for education might look like several decades from now. Whatever the results are, it will most likely be much more stimulating and effective for the learner. It surely will provide a tremendous variety of choices. (Harasim et al., 270). The profound reconstruction at all levels of technology and in society, overall, commands brand new responses for education. We live in an age where resources are becoming scarce, yet knowledge is expanding rapidly. It is an age where "knowledge is power." This is the absolute right timing for looking into network learning, as it almost exclusively offers the possibilities for bringing an equality to the learning environment, where ALL learners might access what they need, whenever and wherever they need it. "The paradigm for education in the twenty-first century that is emerging is network learning. Based on global interactivity, collaborative learning, and lifelong access to educational activities and resources, it provides an approach that emphasizes international connectivities and engenders new ways of working, studying, and problem solving." (278).

In analyzing delivery systems for instructional and other purposes, it is wise to keep in mind that the system will never be perfect, the hardware will sometimes fail, and the software may not totally provide a balanced ecosystem for "virtual thriving." With attention and care for the world we are building, however, "[t]he best outcome that we can hope for and work toward is that the arrival of digital machines will be the catalyst for the changes that are necessary to ensure our own survival on the earth." (Denning & Metcalfe, 242).

These machines, these extensions of our selves, will certainly at least be cooperative conveyors of the knowledge we *must* have, in order to survive.

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