Web-Based Training

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ABSTRACT

Current Web-based training (WBT) is based upon systematic research and experience with strategies for improving learning and instruction, beginning in the early part of the 20th century and continuing to the present. Use of the World-Wide Web for delivery may improve access to training, but the effectiveness of the resulting training and the usefulness of the outcomes is chiefly dependent upon the quality of the instructional design and the completeness of the support package provided. Factors that impact WBT quality, and which must be addressed in design and implementation processes, include assessment and accommodation of trainees' previous learning experiences, training expectations, and overall readiness for new training; availability and familiarity to trainees and trainers of appropriate delivery technologies; presence of technical support; opportunities for interaction with the trainer and other trainees; the preparation and practices of trainers; corporate support and recognition; trainees' capacities and expectations for independent and self-directed learning; and the presence of relevant, quality online training materials.

WBT creates changes and may thus produce stresses in the training environment, as well as efficiencies. Reduction in travel and subsistence requirements means cost savings, but may also be seen by trainees as depriving them of opportunities to meet with each other face-to-face; self-pacing means trainees may proceed independently and at their own rate, but also that group support may be reduced (unless a cohort model is adopted); use of the Internet for delivery of training materials may foster trainee independence, but may also result in confusion for some trainees used to print materials and a paced, group delivery model; trainers no longer have to lecture as materials (always high quality, and often multimedia-based) are prepared in advance, but some may resent the loss of their role at center-stage; trainees are more responsible for their own learning, which may reflect the autonomy of adult responsibility common in the other areas of their lives, but this may be different from the expectations of some for how training should be conducted.

To achieve the efficiencies and advantages well-designed and -managed WBT may offer, adopting organizations must make adjustments. Managers may need to show concrete support for online training by permitting trainees to use corporate resources during company time, to assure access to adequate bandwidth. Trainers may need to master new skills and be willing to adopt new roles less concerned with information dissemination and more involved with meeting individual trainees' expressed needs. Trainees themselves may also need new skills, and may need to exercise more independence and self-direction in their learning.

As technologies become more available to support WBT, and as more models of successful WBT are available, the commitment to this delivery model is predicted to continue to grow. The previous corporate experience of the "productivity paradox" in relation to computers, in which some succeeded in improving productivity while others did not—and some even experienced productivity losses—will need to be avoided, especially in relation to promising innovations such as *reusable learning objects*. Similarly, arrival of the noncommercial "new Internets" in Canada and the United States constitute a fresh start, an opportunity to demonstrate the value of these resources for academic and research purposes.

Choices of the right technologies, effective use of these choices, attention to security and privacy concerns, adequate training and support of users at all levels, assurance of timely and convenient technology access, and attention to interpersonal needs of participants, if achieved, will result in the expansion and continued success of WBT.

WEB-BASED TRAINING (WBT): BACKGROUND

As part of corporate health, even survival, companies and training institutions globally have recognized the need to provide relevant and flexible training. Professional development (PD) in the form of upgrading, re-training, and various educational opportunities is seen as enhancing the skills of valued employees, helping organizations maintain their competitive advantage by developing (and thereby retaining) experienced people.

Well-designed Web-based training (WBT) can offer valuable advantages over other types of training delivery in a wide variety of public and private environments: training time and travel can be reduced, even eliminated, lowering costs; materials stored on central servers can be continually revised and updated, assuring currency and enhancing quality; training content is more consistent, supporting higher standards; greater efficiency (chiefly the result of individualization) can increase trainee learning and satisfaction, improving motivation; and production and delivery of training programs may be more systematic, improving the cost-effectiveness of development.

At the same time, using the World Wide Web (WWW) for training presents some challenges: existing training materials must usually be redesigned, sometimes extensively; bandwidth limitations (often at the user's end, in the "last five feet" of the communications chain) may restrict or even prohibit use of multimedia by some trainees; all participants (trainees and instructors) must learn new skills to use WBT effectively; and an initial investment (sometimes substantial) in equipment and expertise may be needed. Other factors in the structure or culture of a training organization may also need to change to make WBT feasible. Dropout rates (admittedly often a problem in WBT) may indicate the health of WBT programs: high rates may mean a mismatch between trainees' expectations and the instructional design of the training material, or may reveal a lack of leadership or management support (Frankola, 2001).

In this chapter, WBT will be discussed from theoretical and practical perspectives: important training principles are reviewed briefly, including basic concepts now common in WBT; practical problems in WBT are considered, as well as the strengths and weaknesses of this mode of training delivery; and finally the prospects for the future of WBT, and some of the pedagogic, technical, and economic assumptions on which the optimistic predictions depend, are considered.

Training Principles and Technological Developments Supporting WBT

Pioneering Ideas in Training

In the first half of the 20th century, pioneering researchers such as Thorndike (1971), Dewey (1938), Skinner (1971), and Keller (1968) conducted research that began identifying fundamental learning principles. (While these figures wrote and researched in the fields of psychology and education, their theories have evolved so that they are now used in the design of effective teaching and training of all kinds, including WBT.) Thorndike's three fundamental behavioral laws were among the first discoveries: (1) repetition strengthens any new behavior; (2) pleasure or reward associated with a particular behavior increases the likelihood the behavior will be repeated, while pain or lack of reward may diminish the likelihood; and (3) an individual's personal readiness is crucial to the performance of any new skill or behavior (Saettler, 1990).

Dewey added that individual trainee differences were crucial in the success of training. Dewey and Piaget (1952) both recognized the importance of each individual learner's personal background, and advocated that trainees' experiences and previous learning be considered carefully and accommodated as possible in any new training situation.

Skinner applied and extended the behavioral principles emerging from the new science of psychology, launching the "teaching machines" movement of the 1950s and 1960s. By describing the teacher or trainer as "the manager of the contingencies of reinforcement" in the learning process, Skinner helped found the fields of educational technology and information processing psychology. Besides a new role for the instructor, Skinner's work illustrated points vital to the subsequent development of technology-based training, including the value of "the program over the hardware," and the critical importance of the learning materials and the organization of the learning environment (Saettler, 1990).

Keller's Individually Programmed Instruction (IPI) model applied Skinner's discoveries about the importance of instructional design. The IPI model (often called the *Keller Plan*) emphasized individual differences in instruction and evaluation. IPI stressed such principles, later core to WBT, as self-pacing, mastery before advancement, high-quality materials, tutoring help, prompt feedback, and practice testing (Fox, 2002). Experiments in teaching Morse code to World War II recruits demonstrated convincingly that these principles could dramatically increase the efficiency of training.

Innovations such as IPI were impressive, but they encountered resistance for several significant reasons relevant to WBT:

- As innovations, technology-based training models often make new demands upon institutions, trainers, and trainees. In particular, technology-based training delivery increases the responsibility of trainees for their own learning, while reducing instructors' "platform behavior," serious flaws in the eyes of some trainers (and some trainees).
- Technological innovations may initially result in a judgment of "no significant difference" in performance when evaluated. Time may be needed to reveal their true value.
- Tepid managerial support may doom a technological innovation, especially if time and funds are needed to prove its actual potential.

- Individualized training models usually require more advance planning and preparation, while (at least initially) increasing workloads on instructors and administrators, and possibly destabilizing programs while adjustments are occurring. Participants must be aware of these, and must be prepared to work through them.
- When granted responsibility for managing their own learning, some trainees may respond with demands for more individual treatment, including access to records of personal achievement, and remedial and accelerated options. Overall, in individualized programs trainees expect their individual performance, needs, and preferences to be acknowledged.

In the 1960s and 1970s, developments in instructional design, cognitive and behavioral psychology, and organizational analysis converged to produce new tools and approaches for the design and delivery of training, which would quickly impact the emerging field of technology-based training, and, eventually, WBT. Key figures whose work influenced the practice of training (individually, in collaboration, and collectively), in addition to those already mentioned, included Robert Mager (1975), Patrick Suppes (1978), Robert Glaser (1978), Robert Gagne and Leslie Briggs (1979), Leslie Briggs and Walter Wager (1981), and Walter Dick and Lou Carey (1978). There were certainly others, but these individuals led the way.

The Internet as a Training Platform

The earliest forms of the Internet emerged as training was being transformed by a new understanding of learning itself. The fact that the Internet today supports a staggering array of commercial and educational enterprises and utilities (browsers, search engines and indexes, media players and plug-ins, mark-up languages and authoring tools, etc.) is due in part to the commitment to openness and accessibility, and recognition of the importance of interaction as a learning support, made in the early days of its development. The validity of the vision of the early developers of the Internet to an infrastructure of open, flexible protocols and common standards can be seen in the fact that the Internet's first "killer app" was electronic mail (e-mail), still the most used tool on the Internet today. The early developers' commitment to cooperation and collaboration reflected in the modern Web's friendliness and durability helps make it a powerful tool for (among myriad other things) delivering accessible training (Leiner et al., 2002).

High-Technology and Training

Origins: Computer-Based Training (CBT)

As programmed instruction and teaching machines declined in the late 1960s, and before the early Internet emerged from the developers' labs, the first commercial computer-based training (CBT) systems appeared. Initially, CBT systems such as PLATO (*Programmed Logic for Automated Teaching Operations*) and TICCIT (*Timeshared, Interactive, Computer-Controlled Information Television*) were costly, experimental, and rudimentary: text was the mode of presentation, using only occasional simple line drawings or diagrams, with minimal or no animation, sound, or color.

Technical milestones passed quickly in CBT over the next two decades: IBM mainframes were programmed to teach binary arithmetic; mainframe PLATO and TICCIT were used in college teaching (TICCIT was later adopted by the U.S. Navy); authoring languages such as *Coursewriter* and *PILOT* permitted instructors to produce instructional and testing materials for mainframe delivery and, later, for PCs (Rutherford, Patrick, Prindle, & Donaldson, 1997); and multimedia platforms using laserdisc and, later, CD-ROM were perfected for storage and portability.

The personal computer revolutionized and gave a huge boost to CBT. Apple, IBM, and IBM-"clone" personal computers (PCs) became increasingly powerful. As prices dropped, the appeal of desktop technology grew; as authoring capabilities increased, enthusiastic individuals spent money, time, and energy on CBT programming projects (sometimes duplicating the efforts of others, and, due to the lack of careful instructional design, frequently producing materials of marginal training value). The need was clear for a way to link desktop computers for delivery of CBT, in order to increase access to quality information and training resources, reduce needless duplication and unnecessary competition, and facilitate the fundamental goals of collaboration and cooperation among developers and users.

Computer-Based Communications

While specialized uses of proprietary CBT systems were expanding and the lack of effective communications among users was creating obvious training inefficiencies, promising first steps toward use of computers in an open, publicly accessible network were being made, initially, in 1962, with the U.S. military's ARPANET initiative. ARPA (Advanced Research Project Agency) proposed an online research network to link defense contractors and academics with the military, and with each other. Attempting to use the computers of the time as interactive communications devices to promote collaboration was considered novel, and was questioned technically as well as practically by those who still saw the computer as only "an arithmetic engine" (Hauben, 1994). However, in 1972, by the time the final ARPANET report was produced, the feasibility and usefulness of computer-based networked communications was established. Legacies of ARPANET, including tools such as file transfer protocol (FTP) and TCP-IP (*transfer control protocol–Internet protocol*, a reliable packet-addressing, flow-control, and loss-recovery tool), were available and were subsequently incorporated in the first Web browser, *Gofer,* in the early 1990s, and in the first true graphical browser, *Mosaic*, in 1993. Even more importantly, the principles of free communication and interaction were also reflected in the open and unregulated architecture of the early commercial Internet.

USING THE WEB FOR TRAINING

Strengths

The early Internet, with its ease of access and openness, appealed to trainers who were previously forced to rely upon standalone CBT, or pay high costs to access proprietary online training networks. However, previous experience with CBT had shown that a networked training system would need to include certain features to be maximally effective, such as a common interface and delivery format, interoperability among different desktop and server systems, and aids to communication and collaboration, to make development and production processes more efficient, in the form of flexible and robust interactive capabilities. The Web, because of its fundamental openness and flexibility, from the beginning proved impressively capable of accommodating these and many other functions.

A Common Training Platform

The Web had evolved to commercial viability by 1995. (In August of that year, *Netscape* went public with a hugely successful IPO on NASDAQ.) It was obvious that for the Web's widespread adoption, the PC would be the key technology: when networked, the computer would be the critical convergence device for this new means of communication and collaboration. With access to the Internet via a properly equipped computer, anyone, including training providers and their clients, could share the Web's growing "super-network" of services and resources, including training, from virtually anywhere in the world.

Interoperability

Previously, the costs and complexity of developing online materials were greatly inflated by the need to produce versions meeting the specific requirements of hardware platforms, configurations, and operating systems. The Web, using cross-platform "mark-up" (as opposed to programming) languages such as HTML (*hypertext markup language*), SGML (*standard general markup language*), and the powerful XML (*extensible markup language*), made hardware and operating system characteristics largely irrelevant to Web access.

Although markup languages and the Web's interoperability capabilities eliminated many barriers to access arising from system differences, issues still persist today because the Web grants users great freedom in their choices and configurations of software and hardware. Issues arise from, for example, differences in display hardware (monitors) and screen resolutions, Internet connection speeds (still considered the greatest limitation to access of new, multimedia material), and user settings for fonts, background colors, display resolutions, etc., which can dramatically change the appearance and effectiveness of training materials (Jones & Farquhar, 1997). Problems may also arise with new versions or updates of common browsers, plug-ins, and other required software, which occasionally fail to perform as well as previous versions, and may even contain fatal bugs. To address these potential problems, training programs often publish suggested standards for hardware and software (including version or "build" numbers and any required patches or service releases for software), to guide trainees in upgrading their systems for full compatibility.

Training Efficiency

Though costs of initial development were high, it was soon clear that properly designed WBT could deliver impressive results, especially for the highly motivated and wherever cutbacks threatened to affect the quality of face-to-face programs (due to larger training group sizes, limited modes of content presentation, declining opportunities for remediation or individual tutoring, reduced interaction generally, etc). Some advantages favoring quality WBT over typical site-based face-to-face delivery included self-pacing and individualization; greater emphasis on learning, less on instruction (seen in the emphasis on high-quality materials); learner control and autonomy in the training process; more flexible and convenient remote access to training opportunities; quicker and more personalized feedback; peer-to-peer social interaction; and timely, on-demand access to preparation, remediation, review, and outside resources. These advantages were observed early, and led some observers to claim that WBT could be superior in quality to even well-designed and properly conducted face-to-face training, especially when training group sizes grew larger (Harapniuk, Montgomerie, & Torgerson, 1998; Kaye, 1989; Wagner, 1994).

Costs and Convenience

Employers soon found that both direct (travel and subsistence) and opportunity costs (employee fatigue and lost productivity, time away from the workplace, stress) could be reduced by WBT, especially if the training package was designed to take full advantage of the Web's potential efficiencies and conveniences. As bandwidth increased, a progressively more "media-rich" experience could potentially be delivered to trainees almost anywhere. (Ironically, although asynchronous training provided maximum convenience and lower direct delivery costs, the temptation to use rich multimedia-based synchronous [same-time] sessions, more feasible as bandwidth increased and became cheaper, created some of the same problems of inflexibility and inconvenience as face-to-face training formerly did for users who lacked access to high-bandwidth Internet services.)

Weaknesses

Some basic weaknesses were soon evident in Web-based training, too: unless developers employed instructional design principles skillfully and conscientiously, the quality and integrity of materials were sometimes uneven; navigation among linked sites could become a nightmare for the unwary or inexperienced; and users needed to possess and consistently practice self-discipline to avoid being side-tracked by online distractions.

Quality

Quality continues to be a problem on the Web, because the public Internet by definition is a loosely coordinated (not controlled) network of networks. No one is accountable for the quality of what is found anywhere on the Web, or for maintaining functionality: anyone may post information (or misinformation), so points of view masquerading as fact are common (Warren, Brunner, Maier, & Barnett, 1996), and important links may simply fail to connect if not updated frequently. For these reasons, the provenance of any Internet-based information must always be questioned, and linking to Internet materials for training is risky as there is nothing to prevent content from changing, or links from disappearing altogether. Increased security of access and control over content are arguments for *intranet* delivery of training.

Structure and Navigation

Just as no one oversees the quality of materials on the Web, no one assures that Web pages articulate clearly. Retracing one's steps can be a challenge, even for experienced users. The Internet is like a library where all the books have lost their identification codes, and some their bindings. The unwary may quickly become lost in cyberspace.

User Control and Orientation

A strength of the Web—the freedom to explore freely—can be a major weakness for some. The lack of restrictions and navigation guides forces users to make their own choices from a huge number of Web offerings; the inexperienced, immature, impulsive, easily distracted, or learning disabled may be challenged, even overwhelmed. At the same time, the opportunity to seek out related but peripheral information, to pursue an interesting detail, and to dig deeper into a subject are all celebrated differences between Web-based and traditional learning, for those with the discipline and skills needed to use them wisely. For these reasons, proper orientation and training of users is a prerequisite to successful WBT.

WBT'S CHALLENGES

Web-based training, as an innovation, presents challenges: different roles and responsibilities for instructors and trainees; changes in teaching methods; the importance of provision for individual differences; and new financial and economic realities.

New Roles

Web-based training creates changes in the ways trainees connect with the trainer, the content, and the learning system. As described below, because WBT allows shifting of place and pace of learning, roles change; the focus is on the trainees' skill development, and the tutor or trainer consequently becomes less the "sage on the stage" and more a "guide on the side" (Burge & Roberts, 1993). Similarly, if permitted, equipped, and disposed to do so, trainees may assume more responsibility for their own learning, including accessing outside materials and communicating as needed with the trainer and with other trainees. Overall, successful WBT changes trainees' experiences, providing greater individualization, making feasible conveniences such as self-pacing, on-demand review, acceleration, and practice testing, and providing ready linkages to other people and resources.

As the early pioneers of technology-based training found, the quality and completeness of the learning materials are critically important, as are the appeal, intuitiveness, and stability of the delivery system. Team development, combining subject-matter experts (SMEs), graphics artists, learning specialists, designers, programmers, and managers, should make the development process more efficient and productive. This view assumes awareness of another lesson taught by the pioneers: that technology per se does not automatically change the trainees' experiences, but careful instructional design, quality materials, flexible delivery, timely tutor help, and convenient communications systems may.

Because of these differences, trainers in Web-based environments may find their duties and priorities changed. A study (National Education Association, 2000) of U.S. college instructors in a variety of institutions found the following:

- Most reported Web-based teaching was more personally rewarding than traditional methods: distance methods were seen as giving trainees better access to information, better quality materials, more help in mastering the subject matter, and more allowance for individual needs.
- Most instructors had at least some one-on-one contact with learners, and those who had reported higher levels of satisfaction in their teaching.
- Teaching at a distance required more instructor time; unfortunately, most training organizations did not formally recognize this fact.
- Despite lack of organizational recognition of the greater time required, almost three-quarters of the survey respondents held positive feelings about distance teaching (only 14% reported negative feelings).

The WBT Environment

As noted, if designed to do so, and if the trainer supports the shifts implied, WBT can change the basic relationship between the trainee and the tutor, and can alter fundamental characteristics of the training environment: outside information resources and a wider range of human contacts can be accessed; there are more choices and options for trainees (but trainees need greater maturity to exercise them wisely); and WBT environments can emphasize collaboration over competition (Relan & Gillani, 1997). Materials design, instructional methods, and "best" teaching practices are also affected in WBT environments.

Materials and Instructional Activities

In traditional face-to-face teaching, instructional materials may be prepared at the last minute, or even simply dispensed with (trainees being required to take notes from the comments and often random chalkboard musings of the instructor). In WBT, materials preparation is a major stage in program development. Complete WBT materials are self-contained, including organizers and instructions, with guidance and feedback provided through embedded questions and other self-evaluation activities. Support and orientation are available for any technologies used.

In well-designed and -managed WBT, instructional activities and materials may employ some or all of the following principles:

- Typically, a wider range of resources, some from outside the local environment, is used.
- Training may incorporate experiential learning and simulations, accessed via Web links.
- Collaboration replaces competition.

- The instructor is more a guide and coach than a dispenser of information.
- Problem- or case-based learning is more common, sometimes increasing the training's realism and authenticity. (Students are permitted, even required, to clarify and refine questions themselves, without constant reliance on the trainer.)
- Personal knowledge and experience are valued and included in problem-solving activities (Newby, Stepich, Lehman, & Russell, 2000).

"Best Practices" in WBT

Instructors in well-planned WBT adopt specific training strategies known to enhance learning. One training model recommends trainers strive for a balance between *interpersonal rapport* and *intellectual excitement*, requiring the trainer to be interpersonally warm, open, predictable, and learner-centered, while also being clear and enthusiastic about the training content (Lowman, 1994).

Another well-respected model of best practices recommends these training behaviors (Chickering & Gamson, 1989):

- Encourage contacts between trainees and instructors.
- Develop reciprocity and cooperation among trainees.
- Use active learning techniques.
- Give proper and timely feedback.
- Emphasize time-on-task.
- Communicate high expectations.
- Respect diverse talents and ways of learning.

Bloom's (1984) classic description of the "alterable variables" of learning also provides guidance for Web-based trainers. Research in mastery learning showed that the following variables, when emphasized, produced learning outcomes similar to what could be achieved under ideal training conditions (one-to-one tutorial):

- Provide well-designed tutorial instruction.
- Give timely reinforcement.
- Give appropriate and sensitive corrective feedback.
- Provide cues and explanations, as needed.
- Encourage learner classroom participation.
- Assure trainees make effective use of time on task.
- Help trainees improve reading and study skills, as required.

Individual Differences

One of the major differences between Web-based and more traditional forms of training is WBT's capacity for accommodating the individual expectations and preferences of trainees. This feature can be particularly valuable in meeting "special" needs, or those based upon adult trainees' *personal* and *situational* variables. Personal variables include age, maturity, personal health, time availability (and management skills), motivation, previous learning, financial circumstances, and life and developmental stages. Situational variables include factors such as location (related to the location of any required site-based training), admission and training program requirements, availability of counseling and advisement services, and personal issues such as transportation, health, child-care, etc. (Cross, 1981).

WBT's capacity to accommodate differences effectively partially depends upon the trainees' capacity and willingness to exercise independence, autonomy, and self-direction. Even if trainees are adults or mature adolescents, the presence of the needed skills and maturity for self-directed learning cannot always be assumed. Trainees must be willing to exercise self-direction and independence in learning.

Problems arise in WBT situations when there is a mismatch between the self-direction the learning system permits and the expectations of the trainees. Mismatches between *teaching or training style* and *learning style* can result in dissatisfaction with the learning experience, or worse (dropout, failure). Programs are more successful if aligned with the developmental stages of individual learners. Trainee readiness may range from nearly complete dependency to fully autonomous self-direction, requiring the trainer to function variously as an authority or coach, a motivator or guide, a facilitator or mentor, and, at the highest levels of self-direction, a consultant (Grow, 1991). Failure to provide learning conditions that align with trainees' expectations for support, interaction, or recognition may be one of the principal reasons for unacceptably high dropout rates in some WBT programs, a problem which, though hard to describe on a national basis, has been identified as a serious one for some online training (Frankola, 2001).

Economic Factors

The economics of WBT, though changing rapidly in the details, continue to directly impact training providers and consumers.

For Providers

Costs of development of WBT vary dramatically. Text-based WBT, involving conversion of existing material and using one of the many authoring tools available, may be economically accomplished by a subject-matter expert (SME) with basic instructional design skills. On the other hand, development of an hour of computer-assisted learning (CAL) using high-level authoring languages might require 40 to 150 hours (Szabo, 1998), and one complex 4- to 6-hour multiunit module in weather forecasting, incorporating multimedia and simulation effects, reportedly required a year, involved a team of instructional design and subject matter specialists, and ultimately cost $250,000 (Johnson, 2000). Financial considerations are primary in most WBT implementations: if an organization cannot afford the attendant costs (especially the often heavy initial investment in development), it may not be able to make the transition to WBT, even if the need is clear and the organization willing.

The financial case for WBT depends largely upon the relation of *fixed* to *variable* costs of development and delivery. Fixed costs are those incurred whether the training materials serve a handful or thousands of users. Fixed costs include staff salaries, equipment, and other capital costs directly related to development, including rent and other overhead costs. Variable costs are those that increase in relation to demand, such as printing, materials reproduction, and shipping; wages of section lecturers or lab demonstrators hired in response to registrations; additional clerical assistance; costs for licenses or copyright based on usage; and equipment for training delivery, which might have to be acquired to serve increasing demand. In WBT development projects, financial viability often depends upon fixed costs being kept to a minimum, and as many costs as possible remaining variable (dependent upon, and thus paid for, by demand).

Providers of WBT must promote their programs and services without overselling them. While WBT offers the *potential* for substantial convenience increases and improvements in efficiency (including reduced training costs), it is important to acknowledge that WBT results cannot be guaranteed to be uniformly or automatically better for all users. This is due to interactions among economic, technical, and organizational factors, and because of the importance of the design to the quality of the implementation. In fact, one of the paradoxes of the past decade's use of technology generally, including training applications, has been the persistent finding of "no significant difference" in training results, and the "productivity paradox," the failure of some industries to achieve economic benefits from technology implementations, while others made impressive gains, mainly through enhanced performance compared to the competition (Fahy, 1998). Nevertheless, where design converges advantageously with needs, opportunities, and a willing corporate culture, WBT has been proven successful (Vaas, 2001; Welsch, 2002).

For Consumers (Trainees)

WBT trainees have come to expect that they will have access to timely, economical, high-quality, self-paced training, virtually anytime and anywhere (Vaas, 2001). The keys to meeting these expectations are the *cost* and *accessibility* of the WBT technologies used (Bates, 2000), and relevance of WBT's interaction capabilities to specific user needs (Fischer, 1997).

For trainees with "special" learning needs, WBT's interaction capabilities can provide important advantages. The mobility-handicapped, those with learning disabilities (LDs), or attention-deficit disorders (ADDs), including ADDults (Keller, 1999), often find an environment with more learner controls, such as is typically found in WBT, helpful. Two core features of WBT directly applicable to special needs trainees include:

- Structure—Advance organizers; clearly stated objectives, schedules, and timelines; embedded comprehension checks; integrated media under learner control; multimodal presentations; user-accessible performance records and reports; and communication links with the trainer and other support resources.
- Flexibility—Any place, any pace access.
- For the physically handicapped or mobility impaired, the following features and characteristics of WBT can be of value:
- Distributed—Available in accessible locations.
- Interruptible—Trainees can take breaks when needed.
- Modular—Single or multiple skills can be addressed.
- Multisensory—Sight, sound, and tactile cues can be incorporated.
- Nonlinear—Presentation sequence can be varied.
- Portable—Easily moved or transferred.
- Responsive—Adoption time is relatively short.
- Transferable—Crosses cultural, language, situational, physical, and geographic barriers (Gerofsky, 1998).

Those working with special needs audiences have the capability to monitor progress regularly (including administering testing as needed), communicating with trainees easily, allowing trainees to communicate with each other (socialize), and helping coordinate and support training components (including the efforts of helpers and support staff).

Trainees without special needs can benefit from WBT, too; many of the above features can assist most trainees to complete their training with more satisfaction or less stress, by reducing potential conflicts with trainees' careers and personal lives. Experience has shown that training may precipitate problems among trainees in general, which skillful use of WBT's own communications capabilities may help solve, such as:

- Feelings of inadequacy at the sheer amount of material to be covered;
- Delays in receiving feedback or answers to questions;
- Keeping up with the variety of discussions and interaction often present in online (computer-mediated communications, CMC) discussions;
- Adjusting to the absence of visual clues in group relations; and

- Fatigue and health problems arising from reliance on unfamiliar technologies (eye-strain or posture problems at the computer, for example).

THE FUTURE OF WBT

While WBT has proven its potential value for training delivery, there are barriers that may restrict or slow its expansion, chiefly bandwidth availability, security and privacy issues, and user access to required technologies.

Bandwidth and Security

Present "POTS" Systems

Today, most home Web users still access the Internet using POTS (plain old telephone system) dial-up modems. While common, cheap, and reliable, the transfer speeds available with this technology are a limiting factor in the evolution of multimedia-based WBT.

Typical POTS Internet connections move data (theoretically; actual rates are always lower) at 56 Kbps (kilobits per second); at the higher end of the bandwidth spectrum are speeds of 1,000 to 1,500 Kbps (cable, DSL, ISDN, T-1), and some that exceed 2,500 Kbps (RADSL, T-3). To compare these speeds with actual requirements of a common medium, TV graphics (depending upon the screen resolution of the receiver) require throughput of from 1,800 to over 110,000 kilobits of data *per second*. None of the current POTS- or cable-based transmission methods are capable of more than a small percentage of that rate.

Considerably less than full TV-quality video could be adequate for many WBT applications. However, training organizations appear to be ignoring this fact: a survey of the intentions of U.S. colleges and universities showed that, between 1995 and 1998, 2-way video use grew 22%, while many of those institutions that had not yet committed to it were planning to do so within 3 years. On the other hand, use of audio-only delivery (in the forms of one-way audiotapes, or two-way teleconferencing or VOIP [Voice over Internet Protocol; Internet audio] connections), potentially very powerful and relatively low-cost media, remained virtually unchanged at about 10% of institutions (U.S. Department of Education, 1999). A similar focus on high-bandwidth applications was found in the private sector: a 2001 survey showed that "live video" was expected to grow from 7% to 31% in the next year ("Real-time help," 2001).

Satellite Systems

Satellites provide a powerful alternative to ground-based data transmission in WBT systems: satellite-based signals can be broadcast over a much wider area than broadcast tower-based or independent wire/cable transmission. All the usual production costs apply to satellite-based delivery; in fact, production costs may be higher, since the greater potential audience may warrant the highest production values. In addition to the costs of developing and launching the satellite the potential for equipment failure is significant, given the inconvenience of service calls.

At present, broadcast delivery systems, including satellite, are federally regulated in North America, but if deregulation of these services occurs, cable TV and telephone systems will be able to compete to deliver each other's services (as they already do in other parts of the world). The impetus for deregulation is the fact that video and audio signals, when digitized, are simply data, which can in principle (if not yet in law) be delivered by anyone with data transmission capabilities.

Wireless Systems

Wireless technologies (other than satellites) are also changing rapidly, with direct implications for training. The cost of installing "fixed" wireless capabilities (the short-range 802.11 protocols) in existing buildings has fallen below the cost of wiring (or rewiring). Besides cost savings, wireless technologies are quick to install, and are highly portable, so they can be readily moved as opportunities or demands change. Portability also permits cultivation of users by making equipment and services quickly available to those best prepared to make good use of them (McKenzie, 1999). In late 2001, 7% of colleges and universities in the United States had campus-wide wireless installations, and 51% of institutions reported some wireless capabilities, up from 30% in 2000 (Campus Computing Project, 2001). The cost and availability of other types of wireless technologies with much wider coverage areas, such as cell phones and IM (instant messaging) devices, are also dropping, though the training capabilities of these technologies have not yet been widely tested.

Despite cost reductions, wireless systems in training have some major disadvantages: transmission speeds are typically slower; interference may lead to transmission errors, further reducing speed, especially if other electronics operate in the same environment; range depends upon the site layout and configuration of the network; and (as discussed later) wireless systems are much more vulnerable to security breaches.

Web Availability

Another area of concern for the future growth of WBT is trainee access to the Internet. U.S. Census data provide a view of Internet access nationally (U.S. Census Bureau, 2001):

- Access, though increasing, is not yet universal: in the United States by 2000, more than half (51%) of households had access to a computers (up from 42% in December 1998), but Internet access was lower, and differed by regions: highest levels were found in the West, where 40.7% of households had Internet access, while the lowest were in the South, where the level was 34.3%.
- Ethnicity was related to Web access: white households were almost twice as likely to be connected as nonwhite households.
- Income was also associated with Web access: families with annual incomes over $75,000 were three times more likely to be online than those with incomes below $24,000.
- Urban access rates were more than 12% higher than nonmetropolitan rates.

- The presence of a child in the family increased the likelihood of both computer ownership (by almost 22%) and Internet access (by over 16%).
- Age was a major factor: the group most likely to own a computer and be connected to the Internet was aged 25 to 44 (ownership, 61.0%; Internet, 50.2%), followed by the cohort aged 45 to 64 (56.9% and 46.7%, respectively); least likely was the 65 and older group (at 24.3% and 17.7%). In Canada, similar patterns were found ("Getting connected," 1999).

Gender has historically been an issue in Web access, though experience with WBT appears to considerably reduce, and may even be reversing, former access patterns (Wark, e-mail, September 26, 1999). Traditionally, men have been more engaged generally with all aspects of computer use than women; women have reported finding CMC less personal and online environments less comfortable than face-to-face interaction, and have consequently been more reluctant to enroll in computer courses (Blocher, 1997; Kirkpatrick & Cuban, 1998).

The Internet may be about to change that pattern: since May 2000, trends have shown that women as a group exceeded the number of men online, so that by June 2001 women comprised 40.9 of Internet users and men 39.8%. Interestingly, in relation to the question of the feasibility of the Internet for the training of older workers and women, the largest increase in usage was among individuals over age 35, including women in that age group. Even women who were mothers increased their Internet use: mothers who were online averaged 16 hours 52 minutes per week, more even than online teens (who averaged just over 12 hours weekly). Another fact with training implications: mothers who might be expected to have the least free time (single mothers and those with 3 or more children) were online the most, averaging about 20 hours per week, 20% more than the overall average (Saunders, 2002). While women as a group were increasing usage significantly, men continued to lead women in frequency and intensity of Internet use: when online, men averaged 16% more time online than women, viewed 31% more pages, and logged-on 11% more often (Pastore, 2001).

Assuring Security and Privacy

WBT systems may be victimized from the outside by viruses, unauthorized intrusions, sabotage, or fraud. It is sobering that 75% of security breaches in the private sector (incidents of sabotage, hacking, or data theft) are committed by the institution's own personnel (unauthorized present employees or former staff). Wireless operations are particularly vulnerable: not only are wireless systems technically more difficult to secure, wireless users tend to be more casual about employing available security measures (Miller, 2001).

Computer viruses of all kinds have become almost ubiquitous, and are expected to grow in number. By one estimate, in 2001 viruses were found in 1 of every 300 e-mail messages; at the current rate of proliferation, by 2008 the ratio will be 1 in 10, and by 2013 it will be 1 in 2 ("Outbreak," 2001). "Virus" is the generic name for all malicious programs, including worms and Trojan horses; the term *malware* has been suggested for all these malicious forms of code (Seltzer, 2002). Worms and Trojans are special forms of malware, in that they programmed to spread by themselves without human intervention (usually by e-mail), while simple viruses require individuals to deliberately share files for the viruses to be able to move from machine to machine. The magnitude of the threat from malware has led most organizations to install protection in the form of virus detectors and firewalls. As well as preventing unauthorized intrusions from the outside, the latter restrict the access of those behind the firewall to outside people and materials (for example, VOIP may be impossible, or severely limited). While protecting the security of those behind them, firewalls can constitute a major barrier to WBT generally.

Confirming the identity of trainees is also a potential problem in WBT, especially if trainees do not routinely meet face-to-face with instructors. Just as failure of system security might expose a training organization to embarrassment, expensive down-time, or even litigation, failure of an organization's screening and monitoring systems leading to a fraudulent registration, award of credit, or granting of a credential might be disastrous for its reputation. Fortunately, technologies exist and are becoming more economical to help with trainee identification and authentication: biometric devices such as voiceprint and fingerprint identifiers, and remote cameras, have recently become available for economically checking identities of trainees and supervising remote testing events (Miller, 2001).

Implementing WBT

In order to produce high-quality WBT results, incorporating flexibility, efficiency, and individualization, training organizations must assure that certain elements are present. Among these are a conducive social learning environment and institutional collaboration to assure efficient provision of courses and transfer of credit, including prior learning assessment.

Cohort Learning and Socialization

All group learning is social. WBT technologies provide the option for interaction and collaboration, which should in turn increase "social presence" (Garrison, 2000), and reduce "transactional distance" among participants (Moore, 1991).

Cohort-based WBT provides a supportive social network, especially for adult trainees who may lack confidence or who may face hurdles in returning to formal learning. Cohort-based programming uses more active, cooperative, and collaborative learning strategies than more traditional methods. The cohort structure consists of a group of trainees who enter and complete the program together in a predetermined and prescheduled series of common training experiences. Trainees may meet face-to-face occasionally, even in primarily distance programs, to initiate social interaction that technology-based interaction can then sustain. The resulting training, though lockstep, appears to be successful in creating trust, empowerment, and support, while reducing adjustment problems and drop-out, especially among older trainees (Saltiel & Russo, 2001, p. vii).

The communications capabilities of WBT technologies can also reduce isolation, and increase motivation and social interaction. Computer-mediated communications includes one-on-one interaction (e-mail), one-to-many connections (conferencing, list-servs), data sharing (file attachments), and information access (via the Web's links). Computer conferencing is a potentially powerful means of creating community in WBT programs. CMC may increase comprehension of training objectives by promoting peer-to-peer interaction, but basic ground-rules enforced by a conscientious moderator are required to assure that the resulting CMC interaction is effective, and to help avoid asocial outcomes such as “social loafing.” (Other forms of asocial interaction, such as rudeness or “flaming,” are rare in moderated training interactions, but may occur in public nonmoderated environments such as list-servs.)

Institutional Collaboration

WBT assists trainers to address the globally recognized need for more efficient and flexible training delivery, including transnational standards, increased quality assurance (based on competency-based curricula), multiskill training, and the appropriate adoption of electronic technologies to increase trainee success. Driving this is the fact that employers have historically not been very satisfied with what they perceive as the public school system’s inflexibility, and apparent inability, to prepare its young graduates better for employment.

Employers expect graduates to be capable of teamwork, creativity, problem solving, and adaptability. To counter the lack of flexibility in institutional training, some employers advocate training-on-the-job (TOJ) programs. TOJ is seen as providing a better training experience overall, especially if linked with WBT opportunities. The combination has been regarded as better addressing employees’ convenience and privacy, while allowing employers to monitor relevance, and permitting the involvement of experienced employees in the training of novices (Conference Board of Canada, 2001).

Prior learning assessment (PLA), like transfer credit, benefits trainees who have accumulated credits over time, perhaps from a variety of sources, without ever completing a credential. PLA recognizes that learning may appear to be haphazard, while yet equipping the trainee with skills and knowledge worthy of formal recognition (especially if accompanied by relevant work experience). WBT may help a trainee integrate and complete a program based on PLA credits, a process sometimes called “cap-stoning.”

Media and the Future

Some technologies require broadband (simulations, full-motion video, high-quality audio); on the other hand, some technologies are useful only for relatively limited training purposes (text on paper is ideal for information transmittal, but lectures and collaborative group sessions are poor vehicles for this purpose). Research has demonstrated that the impact of technologies on training outcomes depends upon specific media characteristics, and that technologies differ in respect to their cost, accessibility, teaching implications and impacts, interactivity, user-friendliness and control, organizational impact, novelty to users, and speed of adoption and adaptation (Bates, 2000).

Knowing this, WBT programmers can make better decisions about the “right” technology for a particular application on the basis of the amount of separation (the “distances”) between trainees and elements of their WBT programs. Figure 1 illustrates how time and place of training can vary in WBT.

	SAME TIME	DIFFERENT TIME
SAME PLACE	1	2
DIFFERENT PLACE	3	4

Figure 1: Diagram attributed to Coldeway by Simonson, Smaldino, Albright, & Zvacek, (2000, p. 7). A similar typology is also found in Johansen, Martin, Mittman, Saffo, Sibbet, & Benson, (1991, p. 17.).

Differences in the time and place of training can impact trainees, and affect the flexibility of the training, in several ways:

- Quadrant 1 (“same time, same place”). Training in this quadrant is *synchronous* (same time) and *site-bound* (a classroom or lab is set aside for it). Participants in the same place at the same time may still experience “distances”—psychological, interpersonal, socio-cultural, linguistic, philosophical, etc.—which may create barriers to communication and learning, requiring timely trainer intervention.
- Quadrant 2 (“same place, different time”). Training is site-based, but permits asynchronous access in the form of correspondence modules or packages at a training or learning center. Regular attendance at the designated training site is often required so progress can be monitored.
- Quadrant 3 (“same time, different place”). Training is synchronous but not site-bound; technology permits access from off-site, but only at “class” time. Trainees need appropriate remote-access media.
- Quadrant 4 (“different time, different place”). This is “any pace, any place” training. Requires the training institution to provide materials, support, interaction opportunities, and administrative arrangements at the trainees’ convenience. Trainees require appropriate remote-access technologies.

The Evolution of Present Media

Training media are changing as bandwidth improves, and as they do, new forms of familiar technologies are presenting WBT designers with options and capabilities previously unavailable or not cost-effective. Examples include the previously mentioned VOIP, and reusable learning objects, with (for those capable of accessing it) multimedia.

VOIP technology permits use of computers for voice communications, either as person-to-person private conversations or in multipoint group sessions. Users commonly require no more than normal dial-up access to the Web, plus a sound card, microphone, and speakers. For video, VOIP typically provides a 2” x 3” display, with a refresh rate dependent upon bandwidth. (IP video is presently not of full-motion quality; its jerkiness and grainy nature lead some users to switch it off completely, relying upon audio alone.) The quality of IP audio is usually adequate to good. VOIP services are very cheap or even free, and the quality and reliability are improving rapidly.

Standards, and Reusable Learning Objects (RLOs). Training materials are increasingly designed to be reused (“repurposed”), as standards are developed by organizations such as the Aviation Industry CBT Committee (AICC), the Instructional Management Systems (IMS) Global Learning Consortium, the Institute of Electrical and Electronics Engineers (IEEE), and the Advanced Distributed Learning (ADL) Initiative of the Department of Defense (developer of the Shareable Courseware Object Reference Model [SCORM]) (Hodgins & Conner, 2000). WBT instructional materials developed under RLO standards are portable, for maximum present and future (re)use. *Metadata tagging* of RLOs attempts to assure several outcomes relevant to potential WBT uses:

- Flexibility—Material is designed to be used in multiple contexts and to be easily reused in other applications.
- Ease of update, search, and content management—Metadata tags allow quick updating, searching, and management of content through sophisticated filtering and selecting capabilities.
- Customization—Modular learning objects enable more rapid program development or revision.
- Interoperability—RLOs are designed to operate on a wide range of training hardware and operating systems.
- Competency-based training—Competency-based approaches to training are promoted by RLOs; materials are tagged to competencies, rather than subjects, disciplines, or grade levels.

Developing training materials to RLO standards increases their value by making reuse easier and thus more likely. Also, the presence of standards means savings may be realized in reduced design and development time, and in some cases revenue may be generated from sales (Longmire, 2000). Multimedia RLOs must be used sparingly, if at all, in training intended for home use, however: while in late 2001 92% of U.S. businesses with 1,000 employees or more reportedly had broadband connections (T1, T3, DSL, cable, ATM, frame-relay or faster), fewer than 20% of home users had these capacities (Metz, 2001).

The “New” Internets

Worldwide growth in commercial use of the public Web has resulted in ongoing efforts to replace it with a version reserved for academic and military use. In North America, new Internet developments include the United States’ Internet2, the Information Technology Research and Development (ITR&D) Program, and Canada’s CA*net system.

Internet2 is a collaborative effort of more than 120 U.S. universities, partnering with industry and government (through the National Science Foundation) to create an environment that “is not clogged with music, commercial entities and porn” (Rupley, 2002). As with Canada’s CA*net II, CA*net 3, and CA*net 4 (launched in mid-2002), research and education are the focus (Networking, 2002b). In mid-2001, the first implementations of Internet2 in U.S. K–12 schools had commenced (Branigan, 2001), with public access available in early 2002.

The Information Technology R&D Program continues and broadens the agenda of the NGI (Next Generation Internet; NGI, 2001) project, a multiagency, federally sponsored research and development program that, by the time it concluded in 2001, had helped achieve major advances in networking speeds. The ITR&D program includes the collaborations of 12 very high profile agencies (for example, the National Science Foundation [NSF], NASA, the Defense Advanced Research Projects Agency [DARPA], the National Institutes of Health [NIH], and the Environmental Protection Agency [EPA], among others). The ITR&D program conducts research and development in various “program component areas” (PCAs), including cutting-edge projects in high-end computing, scalable information infrastructure, large-scale networking R&D, and high-confidence software and systems. The commitment is significant: the budget requested for 2002 was almost $2 billion (Furlani, 2002).

The California Institute of Telecommunications and Information Technology (http://www.calit2.net) consortium plans to build a high-speed *wireless* network that is cheap, always on, and accessible through a variety of technologies. “Tether-free” online technologies are currently represented by palm-size computing and cell phone-type communications devices. The evolutionary potential for training applications of these highly portable technologies is seen as tremendous, assuming concurrent advances in AI (artificial intelligence) systems and voice command capabilities. Public funding for this project reached $300 million in mid-2001 (Chapman, 2001).

CA*net II, Canada's first “next generation” Internet initiative, demonstrated that a dedicated, noncommercial research Internet was feasible and needed by Canadian academics. Although initially established as a public enterprise CA*net II was privatized in 1993, then coming under the direction and control of CANARIE (the Canadian Network for the Advancement of Research, Industry and Education), a consortium of private Canadian organizations and academic institutions.

The purpose of the CA*net program was to upgrade Canada’s research and development infrastructure, especially networking and communications capabilities, and to permit joint ventures and collaborations to promote the involvement of Canadian business and industry in the knowledge-based economy. Like the United States' NGI and Internet2 systems, CA*net uses “special access points” in each Canadian province to provide access to the system’s high-capacity, high-speed communications link called the vBNS (very high-speed Broadband Network Service), which in turn connects to the network's backbone.

Canada’s CA*net II system, the world’s first nation-wide network of its sort, was succeeded by CA*net 3 (“*Hooked to CA*net 3*,” 2000), and, in 2002, by plans for CA*net 4. Like all high-capacity networking systems, CA*net uses different wavelengths (colors) of light and fiber optics to permit dozens of different transmission “channels” (CA*net II had only one). CA*net 3 was some 20 times faster than CA*net II, and 50,000 times faster than present commercial Internet services; CA*net 4 is expected to continue this evolution in high-speed networking, improving the potential for quality WBT (Networking, 2002a, 2002b).

CONCLUSION

Predicting the future for WBT is, on one hand, simple: it will expand, grow, and become central to more forms of future training worldwide. That prediction is safe, both because so much has already been invested in the Internet delivery infrastructure and because the Web has already proven to be so effective in reducing direct training costs, increasing access, and addressing serious skills deficiencies in an increasingly competitive and technological world.

On the other hand, no one can predict, even a short time into the future, specific details of the training advances WBT will help make possible in the future. Greater usage does not imply standard use; more investment may not result in quality increases; reliance on WBT does not guarantee enthusiasm or success by specific groups of trainees. Experience with other forms of training delivery have demonstrated that instructional design, perhaps even more than the medium, makes training effective, and trainee support and overall relevance of the content make it satisfying to users.

While WBT cannot guarantee that future training will not be pedestrian or inefficient, its potential strengths may suggest how training of all kinds might be improved. The core elements of the Web as a training device—ubiquity, accessibility, stability, supportiveness, redundancy, and friendliness—are common to other successful teaching environments. For WBT to expand, developers, trainers, trainees, and employers must see these aspects of the Web as potential assets for their training programs. If the inherent features of the Web are seen as important to training, continued growth and expansion of WBT are certain to occur.

GLOSSARY

Asynchronous “Different time” (and often different place, i.e., the trainees’ workplace or home) training and communications interactions, made possible by technologies that collect messages and make them available at the convenience of the reader. Examples include e-mail, CMC, and list-servs.

Attention deficit disorder (ADD) A form of learning disability that, in children, results in short attention span and lack of focus, sometimes accompanied by hyperactivity; ADDults, adults with ADD.

Bandwidth The capacity of a channel (for example, a telephone line or a coaxial cable) to carry data. High bandwidth permits multimedia (audio, video, animation), while low bandwidth limits users to text or simple graphics, and may preclude VOIP and other new interaction tools.

Computer-mediated communications (CMC) Text-based, asynchronous communications, usually restricted by password to a designated group such as a class or training cohort, and moderated to assure that the discussion stays on topic and is civil.

Internet The public network of linked computers accessible by anyone with a Web browser.

Intranets Private computer networks that may or may not also provide Web access, providing security and control not available on the public Internet by limiting access and controlling the content available to users.

Malware Any form of malicious code intended to infect a computer or a network, including viruses, worms, and Trojan horse programs (Seltzer, 2002).

Metadata The identifying material added to RLOs to permit easy reuse or “repurposing.”

Online Training that includes potential for synchronous or asynchronous electronic (often Internet-based) interaction between the trainee and the trainer, the training materials, and other trainees.

Prior learning assessment (PLA) A process intended to result in the granting of credit toward a credential for a trainee’s accumulated formal and nonformal learning experiences; recognizes and rewards the learning of individuals who have not been able to complete a credential at one institution in the normal way, due to career or personal reasons.

(Reusable) Learning objects (RLOs) Materials modularized, packaged, and labeled to encourage cataloguing, access, and reuse in multiple contexts.

Synchronous “Same time” and (often) same place training or communication interactions, e.g., face-to-face training.

Training Instruction in psychomotor skills and knowledge primarily for practical purposes and relatively immediate application.

Voice over Internet Protocol (VOIP) The capability of Internet-based programs to provide voice point-to-point or point-to-multipoint connections to anyone with a browser, a sound card, microphone, and speakers; may also include limited video or graphics capabilities

The Web A synonym for the Internet (see above).

Web-based training (WBT) Includes training-on-the-job (TOJ) and workplace training, formal on-campus technical training, and elements of training or professional development (PD) conducted primarily face-to-face, but including some online components, with the Internet or an intranet as the access/delivery vehicle.

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