SOCIAL POLICY RESEARCH
ASSOCIATES

Technology-Based Learning Strategies

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EXECUTIVE SUMMARY

Technology-based learning (TBL) constitutes learning via electronic technology, including the Internet, intranets, satellite broadcasts, audio and video conferencing, bulletin boards, chat rooms, webcasts, and CD-ROM. TBL also encompasses related terms, such as *online learning* and *web-based learning* that only include learning that occurs via the Internet, and *computer-based learning* that is restricted to learning through the use of computers. *E-learning* is synonymous with TBL and has largely replaced it in scholarship and industry as the term of choice.

TBL holds the promise of substantially transforming the way learning takes place because of its numerous advantages. Among these, TBL fosters greater accessibility to learning by offering anytime and anywhere delivery. It is readily scalable to both large and small groups since it can accommodate larger numbers of learners at little extra cost and smaller groups of learners that otherwise would not be able to participate in traditional classroom training for lack of enrollments. Further, the content of TBL courses, especially those that are delivered online, can be centrally developed and updated whenever the need arises; therefore, the cost of replacing outdated course materials and retraining teachers and instructors drops significantly. From the learners' point of view, TBL can be self-paced and matched to the learner's needs, and, building on pedagogy that emphasizes the merits of discovery learning, it offers the prospect of promoting greater comprehension and retention, particularly for complex materials, because of its clear opportunities for the hands-on manipulation of course materials and the use of simulations and game-playing. Perhaps for these reasons, TBL has witnessed marked growth in the training marketplace in government, industry, and education.

At the same time, TBL is not without its challenges. Among the most important of these is the "digital divide," caused by low computer literacy rates and lack of access to technology among some learner populations. Additional challenges include "social loafing," characterized by students who work less diligently than they otherwise might, or who become frustrated by course material or technology and thus less engaged, because of the relative absence of instructor-learner and learner-learner interaction. Further, some TBL has been characterized by high attrition rates among learners. Course developers face their own challenges, as they grapple with

problems related to technological incompatibility, and they must be certain to make appropriate accommodations to promote access for learners with disabilities. Finally, TBL still lacks credibility. Some employers and academicians view TBL instruction as less credible than traditional face-to-face instruction and may be less likely to hire someone with a TBL certificate unless provided by an accredited institution.

Although these benefits and challenges apply in a general sense, TBL in fact is an umbrella term that encompasses multiple delivery modes and methods, with each having particular strengths given certain contexts and learning objectives. For example, TBL includes tutorials, web conferences, online forums, simulations, and gaming, among other methods. The learning can be synchronous, when delivery occurs when instructors and learners meet at a specific time in a physical or virtual classroom, or it can be asynchronous, when the learning does not occur at a pre-specified time and thus can be self-paced. Further, different applications can be predominately instructor-centric, which have an expert at the core who delivers a lecture, either synchronously or as an asynchronous narrated tutorial; or they can be content-centric, where learners interact with content that is embedded in a learning system and experience little instructor-learner or learner-learner interaction; or they can be learner-centric, where the learner is the navigator, the learner's interests and needs drive the learning, and the learning environment is open. In actuality, much TBL mixes these different methods and modes. Furthermore, TBL is increasingly seen as being most effective when it is used in concert with, rather than as a replacement for, more traditional face-to-face instruction, in a style that has come to be known as blended learning.

Given the promise of TBL, it is not surprising that its applications have increasingly been seen in government, industry, and education. For example, in 1997 the Department of Defense initiated Advanced Distributed Learning (ADL), a comprehensive strategy to integrate technology and learning content to further the department's training efforts. In industry, IBM has embraced blended learning that incorporates strategies for diverse learning styles, including a web-based On-Demand Model with just-in-time learning embedded in the workflow as well as traditional, face-to-face classroom sessions. Similarly, Southwest and Delta Airlines have used TBL to make in-house training accessible to all of their company employees, as has Home Depot, which has installed computer kiosks in each of its stores and encourages its employees to access asynchronous training modules during working hours on topics that include customer service, safety, product knowledge, and crafts, such as plumbing, gardening, and painting. TBL has also been used in K-12, post-secondary, and adult education. In fact, most post-secondary institutions now offer distance learning, either as selected courses offered online as part of traditional on-campus programs or as entire certificate, undergraduate, and graduate programs offered

primarily or solely online. The University of Phoenix is a pioneer in the latter and provides asynchronous activities, group study, and meetings with an academic counselor.

With the widespread adoption of TBL, measuring its effectiveness has become more of a priority. Different facets of evaluation include measuring learners' satisfaction with the experience, measuring their skill gains through pre- and post-tests (sometimes in comparison to learners who received traditional classroom approaches), gauging how learners applied their new knowledge in work settings, and estimating how the institution itself benefited from employee learning. In return-on-investment calculations, the latter entails an assessment of whether the benefits are commensurate with the cost of providing the training.

Although rigorous wide scale research evaluating TBL's effectiveness by any of these criteria is sparse, the available evidence seems to suggest that TBL generally seems to work at least as well as traditional approaches and is often less costly. Nonetheless, it also seems clear that, to realize its full potential, TBL should not dispense with opportunities for human interaction (either face-to-face or electronically), and that it should provide opportunities for the active engagement of learners, provide content that is relevant and linked with what learners already know, and offer opportunities for feedback and support.

What is clear as well is that TBL is rapidly evolving in adopting these principles, as new technologies emerge and old ones fall out of favor, as training designers and educators learn how to use these tools to increasingly better effect. Recent trends include the gravitation towards online delivery and the adoption of Learning Objects. The latter consists of small units of instructional content that can be assembled, reused, and rearranged for use in multiple lessons and courses.

A. INTRODUCTION

This paper is the result of a Quick Research Task Order to assist the Employment and Training Administration gain a better understanding of the concept and state of technology-based learning and the application of technology-based learning in government, industry, and education.

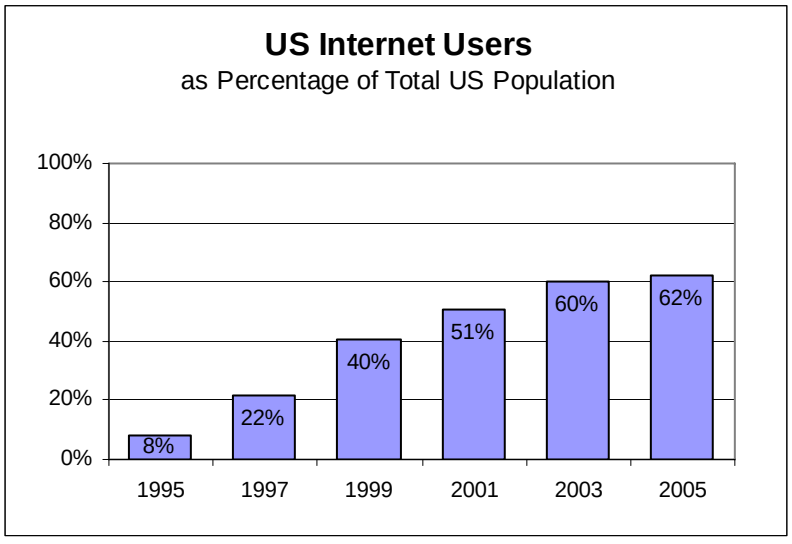
The report provides an overview of recent trends in industry and media that have made technology-based learning such a rapidly growing phenomenon. The report then defines the term and compares and contrasts it with related terms, such as e-learning and distance learning, and next describes the benefits and challenges that are associated with providing learning via technology.

The report also provides brief descriptions of the main delivery modes as well as methods and tools used in providing technology-based learning programs, and provides examples from government, industry, and education.

The report concludes by describing the most common framework used today to measure the success of technology-based learning programs and looks at future questions for technology-based learning.

B. OVERVIEW

Technology-based learning (TBL) in the early 21st century is transforming the way people learn at a time when two powerful trends converge. The first trend is the rapid acceleration of technological change and the demand that this change places on education and workforce training. While successful economies have always depended on a skilled and knowledgeable workforce, today's rate of change in production processes and workplace tools requires much more training and retraining of individuals on the job than it did in the past. As more workers become knowledge workers, the demand for frequent retraining is further accelerated with each technological shift. Industry has to be able to retrain its workforce much more quickly, and the development cycles of training programs have to be shortened if companies want to stay competitive. Given that updating workers' skills rapidly and as the need arises is so critical in today's economy, the efficiency with which companies do so can thus be critical in helping them maintain a competitive edge.



The second major trend is the change that the digital revolution has brought to media usage among Americans. While in 1995 only 22 million Americans used the Internet, in 2005 more than 184 million were users.[1] Even more remarkable, in 2004 U.S. Internet users spent almost twice as much time on the Internet than they did watching television.[2] This represents not

[1] Fox and Madden, 2005.

[2] Institute for the Quantitative Study of Society, 2004.

just a shift in consumer habits, but also a shift in the way users interacted with the medium. Internet users have shifted away from a spectator role in the hierarchical broadcasting medium toward a much more participatory role with the new medium where they can create and modify content and where content creation and distribution is shared.

The convergence of these two trends means that, at a time when the nature of work is changing profoundly, the way workers learn how to do that work is also transforming.

What is Technology-Based Learning (TBL)?

For the purpose of this report, we are using the widely accepted definition of ***technology-based learning*** as the learning of content via all electronic technology, including the Internet, intranets, satellite broadcasts, audio and video tape, video and audio conferencing, Internet conferencing, chat rooms, e-bulletin boards, webcasts, computer-based instruction, and CD-ROM.[3] TBL also encompasses related terms, such as ***online learning*** and ***web-based learning*** that only include learning that occurs via the Internet, and ***computer-based learning*** that is restricted to learning using computers. ***E-learning*** is synonymous with TBL and has largely replaced it in scholarship and industry as the term of choice. Therefore, the report uses these terms interchangeably.

TBL is distinguished from ***distance learning*** or ***technology-delivered learning*** in that TBL includes methodologies where instructors and learners are in the same room or instruction is computer-based and there is no 'distance' involved. On the other hand, TBL is more narrowly defined in that it does not include text-based learning and courses conducted via written correspondence that would be covered by either distance learning or technology-delivered learning. Furthermore, ***technology-enhanced learning*** describes a methodology in which technology plays a subordinate role and serves to enrich a traditional face-to-face classroom.

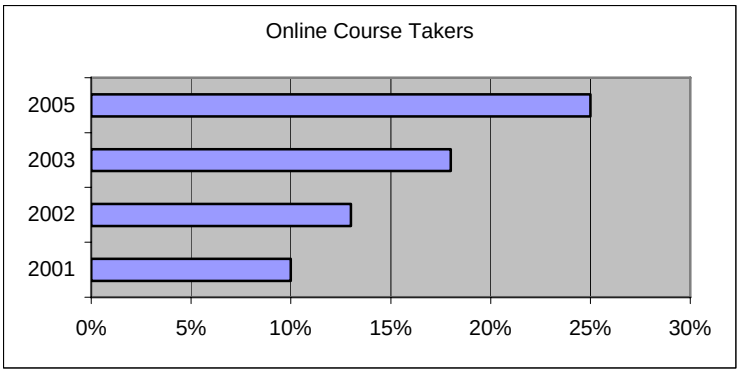
Technology-Based Learning's Potential

Whereas even ten years ago, the majority of TBL depended on shipping video tapes or on expensive satellite upload and downloads in selected sites, most TBL content today is distributed via CD-ROMs or the Internet.

The Internet holds particular promise among educational technologies since it easily accommodates multiple learning styles and distributed learning models.[4] On the Internet, users

[3] ASTD, 2005.

[4] Brown, 2002.



cannot only view all types of content from text to pictures to music; they can also interact with it, alter it, create new content, and disseminate it back to a wider community. In addition, the medium is well matched to the new requirements of education and training in the knowledge-based economy.

Because of these facts, growth in online course delivery has been strong. In just the past 5 years, the number of adults who said that they had taken an online course has grown from one in ten, to one in four.[5] Growth in this area is still accelerating. This explains why the CEO of Cisco, John Chambers, calls e-learning "the Internet's killer app."

Exhibit 1:
Education in the Knowledge Economy[6]

Old Economy	New Economy
Four-year Degree	Forty-year Degree
Training as Cost Center	Training as Competitive Advantage
Learner Mobility	Content Mobility
Distance Education	Distributed Learning
Correspondence & Video	High-Tech Multimedia Centers
One Size Fits All	Tailored Programs
Geographic Instituting	Brand Name Universities & Celebrity Professors
Just-in-Case	Just-in-Time
Isolated	Virtual Learning Communities

In the new economy, training is less dependent on 'credit hours' towards a degree and more on being able to demonstrate a measurable competency in a given skill. It is also much more time sensitive. In fact, most technology companies have no idea what knowledge or skills their employees will need five years from now to stay competitive.

5 PEW Internet and American Life Project, 2005.

6 Erwin, 1999, p. 8.

Another key feature of TBL is that it emphasizes 'learning solutions' and 'learning results,' and is contextual and can be personalized. As such it allows for a new way to integrate learning with work. Rather than training workers on every possible procedure that they may need throughout their working lives, in an e-learning or TBL model, workers have access to the training module for a given process only if and when they need it, perhaps delivered via a handheld computer. In addition, technology is already in place that allows TBL delivery systems to anticipate future information and learning needs by recognizing patterns in learning styles and delivering training in chunks as needed by the learner.

Since much of TBL technology is so new, no leading paradigm has been established regarding the most effective delivery of content for the various modes that are available. In fact, a number of technologies ended up on the trash heap in just the past few years, after appearing to be tremendous breakthroughs when first introduced. To avoid this potential pitfall, the following sections will describe different TBL methodologies and their applications without trying to rank them or rate their efficacy.

Benefits and Challenges

TBL comes with substantial benefits. Most of all, it offers geographic reach and a scalability of training and educational efforts that face-to-face interaction cannot achieve. It also offers a wide range of learning modes and an opportunity to track progress and measure outcomes as a seamless part of learning. However, as with all technology applications, the use of technology in itself poses some new challenges. In TBL, the most significant problem is the digital divide, which still splits the country into digital haves and digital have-nots. In addition, transferring learning into a TBL environment creates additional challenges for educators and training designers.

Benefits

There are numerous advantages to TBL in comparison to face-to-face learning. Five of the primary benefits are the following:

- Accessibility, offering anytime and anywhere delivery
- Training that is self-paced and matched to the learners' needs
- Full scalability
- Timely dissemination of up-to-date information
- Streamlined and effective learning delivery

Accessibility: A major benefit of many TBL courses is that learners may enroll in a course at any time, rather than at the start of a semester. They can also fulfill their learning requirements at any time of day or night. This flexibility holds particular promise for working adults and parents whose life-schedules are not compatible with the time of day a particular course is offered.[7] [8] Likewise, it can also be appealing to incumbent workers who cannot afford to take time off from their jobs to advance their careers.

Technology-based training can also increase the geographic reach of training and bring access to those with transportation barriers. For example, Creighton University has a TBL program for obtaining a Doctor of Pharmacy degree. Forty percent of the students in this program are not within driving distance of a pharmacy school.[9] In fact, for students with a laptop, TBL can be accessed from anywhere in the world where there is Internet access.[10] As a result, many TBL programs have entirely migrated to an online-only delivery model.

Self-Paced Learning Matched to Need: Another benefit of TBL programs is that they allow learners to advance through required—or desired—course content at their own pace. For example, Toshiba uses a self-paced sales training program for its sales representatives. While time spent in each module is self-paced, the learners have to test with a score of 80 percent or higher before progressing to the next module.[11] Additionally, TBL programs can serve as a low-cost self-paced "refresher course." British Airways, for example, requires that their employees participate in TBL programs, and then revisit the same program every few years to refresh and retest their knowledge.[12]

Scalability: Well-designed TBL programs can also accommodate larger volumes of customers at little extra cost. For traditional face-to-face training, there are two options to scale up a training program and reach more learners: (1) increase class size, or (2) have trainers repeat the training at different times or locations. TBL, on the other hand, can be scaled up with relatively little additional effort and little marginal cost for additional students. Classroom limitations do not apply and modern learning management systems (LMS) allow the management of learning outcomes for large

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7 Australian Flexible Learning Framework, 2004.

8 Twigg, 1995.

9 Sloan Consortium, 2004.

10 Twigg, 1995.

11 Harris, 2005.

12 Summerfield, 2005.

numbers of students. For example, the U.S. Navy saves about $40 million per year in travel costs by using TBL programs.[13]

Timely Update: Another major advantage of TBL courses, especially those that are delivered online, is that they can be centrally developed and centrally updated whenever the need arises. Therefore, the costs of replacing outdated course materials and retraining teachers and instructors drop significantly, and frequent updates become much more manageable. Nowadays, most course updates in the corporate learning market are done on an as-needed basis, and trainers simply get the updated content when they sign in the next time.

Streamlined and Effective Learning Delivery: Course developers sometimes find that learning content can be streamlined when a course is converted from traditional to TBL delivery, in that the amount of duplicated material can be considerably reduced. For example, the University of Tennessee's Physicians Executive MBA program integrated 14 traditional courses into a year-long technology-based training program.[14] By integrating all of their coursework, they were able to identify and eliminate duplicative learning objectives and information across the 14 courses, thereby reducing overall training time.

There is also some evidence from cognitive psychology that TBL offers advantages in promoting learning retention. It has long been argued, for example, that learners learn best and retain knowledge better when they are actively involved in the discovery process rather than being mere passive receptacles for mastering content delivered by others, as expressed in the paradigms of "discovery learning" and "autonomous learning."[15] With its opportunities for the hands-on manipulation of course materials, simulations, and game-playing, TBL offers the clear prospect of building off this potential.

Challenges

The introduction of TBL is not without challenges. They include:

- The "digital divide," caused by low computer literacy rates and lack of access to technology among some learner populations
- "Social loafing," which occurs when learners reduce their effort in TBL programs, or are frustrated in their attempts to use TBL, because of the program's lesser focus on personal interactions

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13 Hollis, 2004.

14 Dean, Stahl, Sylwester, and Peat, 2001.

15 See, for example, Anderson, Reder, and Simon, 1998, and Greitzer, 2002.

- Higher attrition rates
- Accommodating individuals with disabilities
- Technology incompatibility
- High development costs
- Lack of credibility

Digital Divide: The Digital Divide directly affects TBL implementation since a significant portion of the population still does not have access to computers or to the Internet. Internet use is lowest for low-income people, those who are over 50 years old, the unemployed, and individuals who have never attended college.[16] It is also lower among African-Americans and Hispanics than those in most other racial or ethnic groups. Further, over the past four years, computer use has been about 10 percent lower in rural areas than in urban and suburban areas.[17] Internet access in the U.S. has begun to plateau and, very recently, has started to decline slightly. This suggests that, for the foreseeable future, the digital divide will not shrink very much in the near-term, unless major changes in the market or public investment result in further access.

Social Loafing: TBL is also more likely to produce "social loafing," in which learners reduce their level of effort when they perceive that doing so will not have negative social effects. TBL learners can be particularly prone to social loafing because, without the personal contact of instructor and peers, it is easy for learners to perceive that they are not being monitored. Larger class sizes—usually described as an advantage of TBL—can contribute to social loafing unless individuals are held accountable for their actions, such as requiring individuals to post contributions on group discussion boards or requiring periodic deadlines for deliverables. Users who are frustrated by the technology, or who are better able to absorb information through personal interaction with an instructor, may also reduce their effort in using TBL which may be perceived as social loafing.

Attrition Rates: Given the social loafing effect, it is not surprising that attrition rates can be higher with online courses as opposed to classroom-based courses. The dropout rate among TBL students frequently reaches 50 percent to 80 percent, which is far higher than in face-to-face training. There are a number of reasons for high dropout rates:[18]

- Students take TBL courses for the wrong reasons

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[16] National Telecommunications and Information Administration U.S. Department of Commerce: Economics and Statistics Administration, 2002.

[17] Bell, Reddy, and Rainie, 2004.

[18] Adapted from Murray, 2001.

- Some TBL courses lack auditory stimulation and in-person contact with others
- Some courses may be overbooked and skimp on student support
- Student may lack the technical skills they need to succeed
- Students may only stay enrolled until they have met their own personal objective and will then dropout, regardless of other future needs
- Students realize that TBL requires more effort than originally anticipated[19]

Access for Individuals with Disabilities: Access to TBL courses for individuals with disabilities can also pose a challenge. While TBL generally offers access options for those with disabilities, accommodations must be made in order for TBL to be accessible.[20] For example, assistive technology must be purchased to accommodate individuals' needs, such as by using appropriate mouse devices, computer stations, and keyboards. Likewise, assistive technology software, such as Zoom Text and JAWS, must be made available to persons with visual impairments so they can read computer-based text. Additionally, TBL developers must program web pages so they are compatible with assistive technology.[21]

In addition, TBL content developed or procured by the federal government falls under the provision of Section 508 of the Rehabilitation Act of 1973, which requires that electronic and information technology offer comparable access to individuals with disabilities as to those without disabilities.[22] Section 508 has resulted in a series of design-standards that are now met by most TBL and web developers who are developing content for a wider audience.

Technology Compatibility: Another challenge for TBL is the need for compatible technology. In order for training programs to share and recycle content, the content needs to be able to interface with a variety of learning management systems (LMSs). Nevertheless, as LMSs were designed and marketed, developers created learning content specific to each system. Very little attention was paid to ensuring one system's compatibility with content from another. This has resulted in high development costs, as content must be recreated if, for example, a program changes management systems. Within the past five years, leading organizations have made efforts to standardize LMSs. The most extensive initiative, spearheaded by the Department of Defense, is discussed in Section D of this report.

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[19] University of Central Florida, 2006.

[20] The Rehabilitation Act Amendments of 1998.

[21] The National Arts and Disability Center is one resource for learning how to make websites compatible with assistive technology.

[22] Rehabilitation Act of 1973, Section 508, Subpart A, § 1194.1.

Development Costs: Another disadvantage of technology-based learning is high upfront development costs, which can require a significant investment. For example, Pace University estimated that they lost over $46,000 during their first year of offering technology-based learning programs, because they spent so many hours developing the materials and so few students enrolled in the course. However, they expect that by the end of the second year they will realize a slight profit, compensating for their high initial investment.[23] Thereafter, they expect to continue to profit from the course with relatively little additional investment.

Lack of Credibility: Lastly, TBL degree programs still lack the level of credibility of traditional degree programs. For example, a survey administered to hiring committees of 60 higher education institutions found that respondents preferred to hire applicants who received a degree from a traditional institution to those with a degree from distance education institutions. Additionally, some respondents were even wary of hiring applicants who took some courses online at a traditional institution. In general, they were concerned that TBL is more susceptible to cheating and poor quality than traditional face-to-face and classroom-based training.[24]

23 Carr, 2001.

24 Adams and DeFleur, 2005.

C. METHODOLOGIES AND TOOLS

As we have seen in the previous section, TBL is transforming training and education by providing new technological opportunities to address new learning needs. In this section, we will look at various methodologies, delivery modes, and tools that are common in TBL applications in government, industry, and education.

Technology-based learning programs come in different delivery modes and forms. They can include online tools, such as discussion boards and e-mail, and real time events, through videoconferencing and web conferencing. They can be self-paced, and have a varying focus of instruction.

With the right mix of delivery modes and methodologies, TBL offers more than a repository of learning resources online or a new way of reaching learners at a distance. When done well, TBL offers a way to complement any learning process and, in some cases, it can bring learning to places where it has not traditionally been accessible.

Methods and Tools

Technology-based learning uses a series of delivery methods and hardware and software tools to manage and deliver learning content and manage and track learner progress, as well as learner-to-learner and learner-to-instructor communication. In this section, we provide brief descriptions of each of the most common delivery methods and tools used in TBL and the role they play in a TBL environment.[25]

- **Tutorials** are self-paced training programs delivered online or from a CD-ROM. They may contain audio and video and allow learners to control key aspects of the learning experience. They may track progress and include quizzes and a competency assessment.

[25] Adapted in part from ASTD, 2005.

Typically, they are modular and are accessed in sequence or out of sequence, depending on the learners' needs.

- **Web Conferences** are synchronous meetings in a virtual environment. They are usually centered around a website where visual and text content is displayed, and include audio and sometimes video. A single facilitator may drive the visuals or they may involve interaction among multiple participants. More advanced web conference environments try to mimic most typical classroom interactions and allow for polling, live chat, and other interaction among participants. Smaller web conferences sometimes are called Webinars. Both may be archived for later asynchronous delivery.

- **Online Forums (also called bulletin boards, discussion groups, or news groups)** allow learners to interact with each other and the instructor through threaded discussions by posting messages on specific subject areas, starting new threads and sub-threads, or posting replies to others. Online forums are either self-moderated or moderated by an instructor or expert facilitator, and the threads are typically archived. In order to participate in a forum discussion, a learner has to visit the specific online location to review the postings of others and post messages.

- **Electronic Mailing Lists (also called listservs)** allow members to send messages to other members of the same mailing list. They are different from online forums in that postings are delivered to e-mail boxes and are not typically archived in a communal online space.

- **Wikis and Virtual Collaborative Workspaces** allow members of a group to share a virtual space on the web where they can store reference documents, add and edit documents and track progress on a collaborative work effort.

- **Blogs (Weblog)** are web-based journals and are usually a component of a larger personal or corporate website. Some are more topical and others are highly personal. They typically allow readers to post replies or to be promoted to a co-contributor role. In an online learning environment, they can take on the role of a learning journal.

- **Simulations** allow learners to model or role-play in a scenario as a way to practice or test learning. Applications range from simple scenarios to complex, highly scripted, and interactive games.

- **Goal-Based Scenarios** are simulations in which learners assume a major role in the pursuit of a well-defined mission or task. In order to achieve the goal the learner needs to acquire particular skills and knowledge, which is where the learning occurs.

- **Gaming** involves more complex simulations with "(1) formal rules in which players engage in artificial conflict with variable and quantifiable outcomes and both game play and learning objectives, (2) a narrative which provides cues, context and relevance for the activities, and (3) a simulation which represents the learning space necessary to support the activities and narrative."[26]

- **Learning Management Systems (LMSs)** typically register, track, and deliver content to learners; report on learner progress, assessment results, and skill gaps for instructors; enroll learners; and provide security and manage user access for administrators. LMSs typically handle courses by multiple publishers and providers. They are similar to **Learning Content Management Systems (LCMS)** that are especially designed to handle content objects in modular form for learner use.

- **Integrated Learning Systems (ILSs)** are different from LMSs in that they are fully integrated around a specific learning content and are not designed to handle learning objects from disparate sources. ILSs typically include hardware, as well as curricula and lessons organized by competency level. They usually include a number of tools such as assessments, record keeping, report writing, and user information files that help to identify learning needs, monitor progress, and maintain student records.

The delivery of these methods and their application are elaborated upon in the sections below.

Synchronous and Asynchronous Delivery Modes

Technology-based learning is grouped into synchronous and asynchronous delivery modes. TBL courses often employ both modes in a form of blended learning.

Synchronous learning delivery occurs when instructors and learners meet at a specific time in a physical or virtual classroom, in person or via Internet, satellite, or phone link-up. In a TBL setting, synchronous learning occurs in broadcasted lectures, teleconferences, video conferences, or webinars. In webinars and web conferences, audio lectures are often accompanied by slides and sometimes a video image of the instructor is streamed to the learner's desktop. As costs for such web conferences have come down and tools have become more user friendly, synchronous

[26] Definition adapted from the Advanced Distributed Learning, 2005.

training has become the fastest growing segment of the TBL market. In 2002, 60 percent of corporations delivered some of their TBL synchronously. Subsequently, in 2004, that percentage increased to nearly 75 percent of surveyed corporations.[27]

Asynchronous learning in a TBL environment need not occur at a specified time and is not linked to a specific learning event. Self-paced asynchronous applications include web-based and computer-based courses that learners use at their own pace. Facilitated asynchronous applications range from a simple e-mail dialog or a discussion via a bulletin board to a comprehensive virtual learning environment where the instructor posts readings, video and audio content, and assignments, and then monitors students' progress over time. Asynchronous learning also tends to emphasize the role of the community of learners of a given subject. Online discussions are typically archived and become important repositories of knowledge and learning. Because of this enhanced ability of learners to interact outside of 'in-class events,' the traditional power differential between instructor and learners is less pronounced in an asynchronous environment. Another advantage of asynchronous TBL is that it is no longer constrained by timing or geography. Learners can begin a course when they are ready for it and advance through it as quickly or as slowly as their own time and ability permit.

Exhibit 2:
Synchronous and Asynchronous TBL Delivery Methods

Synchronous	Asynchronous
Teleconferencing	E-Mail
Conference Calls	List servers
Web conferencing	Threaded discussions
Instant Messaging	Blogs
Chat	Discussion Forums
	Podcasts
	Simulations

Instructor-Centric, Content-Centric and Learner-Centric Teaching

Delivery modes can also be distinguished by the focus of instruction. TBL, just like traditional classroom teaching, can involve three main teaching modes—instructor-centric, content-centric, and learner-centric—and often involves a combination of several of these modes.

[27] Pulichino, 2004.

In a TBL environment, the **instructor-centric** mode includes synchronous events, such as web conferences with a lecture at its center. It can also include pre-recorded lectures or narrated tutorials that are disseminated online, or via CD-ROMs. These lectures generally provide a record of expert knowledge that learners view, listen to, and, sometimes, respond to. Expert-learner contact can be frequent if the learner community is small, but tends to be rare in most cases.

In a **content-centric** TBL model, students typically interact with content that is embedded in a learning system that runs either from a CD-ROM on a stand-alone computer or from a web-based system where the content resides on a remote web server and is accessed via the Internet. In this model, there is little learner-expert interaction or learner-learner interaction. Typical examples of content-centric TBL in industry include online courses on generic topics such as project management, leadership, and compliance training, as well as training that leads to industry certifications such as for information technology workers. Major corporate e-learning providers include the recently merged market leaders SkillSoft and SmartForce, which provide more than half of all content-centric TBL for Fortune 5000 companies. Typical examples of content-centric courses in education include basic skills and GED courses delivered online or via CD-ROM. Examples of software for adult education are Aztec, PLATO, SkillsTutor, and GED Illinois Online.[28]

In a **learner-centric** TBL model, the learner is the navigator and key decision-maker, and the learner's interests and needs drive the learning. The instructor acts as a coach and facilitator who helps the student to achieve the learning objectives. The learning environment is open, and learners are free to roam in search of learning objects that help them construct their understanding of the given topic. A learner-centric model is well aligned with constructivist learning pedagogy which maintains that students learn best when they can actively participate in their learning and build their knowledge, rather than just act as passive recipients of knowledge.

All three modes of delivery are effective at transmitting factual knowledge. However, research suggests that a constructivist learner-centered approach leads to better content retention, improved student motivation, and lower dropout rates.

Simulations and Goal-Based Scenarios

The presumed effectiveness of learner-centered, discovery-based methods has led to the promotion of simulations and goal-based scenarios as part of TBL. Of course, simulations have

[28] Young, 2005.

been used for quite some time—as a part of military training for example. But as simulations have come to be adapted as a part of TBL and explicitly linked with a constructivist pedagogy, the range of their applications has expanded to new content areas, including marketing, finance, management, and even foreign languages.[29] For example, MIT developed the Beer Game as a way of teaching its MBA students the principles of systems dynamics and operations management as they work through the wrinkles of developing an effective beer production and distribution chain. In this and other examples, simulation's and goal-based learning's elements enable discovery, experimentation, practice, and the active construction of systems and content based on concrete examples in a risk-free environment.[30] These features are well illustrated in the following exhibit.[31]

Exhibit 3:
A Comparison of Simulations and Traditional Approaches

	Traditional Approach	Simulations & Scenarios
Scope	Deductive: experts determine the scope of learning and establish right and wrong answers	Inductive: learners use their experiences to create indicators of successful outcomes
Focus	The object or subject to be mastered	The learner's behavior
Learning objectives	Listed and prioritized based on expert judgments	Not fully known until after the lesson
Nature of learning	Hierarchical, linear, and rule-based	Systemic, non-linear, with multiple feedback
Learning styles	Can be multiple but usually less kinesthetic	Usually highly visual and highly kinesthetic
Best suited to	Knowledge focused: Suited to relatively simple, well-known, and well-structured topics with high knowledge requirements	Performance focused: Suited to complex topics with high interaction or practice requirements and where judgment skills, not facts, are being taught

29 Marquardt and Kearsley, 1999.

30 Aldrich, 2004.

31 Kindley, 2002.

Blended Learning

The experience with CD-ROM-based TBL and online learning has shown educators and trainers that learning that is exclusively delivered via technology is not the panacea to teach students and train workers. Even if all technological hurdles are overcome, TBL that does not integrate well with on-the-job training processes is missing an important experiential component. That is why in the past few years many educators and trainers have begun to consciously mix different elements of TBL and face-to-face learning into a **blended learning** model.

Blended learning, also known as hybrid or integrated learning, has recently become the dominant paradigm for TBL success among training designers and experts. Blended learning typically refers to a training approach that combines a mix of online and face-to-face training delivery for improved engagement and better retention. Blending face-to-face with online activities also has the potential of bringing the best of both worlds together in a single course. In its most basic form, it combines a synchronous face-to-face lecture with some online follow-up activities, such as discussion forums or chats.

While blended learning does not represent a new concept (many college courses have combined classroom with online content for some time without ever calling it blended learning), it is having an effect and changing training design in the corporate TBL market. The reason why it is having such an impact there has to do with a weakness in early corporate implementations of TBL. Early TBL initiatives were often too dependent on a single mode of delivery and were too technology-driven. Blended learning in the corporate training market is likely to continue to evolve and employ a more varied mix of learning tools. There is also evidence that blended learning is more effective than non-blended approaches. In a controlled study, students who learned Excel tasks using a blended approach showed a 30 percent improvement in accuracy and learned 40 percent faster than their control groups in a non-blended approach.[32]

Successful blends use a course design that ensures that each element complements the other without duplication. For example, an instructor might be available for online discussions between classes, post required reading on course websites, suggest further exploration with a list of links, archive answers to frequently asked questions, and request that assignments be completed online.

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[32] Thomson, 2002.

D. APPLICATIONS

Technology-based learning can be implemented in a wide array of forms including through blended learning, distance education, instructor-led classes, or just-in-time training. The following are examples of a variety of TBL applications in government, industry, and education.

Government

Government at the federal and state level has turned its attention to technology-based learning as a cost-effective strategy to provide training and professional development for the workforce; literacy, math, and science education for K-12 students; and up-to-date, on-demand training for military personnel and other government workers. Beginning in the 1990's, the Congressional Web-Based Commission conducted research on e-learning methodologies implemented in industry and education.[33] The National Governors' Association (NGA) also funded research to direct policy on technology-based learning for workforce development and K-12 education.[34] Current issues of importance to government include funding for accessibility, intellectual property, and the standardization of management systems throughout learning environments. Reports from these bodies point to TBL's capacity to produce a stronger, better qualified workforce if advances are made in these areas.[35] [36] A Presidential Executive Order issued in 1999 addressed these concerns and gave direction to government agencies to collaborate on technology-based learning efforts.[37]

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33 Congressional Web-based Education Commission, 2000.

34 Ganzglass, Simon, Mazzeo, and Conklin, 2002.

35 Ibid.

36 Commission on Technology and Adult Learning, 2001.

37 Executive Order 13111, 1999.

Example: Advanced Distributed Learning Initiative

The Armed Forces are increasingly deployed to global locations with little time allotted for planning. Consequently, the number of service people and their dispersed positioning prompted Department of Defense (DoD) leaders to incorporate technology-based learning strategies as part of existing training programs. The fast-paced work of the Armed Forces requires cost effective "just-in-time" training to prepare soldiers for a wide range of critical situations. However, when branches of the Armed Forces began investing in training programs individually, the lack of coordination within the DoD caused duplication of effort and monies.

In 1997, the DoD initiated Advanced Distributed Learning (ADL), a comprehensive strategy to integrate learning content and technologies and transition department-wide training efforts. Specifically, ADL attempts to provide "a network of dispersed accessible and reusable learning content, standardized guidelines for the implementation and use of technology in learning, research and guidance on technological challenges to distributed learning, cost-effective technology-based learning capable of generating profits for industry, and a forum for partners to exchange knowledge of distance learning on a large scale."[38]

One of the largest issues in coordination is that most LMSs were not designed to be compatible with each other. This discrepancy affected one program's ability to share learning content with others. To resolve this issue ADL produced the Sharable Content Object Reference Model (SCORM). The Department of Defense asserts that SCORM facilitates the "creation of reusable content as 'instructional objects' within a common technical framework".[39] Within this model, LMSs that conform to SCORM standards are more readily able to interact with content utilized in other management systems.

ADL is spearheaded by the DoD, but includes collaboration from national and international government agencies, industry, and educational institutions. One example of international buy-in is from NATO and the Partners for Peace (PfP). Together, they have developed a training school with the use of ADL "to leverage individual countries' training efforts by reaching larger audiences with significant savings."[40]

Also, many federal government agencies including NASA, IRS, and USPS have adopted the SCORM model. The U.S. Department of Intelligence Agency's Joint Intelligence Virtual

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38 Advanced Distributed Learning, 2005.

39 Brooks and Wirth, 2006.

40 Nato PfP Advanced Distributed Learning Website, 2006.

University recently selected a SCORM-based LMS to deliver the online segment of its in-house training. The agency offers employees and contractors over 300 courses covering topics such as counterterrorism, battle damage assessment, and language and cultural training. Learners access the training modules from their computers through secured online networks.[41]

Finally, private companies with advanced technology-based programs including IBM, Boeing, Delta, and Home Depot have also adopted SCORM-based LMSs. Several cases are highlighted in the following section.

Industry

Private corporations have made great efforts to capitalize on the benefits of technology-based learning. The web and computer-based models are especially valuable to companies in competitive markets and those with a large and widely dispersed employee base. More and more private companies realize the importance of investing in a quality workforce while maximizing profits through cost-effective technology-based learning programs. Although overall training budgets fell 6 percent in 2003, many companies are choosing to spend money on e-learning.[42] In fact, according to the ASTD 2004 State of the Industry Report, technology-based training rose from 15.4 percent of all training offered in 2002 to 23.6 percent in 2003.[43] Employees take advantage of these opportunities through integrated on-the-job training as well as off-site professional development programs.

Example: IBM

Within the last five years, IBM has invested in a large-scale plan to continuously and efficiently train employees at all levels and functions of the company. Part of this plan included the creation of Learning Governance Councils to address issues of priority setting, investment allocation, methodology, and quality and outcomes of the company's training programs. Through continuous research, IBM has chosen to implement in-house learning programs focused on core and job specific competency skills. Based, in part, on a Department of Labor study indicating that about 70 percent of all learning actually happens on the job, their goal is to maximize opportunities for employees to learn while working.[44]

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[41] E-Learning Research Services, 2006.

[42] Bersin & Associates, 2004.

[43] ASTD, 2004.

[44] Ward, 2006.

The company's blended learning approach incorporates strategies for diverse learning styles including a web-based On-Demand Model with just-in-time learning embedded in the workflow as well as traditional, face-to-face classroom sessions. Generally, training programs utilize the following delivery styles in the order in which they appear below:

- *Online Information Delivery*- On the company intranet, learners can choose the information they need when they need it.
- *Gaming and Simulation*- These asynchronous media-based activities allow learners to apply gained knowledge to "real-life" on the job situations.
- *Team Work*- These generally synchronous activities include online communities of coworkers in virtual classrooms where they take part in discussions or tasks facilitated by an expert in the area.
- *Traditional classroom sessions*- Learning is face-to-face in these sessions. Coworkers and a facilitator build on prior activities, look into case studies, and strengthen the sense of community.[45]

IBM's Basic Blue for Managers training program is one example of a training program that uses this delivery style to foster effective leadership. Completion of the program is a baseline requirement for new managers. Upon becoming a manager, they begin Phase I asynchronous online learning sessions for two hours per week, during regular work hours, over the course of six months. Sessions cover topics such as IBM company policies, leadership skills, and productivity. Next, new managers begin Phase II by attending a weeklong instructor-led learning lab to build on the background they formed in the previous phase. New managers go through an online assessment during the learning lab as well as an assessment of how well they apply their gained knowledge on the job. The Harvard Business School evaluated managers' perceptions of the Basic Blue program and found that learners were generally very pleased with the blended approach. One manager commented, "…the combination of Phase I and Phase II is so powerful. Phase I orients you to all the factual things you need to know about the organization, and then Phase II brings it all together, [and] you feel like you really belong here."[46]

IBM also works with employees to create Individual Development Plans for career advancement. Once a worker and mentor identify professional goals they construct a learning plan that may include workplace-learning opportunities such as On-Demand online training, simulations, shadowing experienced workers, team projects and workplace tasks in order to develop the needed skills for advancement.

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[45] IBM, 2005.

Example: Airlines

Airlines are also faced with massive training needs for a geographically dispersed workforce in a fast-paced competitive market. Like many of its competitors, British Airways continuously searches for innovations in effective training for a large base of employees dispersed throughout the United Kingdom and Europe. The company boasts 45,000 workers and flies to over 550 international locations. In order to maintain its competitive edge, British Airways implemented a blended learning approach to training in which employees—managers, pilots, and sales representatives—receive face-to-face and online training sessions. The airline offers technology-based learning in the form of asynchronous refresher courses to follow face-to-face sessions. In addition, British Airlines is exploring further technology-based models specifically for its information technology employees to be able to access experts in the form of virtual classrooms.[47]

Similarly, Southwest Airlines has developed an extensive technology-based training program. Its University for People is accessible to all 35,000 employees for personal and professional development. The virtual university offers courses ranging from software training to customer service. Furthermore, the airline's Career Development Services (CDS) provides employees with career counseling, assessment, and development plans. The CDS utilizes an online component that provides personal and professional needs assessment for participants. To implement these training programs, Southwest contracted an LMS that allows them to manage learning activities and track employees' performance.

Finally, Delta Airlines employs over 60,000 individuals in over 110 airports in the United States and around the world. The company is implementing TBL as a way to improve the quality of its workforce to maintain pace within the competitive air travel business. Delta wants to train employees to be able to perform in various functions across the organization and adapt quickly to changes. With this in mind, Delta fosters two TBL initiatives: (1) an in-house training program focused on developing job related skills, and (2) a distance learning program focused on professional and personal development of employees outside of work.

In-House - Since transitioning to online learning, Delta's training costs have gone down and training effectiveness is on the rise. For example, Delta has used less expensive computer-based training to more efficiently adhere to federal regulations. Previously, employees had to travel to training centers in a few select locations but now they can access training, during work hours,

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46 Moon, 1999.

47 Hollis, 2002.

anywhere globally. Time spent on training has also decreased as employees take about an hour to complete training as opposed to the six to eight hour courses for an equivalent paper-based course. Courses blend teaching styles with online and instructor-led sessions. The airline uses a SCORM compliant online learning management system to track training schedules, attendance, and learner assessments.

Off-Site - Retention is also an issue, as the company struggles with keeping employees in a competitive job market. A Delta workforce survey revealed that employees were looking for professional development opportunities and training for career advancement. To address this issue, the Delta Learning Services Organization created Delta U, a collaboration between private educational and vocational institutions and Delta. The venture's mission is to "build a highly skilled, globally diverse and motivated workforce" and "to provide opportunities for employees to learn and grow."[48] Outside of work, employees may take traditional or online courses or enroll in degree programs through participating educational institutions such as Georgia State University, Embry Riddle Aeronautical University, and Cardean University. To offset the cost of post-secondary education some institutions offer financial aid or discounts to Delta employees. Moreover, through DegreeClub, Delta provides workers with academic counselors who offer academic and occupational assessments and work with them to identify high quality programs at the greatest value. This program alone has reduced the amount of time employees spend on degree completion by 1.22 years.[49]

***Example*: Home Depot**

As the world's largest home improvement retailer, Home Depot boasts over 300,000 employees, 1,731 stores nationwide and abroad, and over 30,000 products for sale.[50] In 2004, the company reported hiring 60,000 new cashiers a year.[51] Home Depot's growing size and scope require executives to search for new strategies to compete with smaller, more flexible home improvement stores. One such strategy Home Depot has implemented extensively is the blend of traditional mentoring and technology-based employee training.

In 2003, Home Depot, in partnership with Hewlett-Packard, installed at least two computer kiosks in each store for employee training. At the kiosks, employees can access asynchronous internet-based training on plumbing, gardening, painting, product knowledge, and on-the-job

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[48] Stricklen, 2003.

[49] *Ibid* pp. 2

[50] Holton, M. and King, J., 2004.

safety. In addition, field trainers offer staff traditional face-to-face instruction to compliment the kiosk training. Home Depot has created its own Training Tracking System, a SCORM compatible learning management system that allows managers to monitor training progress and to weigh in on decisions about employee bonuses and performance evaluations. The LMS also allows executives to report activities to the Occupational Safety and Health Administration in accordance with work safety regulations.

The company invests significant amounts of staff time to training with the expectation of boosting sales and strengthening employee retention. For example, the e-learning department can spend up to 800 hours developing an hour-long course, and each employee must spend about six of their regular work hours a month in training.[52]

Consequently, the implementation of technology-based learning at Home Depot has led to remarkable results. In 2004, e-learning director Charles Gardner asserted that the method has led to shorter training times. Since the company hires a large number of cashiers per year, it is significant that "time to competency"—the measurement of time it takes a new cashier to be adequately trained—was reduced from three to two days.[53]

In addition to cutting instructional delivery time, Home Depot learning executives also believe the technology-based training doubled content retention.[54] The company attributes this benefit to e-learning's "active learning" facet. Students must click through questions on computers and answer them correctly before moving on to other lessons. Unlike instructor-led courses, the computer-based training also offers students the opportunity to review the presented content when needed.

Due to this success, the company has continued to invest in technology-based training. In 2004, Home Depot, in collaboration with the University of Georgia College of Agricultural and Environmental Sciences and Macquarium Inc., initiated a new e-learning program intended to train store employees to be certified nursery consultants. The program succeeded in increasing the number of Home Depot certified nursery consultants from 480 to 1,700.[55]

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[51] Workforce Management, 2004.

[52] *Ibid*.

[53] *Ibid*.

[54] Walker, L., 2003.

[55] Gleim, S., 2004.

Using the company's training kiosks, employees engage in eight, two hour asynchronous courses including interactive training modules with animated virtual instructors, as well as simulations of common customer service scenarios and testing.[56] One benefit of this e-learning program is its flexibility. Employees can learn for as little as 15 minutes, bookmark where they left off, and return when time permits. The flexible training course is intended to boost the company's competitive edge by increasing employee competency and, therefore, customer service.

Finally, in addition to the increase in sales and the improvement in customer service, e-learning is instrumental for Home Depot's staff retention efforts. This is especially true since employees cite lack of training and preparedness as the most common reason for leaving the company. Home Depot's various blends of instructor-led and e-learning programs offer employees the opportunity to develop new skill sets and further their careers.

Education

Technology-based learning has also gained momentum in the K-12, adult education, and post-secondary education systems. For example, in 2003, about 38 percent of public high schools had at least one student enrolled in a distance-learning course by video or online.[57] The Center for Education Reform estimates that 86 cyber schools, offering supplemental courses and complete degree programs, served 31,000 students nationwide in 2004-2005.[58] Moreover, in higher education, a majority of colleges and universities offer some form of online education. Specifically, 63 percent of all schools offering undergraduate face-to-face courses, and 65 percent offering graduate face-to-face courses also offer courses online.[59] A survey of over 1,000 colleges and universities found that 56 percent of schools believe that online education is a critical long-term strategy for reaching a diverse student body. This is especially true of Associates degree institutions where 72 percent view online education as one of their institution's long-term strategies.[60] It is estimated that over 2.35 million college and university

[56] Holton, M. and King, J., 2004.

[57] Setzer, J. and Lewis, L., 2005.

[58] Chute, E., 2005.

[59] Allen, E. and Seaman, J., 2005.

[60] *Ibid. pp. 2*

students are enrolled in online education courses.[61] While evidence shows the use of TBL is growing in education, its implementation varies depending on the learner groups served.

K-12 Education

At the K-12 level, schools use TBL as a component in blended learning programs to enrich traditional curriculum by providing authentic learning experiences. Instructors often implement blended learning to teach students to use technology as well as to help them apply the technology to develop math, science, and reading skills. Researchers have found that TBL components promote active learning and ownership of the learning experience in K-12 students.[62] [63] This is in part because the Internet provides students with the immediate opportunity to research topics they are studying in class and build on information they acquire from traditional classroom instruction.

In addition, schools use distance learning to better tend to students' individual needs. Research shows that the use of distance education in K-12 education is substantial. In 2005, 22 percent of states had established virtual schools, and 16 states had at least one virtual charter school.[64] One example is the Michigan Virtual High School (MVHS) initiative funded by the Michigan legislature in 2000. Schools and individual students may enroll in this online virtual high school to participate in independent study programs, including remediation, summer school, and Advanced Placement courses. MVHS employs certified teachers for all classes and works together with local school districts to offer course credit and diplomas for students who complete its programs. While classes can be expensive, financial aid is offered to select students in need. For example, MVHS recently offered scholarships to high school students displaced by Hurricane Katrina.[65]

Adult Education

Although TBL in adult education is still underdeveloped, schools are beginning to make strides in Adult Basic Education, ESL, GED preparation, and vocational education. One of the obstacles of implementing technology-based learning in adult education appears to be funding.

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[61] *Ibid. pp. 3*

[62] Russell, Bebell, and Higgins, 2004

[63] Efaw, Hampton, Martinez, and Smith, 2004.

[64] *Ibid.*

[65] Michigan Virtual High School, 2006.

For example, the Outreach and Technical Assistance Network (OTAN) indicated that, in California, "The financial resources provided to adult education programs are a fraction of the resources provided to the K-12 community or to the post-secondary education community."[66]

Nevertheless, several initiatives in adult education have begun to incorporate technology-based learning in their programs. The *McGraw-Hill Companies Integrated Online Solution* and *GED Connected* are examples of online learning curriculum available. Recently, project IDEAL, a consortium of states working to produce successful distance education programs, funded several community colleges and adult schools to run pilot programs using these TBL modules to offer adults courses with flexible schedules. Students may enroll in adult education distance programs, and, working five to ten hours a week, improve their literacy and computer skills, or study for the GED.[67]

Post-Secondary Education

Technology-based learning has provided traditional students with opportunities to access the best programs offered by a variety of educational institutions and offer working adults greater access to education and professional development regardless of distance. The use of technology-based learning in post-secondary institutions is continuously growing. Its applications range from offering select courses online as part of traditional on-campus programs to offering entire certificate, undergraduate, and graduate programs solely online as well as blended learning options. Other delivery systems include networks and affiliations of colleges that join together to offer learners the best of each institution's courses. Students work with their own college on a degree or certificate program and receive credit for courses they complete through other institutions belonging to the network or affiliation.

Another growing trend in delivery systems is the public-private technology-based learning partnerships. For example, Ohio State University has teamed up with the private corporation, Gatlin Education Services, to offer self-paced online career training courses for continuing education. Certainly, post-secondary institutions have fostered significant innovations in technology-based learning strategies, with one of the most common being the online university.

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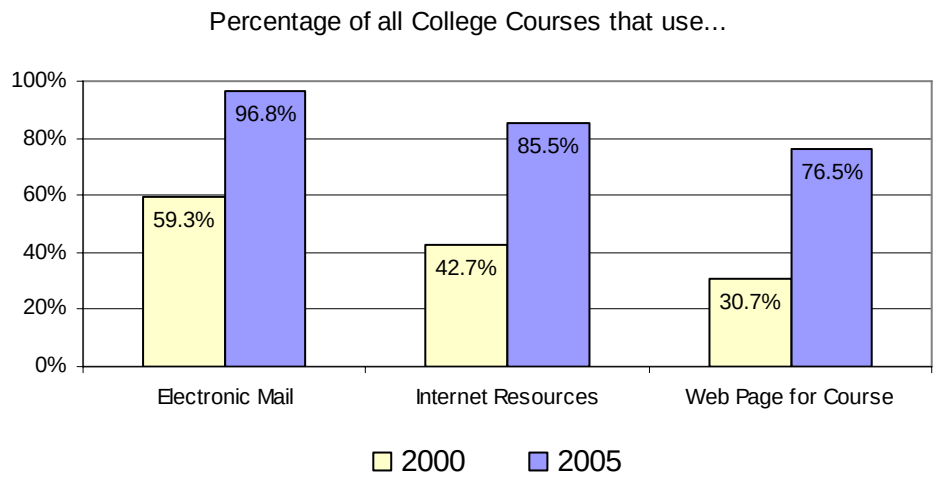
66 OTAN, 2001-2004.

67 Project IDEAL, 2005.

Exhibit 4:
Rising Use of Technology in Instruction



Source: The Campus Computing Project, www.campuscomputing.net

***Example*: University of Phoenix**

University of Phoenix (UOP) is a regionally accredited for-profit university with several programs licensed by the Department of Education. Founded in 1979, it is the fastest growing virtual university. University officials report that the online student body has grown from 49,400 in 2002 to 140,000 in 2005.[68] The University of Phoenix offers degree and certification programs to students on an individual basis but also partners with private companies and the military to offer career training and continuing education programs tailored to their needs.

Because UOP almost exclusively serves working adults, courses emphasize learners' needs by focusing on workplace applications and professional development. For example, instructors utilize a learning model that builds on students' previous personal and work experiences. In addition, this workforce orientation is reflected in the University's requirement that all instructors be employed in the subject area that they teach.

Even more so than its local "brick and mortar campuses," the online programs are especially geared to fit around the complex schedules of working adults. For example, the University of Phoenix Online offers a "rolling-cohort" enrollment model, which allows students to enroll in programs once a group of eight to thirteen students is formed. The UOP also differs from other online universities that offer "self-paced" study because its programs are strictly structured so that working students take only one class at a time and meet weekly course goals. The learning

experience includes asynchronous activities, group study, and meetings with an academic counselor.

UOP also prides itself on being an "outcomes-driven institution." To measure this, the university relies heavily on assessment. Students are tested in the application process, as well as before and after major coursework. Additionally, to ensure standardization, the university engages in the annual assessment of curriculum. Courses are divided into modules that students are required to complete over a short period. Instructors deliver content through online media and are not encouraged to "lecture" to students. Instead, learning is realized through task completion and group study with classmates. To further ensure that instructors adhere to the UOP's brand of education, courses are developed on a master curriculum calendar. These practices enhance the consistency of the courses offered but also raise questions as to the importance of academic freedom as less of the course content is left to the discretion of instructors.[69]

Finally, student participation in class activities and group study is a priority. To foster this, online class sizes are deliberately kept small. Classes are generally made up of eight to thirteen students, which makes them about 20 to 25 percent smaller than the university's traditional classes. This may also contribute to low class attrition rates. According to Jorge Klor de Alva, UOP's president, 97 percent of students who start an online course complete it, and 65 percent graduate.

68 Myer, and Swenson, 2005.

69 Kirp, 2003.

E. MEASURING SUCCESS

Evaluating the effectiveness of TBL programs does not follow a single established methodology. However, Donald Kirkpatrick's training evaluation framework is widely used to describe the functional needs for measurement of TBL programs. In this section, we describe the four steps of Kirkpatrick's training evaluation.[70] The added fifth step of ROI measurement has widely gained acceptance in industry.

1. **Reactions:** At this level, we measure the customer satisfaction of the learner. Many TBLs can integrate this level of evaluation directly into their learning management systems in the form of simple online surveys. Key questions include: Did the learner like the training? What aspects of the training could be improved? Would they recommend the training to others?

2. **Learning:** At this level, we measure the mastery of learning content, skill advancement using pre- and post-tests and self-assessments. TBL courses include quizzes and more formal online tests that measure learning progress. LMSs track progress over time and provide feedback to learners and to instructors. Typical research questions at this level include: What knowledge was retained? What skills were developed?

3. **Behavior (Transfer):** At this level we measure the impact of training on behavior. The goal is to learn how well learners are transferring their knowledge back into their workplace. This measurement rarely occurs directly as part of TBL initiatives and usually requires additional evaluation efforts. Key questions at this level include: What behaviors changed? How did this training affect on-the job performance?

4. **Results:** At this level, we measure business results that can be tied back to the training event. It is often described as the bottom-line measurement and may include a cost-

[70] Kirkpatrick, 1998.

benefit calculation. For accurate results, evaluators may use a control group who do not receive the same training or who do not receive any training at all.

5. **ROI:** Return on investment is a measurement widely used in industry as a metric to measure value of a specific investment. As a training metric, this level was added to Fitzpatrick's framework.[71] To calculate monetary ROI, an organization needs to identify the total financial benefits it draws from a TBL initiative, then subtract the total investment made to develop, produce, and deliver that program. A simple ROI formula looks like this:

   $$\frac{\text{(total benefit - total costs)}}{\text{total costs}} = \text{X 100 = ROI}$$

   In this calculation, it is particularly important, that all benefits are accurately identified and measured. This includes money saved by the organization. In addition to monetary values, ROI can also be applied to less tangible values, such as improved accuracy, improved timeliness, and higher retention of employees.

Though true impact of training is not easy to measure, there is ample evidence that effective training can have a substantial direct and indirect ROI. For example, a four-year study by ASTD showed that firms that invest $1,500 per employee in training compared to those that spend $125 experience on average 24 percent higher gross profit margins and 218 percent higher income per employee. In addition, a Louis Harris and Associate Poll indicates that among employees who say their company offers poor or no training, 41 percent plan to leave within a year. Conversely, of those that say their company offers excellent training, only 12 percent say they plan to leave.

[71] Phillips, 1997.

F. PROMISING APPROACHES AND EMERGING TRENDS

The preceding pages have made clear that TBL holds substantial promise. Evidence of its effectiveness, although sparse, also seems fairly clear—in comparison to traditional approaches, TBL generally seems to work at least as well in terms of promoting student learning.[72]

At the same time, a number of accounts of high drop-out rates and lack of user satisfaction suggests that TBL is by no means a sure-fire strategy. Indeed, the mindless transference of learning content from a traditional classroom environment to TBL seems sure to yield disappointing results. As Michael Allen remarks "Lurking behind many of today's slick delivery systems are shop-worn, passive learning paradigms that Socrates spurned in the fifth century B.C."[73]

Decisions whether or not to use TBL should balance its positive attributes, e.g. accessibility, flexibility, scalability, with these challenges. To be used effectively, TBL must exploit this delivery system's key advantages, adhering to some key principles.[74]

1. **Human interaction is important**. Interaction with instructors and peers can be important to learner satisfaction and can provide the reinforcement that learners need to gain competency. Interaction can be achieved electronically using synchronous means, but traditional face-to-face meetings might be preferred. For this reason, as we discussed earlier in this paper, blended learning strategies have emerged as a leading paradigm in recent years.

2. **Provide opportunities for active engagement**. As Dr. Larry G. Moyer rightly remarks, "e-learning that consists of reading material on a computer display or drill-and-kill exercises does not exploit the potential of TBL and is unlikely to be very effective."

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72 Marquardt and Kearsley, 1999.

73 Allen, 2002.

74 Based on Moyer, 2002.

Instead, learners should be provided with opportunities to the extent practical for discovery learning, peer activities and discussions, practice sessions, and the application of their knowledge. Indeed, although TBL generally has not been found to be overall any more effective than traditional learning, research does suggest that simulations can be particularly effective. Similarly, interactive multimedia programs seem to result in better comprehension, increased retention, and the effective transfer of skills and knowledge.[75]

3. **Make the content relevant and timely.** Building off a constructivist approach to learning, e-learning—as indeed traditional learning—must be perceived as relevant to learners and, to be mastered and retained, content must be connected to things they already know.

4. **Provide feedback and support.** TBL runs the risk of isolating learners as they proceed through their learning exercises. As we have discussed above, interpersonal interaction is critical to overcome this obstacle. Just as important, learners must be provided with feedback and support. When learners make a mistake, it is important that they know they made a mistake, why it is a mistake, and how it can be avoided the next time.

The field of technology-based learning is rapidly evolving in adopting these principles. New technologies emerge and old ones fall out of favor, as training designers and educators learn how to use these tools to increasingly better effect. Certain trends have also begun to emerge. Among these has been the shift to **online delivery**. While 10 years ago most TBL was still delivered offline, either via computer-based training, satellite conferences, or other distance learning modes, most of that delivery has now shifted online. With the ubiquitous access to high-speed Internet in the workplace, in education and even at home, the biggest barrier to online delivery has been removed.

The advantages of online delivery are obvious. For synchronous events, both infrastructure cost and event costs for online delivery are far lower than for satellite-based video conferences. For asynchronous delivery, dissemination costs are far lower online than via distributed CD-ROMs. In fact, for CD-ROM-based courses that dominated the TBL market in the eighties and early nineties, the content maintenance costs were higher than the original content design costs. In an online environment with content hosted on a central web server, changes and updates are done without any delays and at a much lower cost. This is particularly essential for time-sensitive corporate training.

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[75] Marquardt and Kearsley, 1999.

Another key development has been the adoption of **Learning Objects** (LOs) in building TBL. A Learning Object constitutes the smallest unit of instructional content that can stand alone to meet a learning objective. Learning objects consist of information objects, which in turn consist of raw content, such as graphic, audio, or text files. Learning objects are assembled into lessons, which are then assembled into courses. Working with learning objects rather than lessons as units of learning has the advantage that individual learning objects can be reused and rearranged for uses in multiple lessons and courses. Such learning objects are called Reusable Learning Objects (RLOs). This modular approach to learning has become particularly important in industry and the military, where learners need just enough knowledge delivered for a specific purpose and they need it just in time to achieve a specific objective. In a learning object model approach to TBL, content updates can be frequent and dynamic and trainers and even users themselves can arrange and rearrange them.

Each learning object contains an objective, an introduction, the informational content to meet the objective, a summary, and an assessment. Some learning objects also contain relevant practice activities. Learning Management Systems (defined in the Methodologies and Tools chapter) organize learning objects in a database and manage content delivery, user access, and user progress.

A software help system can serve as a good illustration of a practical use of learning objects. For example, a software help system may contain a set of instructions on how to insert a graphic file into a web page. The help system may also contain examples and a demonstration on how this is done. This set of instruction can be accessed from anywhere within the software using simple keyword search. It may also be shared among different programs that are part of the same software suite. In addition, the same set of instruction might be used as part of a demonstration or tutorial of the software. In each case, the same learning object is reused.

While learning objects within a single software help system can easily be reused, when educators or instructional designers try to do the same across an institution, a company, or even an entire industry, they often run into compatibility and inter-operability problems. To ensure that Web-based learning objects are accessible across different software platforms and learning management systems, the Advanced Distributed Learning initiative (ADL) of the Department of Defense developed the Sharable Content Object Reference Model (SCORM), as was described earlier. Vendors of LMS and authoring tools and TBL designers have voluntarily adopted SCORM standards and specifications. A learning object that conforms to SCORM standards is called a Shareable Content Object (SCO).

While these developments have begun to crystallize, three additional macro-trends are on the horizon that might guide the future development of TBL. These are:

1. **Rapid E-Learning:** Increased emphasis on rapid e-learning is likely to shift development of training content back to the subject matter experts and away from instructional training designers. This shortens the development cycle of new training content and reduces development costs. New, easy-to-use development tools allow content experts to develop professionally looking training content from their desktop.

2. **M-Learning:** With the wide availability of audio and video podcasting, iPods, MP3 players, and smart phones will become an increasingly popular delivery vehicle for e-learning content. This delivery mode may in the future integrate chapters, bookmarks, images, and video clips. E-learning will move from the home to the street, the gym and even the ski slopes and golf courses.

3. **Wider Adoption in K-12 Classrooms:** The use of blended learning models with an increased use of video and Internet searching as part of regular in-class and between-class activities is likely to be evident.

Some major public policy questions that were posed in 2001 as part of the "Vision of E-Learning for America's Workforce" report remain:[76]

1. How do we ensure consumer protection and high-quality learning in an open e-learning environment?

2. In a learner-centered system, what is the best way to assess what individuals are actually learning? How can we best certify learning results?

3. How do we promote equitable access to the technologies and the high-quality learning content that play a vital role in the success of e-learning?

In addition, the question of public investment in bridging the digital divide and in bringing e-learning to poor and underserved areas will continue to dominate discussions about TBL in education and government.

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[76] ASTD/NGA, 2001.

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