

## E-Learning Growth and Promise For the Developing World

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### The Status of E-Learning

A growing number of organizations are now delivering training and education over the Internet, including colleges and university, corporations, military institutions, and even secondary schools. Just last month, the Massachusetts Institute of Technology (MIT) announced that learning materials and syllabi for all courses were being put on the Internet for anyone to use. While access to the materials will not grant course credit with the institution, the faculty and administration determined that knowledge is for sharing and the Internet is the most efficient transmitter of knowledge ever available. The United States Army recently announced the launch of the Army U., a complete online university degree program available to all Army personnel.

There are an estimated ten million courses now online, and the U.S. alone reports about 700 e-learning companies. Some companies or institutions offer online tutoring to students at specific grade levels, ranging from primary through university; others offer courses only for corporations; some offer courses for individuals in career development and/or personal development; and many offer training in various management, finance and IT-related skills. Increasingly, training and support for teachers is occurring online, and a number of institutions now offer either partial or complete secondary diplomas through e-learning.

E-learning companies tend to fall into one of the following categories:

- *Providers of content – often corporate and IT training.* Within this category are three subcategories: companies that develop content and sell to all who choose to enroll; those that aggregate content developed by others; and those that custom design content for the specific needs of an organization. Two organizations that evaluate online content are [www.Lguide.com](http://www.Lguide.com) and [www.Brandon-Hall.com](http://www.Brandon-Hall.com).
- *Providers of learning platforms.* These companies provide a range of hard- and software technologies that facilitate the development and delivery of online courses, ranging from content creation to learner registration and course record keeping.
- *Learning hubs* or portal companies offer learners or organizations consolidated access to learning and training resources from multiple sources.
- *A complete package.* Some e-learning companies are attempting to do all of the above.

### The Future of E-Learning

Increased access to the Internet and greater bandwidth are both expected to increase the number of individuals moving into online learning. International Data Corporation (IDC) forecasts that there will be 320 million Internet users worldwide by the end of 2002, up from 97 million at the end of 1998. And broadband connectivity is expected to grow from approximately one million households in 2000 to almost 26 million by 2003 (Close et al. 2000). Broadband access increases the speed of Internet access and does away with the frustrating tedium of waiting for Web pages to download – a disincentive for the e-learning process. A study conducted by MediaOne found that households with broadband cable Internet connections averaged 22.5 hours of usage per week as compared with just 4.7 hours for households with dial-up connections.

In the past year, four US investment firms have conducted detailed market analyses of what they refer to as the e-learning sector, encouraging their clients to consider investing in e-learning companies. They project remarkable growth in online learning worldwide and have peppered the reports with dramatic statistics and claims. For example:

- John Chambers, CEO of Cisco Systems argues that, "Education over the Internet is going to be so big it is going to make e-mail look like a rounding error." (*Close, Humphreys and Ruttenbur, SunTrust Equitable Securities, March 2000*)
- The online training market is expected to nearly double in size every year, reaching approximately \$11.5 billion by 2003. (*Urdan and Weggen, 2000*)
- Venture capitalists see the growth potential of e-learning. Over US\$1 billion in private capital has been distributed to e-learning companies and more than US\$302 million in public equity was raised in 1999 alone. (*Close, Humphreys and Ruttenbur, SunTrust Equitable Securities, March 2000*)
- Knowledge services – education and corporate learning for the new economy – is a \$2-trillion industry globally. (*Moe, 2000*)
- By 2002, technology-based training will capture the majority of dollars for IT training, at 55% versus the

45% share captured by instructor-led methods. (Moe, 2000)

## The Advantages of E-Learning

There are a number of benefits to learning online that are unique to the medium:

- *Any time.* A participant can access the learning program at any time that is convenient –not just during the specific 1-3-hour period that is set for a conventional course. The episodes can be quick snatches at odd times or long late-night sessions. Cross-time-zone communication, difficult to arrange in real time, is as easy as talking to someone across town when using the Internet.
- *Any place.* The participants do not have to meet. That means they can be anywhere. International sharing is feasible. Individuals can log on at work, home, the library, in a community learning center or from their hotel when traveling.
- *Asynchronous interaction.* Unlike face-to-face or telephone conversations, electronic mail does not require participants to respond immediately. As a result, interactions can be more succinct and to-the-point, discussion can stay more on-track, and people can get a chance to craft their responses. This can lead to more thoughtful and creative conversations.
- *Group collaboration.* Electronic messaging creates new opportunities for groups to work together, creating shared electronic conversations that can be thoughtful and more permanent than voice conversations. Sometimes aided by on-line moderators, these net seminars can be powerful for learning and problem-solving.
- *New educational approaches.* Many new options and learning strategies become economically feasible through online courses. For instance, the technology makes it feasible to utilize faculty anywhere in the world and to put together faculty teams that include master

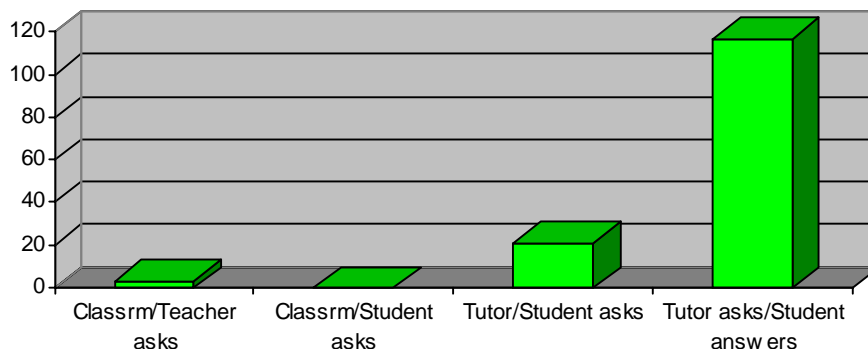
teachers, researchers, scientists, and experienced professional developers. Online courses also can provide unique opportunities for teachers to share innovations in their own work with the immediate support of electronic groups and expert faculty.

- *Integration of computers.* The online learner has access to a computer, so computer applications can be used without excluding some participants. This means, for instance, that a mathematical model implemented in a spreadsheet can easily be incorporated into a lesson and downloaded so all participants can run, explore, and refine the model and then share their findings and improvements.

## Does E-Learning Work?

The individualized interactivity provided by an Internet-connected computer is believed to contribute significantly to the effectiveness of the online learning environment. And even without the Internet connectivity, computer-based learning programs have shown compelling results in both effectiveness and efficiency. While no machine can come close to the quality of instruction that can be provided by a good human teacher working with a student one-on-one, teachers typically have 25 to 35 students to deal with at one time – and often many times that number. A well-designed computer-based or online learning program can offer much more opportunity for individualized interactivity than is available in most classrooms. Studies have shown that individualized learning environments are considerably more interactive. For example, as the graph below shows, the average number of questions a teacher asks in one classroom hour is three, and the average number of questions asked by one student during one classroom hour is less than one. However, when learners are in a one-on-one tutoring environment, they typically ask up to 21 questions per hour and tutors ask and students answer an average of **117** questions per hour.

**GRAPH 1: Number of Questions Asked and Answered in Classrooms vs. One-on-One Tutoring One Hour Session**



Source: Woolf and Regain (2000)

In a classroom, teachers are seldom able to spend more than a couple of minutes with any one student. Consequently, students must often practice new skills on their own. If the student does not understand the skill or concept, then he or she may be practicing problems or exercises incorrectly, or developing inaccurate conceptions.

A 1990 review of computer-based instructional programs using interactive videodisc (a precursor to CD-ROMs and DVD) to train adults across a range of sectors revealed quite positive findings. Of the 21 studies that compared the computer-based training with traditional instruction, all showed equal or significantly superior performance of the computer-based students, and eight studies found that these students learned in less time with savings ranging from 10% to 60% and from 4.7 hours to 8 hours (Capper, 1990). Studies represented a range of subjects, topics, sectors and settings, including health (giving intra-muscular injections or CPR), college science, management training, sales training, military terrain analysis, troubleshooting and repair of large and costly equipment, use of a 35 mm camera, use of hazardous materials in the workplace, and smoking cessation.

These studies and those listed in Tables 1 and 2 did not have the benefit of the increased interactivity and accesses to vast libraries of resources available on the Internet, and yet con-

sistently showed superior performance both in terms of higher learning achievement and quicker mastery of learning objectives. The results are likely to be even more substantial given Internet access, for which research evidence is still quite limited. Tables 1 and 2 show achievement and time-to-mastery comparisons between traditional computer-based instructional programs at various levels, and the more robust knowledge-based tutoring programs developed more recently, also called intelligent computer-assisted instruction (ICAI).

**Table 1** shows that on average, across levels of education and training, the 233 computer-assisted instructional (CAI) studies resulted in increased student performance from the 50<sup>th</sup> percentile to about the 65<sup>th</sup> percentile (Kulik, 1994, Fletcher, 1997). But the three studies of the more recently-developed knowledge-based tutors resulted in increased learner performance from the 50<sup>th</sup> percentile to about the 84<sup>th</sup> percentile. **Table 2** shows that this increased performance is accomplished in 55% less time than traditional instruction, compared with an average of 29% reduced time for CAI. In fact, contractors who bid to develop online training for the U. S. military bid on the promise of reducing time to mastery by 50%, and one study of Italian Air Force training reported an 80% time savings. Such time savings can result in substantial cost savings (Fletcher, in press).

**Table 1: Effect Sizes Achieved with CAI and Knowledge-Based Tutors**

Instructional Setting and Courseware Type	Number of Studies	Effect Size	(%) Performance Increase Compared to Traditional Instruction
Elementary School (CAI)	28	0.47	68
Secondary School (CAI)	42	0.42	66
Tertiary Education (CAI)	101	0.26	60
Adult Education (CAI)	24	0.42	66
Military Training (CAI)	38	0.40	66
<b>Average Effect Size (CAI)</b>	<b>233</b>	<b>0.39</b>	<b>65</b>
Tertiary Education (Knowledge-Based Tutors)	1	0.97	83
Military Training (Knowledge-Based Tutors)	1	1.02	84
Secondary School (Knowledge-Based Tutors)	1	1.00	84
<b>Average Effect Size (Knowledge-Based Tutors)</b>	<b>3</b>	<b>1.00</b>	<b>84</b>

Source: Woolf and Regain (2000)

**Table 2: Reduction in Time Needed to Reach Instructional Objectives for CAI and Knowledge-Based Tutors**

Instructional Setting and Courseware Type	Number of Studies	Percent Time Reduced
Military Training (CAI)	23	28
Military Training (CAI)	N/A	30
Tertiary Education (CAI)	17	34
Adult Education (CAI)	15	24
<b>Average Time Reduction (CAI)</b>	<b>55+</b>	<b>29</b>
Tertiary Education (Knowledge-Based Tutors)	3	55

Source: Woolf and Regain (2000)

ICAI programs are able to generate and solve problems, store and retrieve data, diagnose students' misconceptions, select appropriate teaching strategies and carry on dialogues with students. They incorporate some very sophisticated conceptions about learning, and, for the most part, are designed by researchers who have devoted a great deal of time to the study of how people think, learn and solve problems, and thus offer useful standards and expectations for the use of computers as tools for learning

Courses designed for online learning tend to be much more richly developed than are typical in-person courses where the instructor expects to be able to provide clarifications as questions arise. In fact, interviewed e-learning directors stress that it is important to completely reinvent how a course is taught when it is put online - that simply putting PowerPoint slides onto the Web will not result in high-quality learning. They claim that the online courses they develop are highly robust, are specifically designed for Web-based learning, attempt to have all the learning resources embedded into the course, and include detailed tracking and reporting tools.

Some e-learning companies also tailor material to their client's needs and provide instant updates on the latest developments in their client's field of interest. This means that the information disseminated to the individual learner is the latest available. In business, where knowledge is the greatest asset and biggest profit-maker, this is perhaps the ultimate expression in the Internet's cost-effectiveness.

Ruttenbur et al. (2000) report that "business models are continually (and quickly) evolving in this nascent industry" (p.37). What remains constant, though, is the need for better ways to provide an education at the lowest possible price. For a company or university to remain competitive in the field of Web-based education, it must adapt to both changes in technology and the requirements of its clients.

### Promise for Development

Most developing countries have tremendous education and training needs. Few have even close to adequate numbers of IT professionals and most companies and government agencies will need to spend considerable investments in preparing their current staff to use information technology in their jobs. The overwhelming demand for secondary and tertiary education is an issue that will not go away and will have to be addressed in some way or other. Internet based learning offers the possibility of expanding that access. Upgrading of government staff, health workers and teachers is an ongoing process and the current training-of-trainers approaches often suffer from quality dissipation as the training works its way down the cascaded system. The plague of HIV/AIDS is exacerbating already existing shortages of trained teachers and

other workers and in some countries, two people are being trained for every one that is needed to replace those lost to this ravage.

Clearly we cannot expect that most individuals will be able to afford a computer at home. But a viable option is to establish a nationwide network of community learning centers stocked with computer laboratories with broadband access and staff who are trained to access online distance education opportunities and provide tutoring support to individuals and groups as they engage in learning activities. Such centers can be connected to schools, hospitals, clinics or other community service centers where community members congregate and the existing needs are strong.

We don't yet know what it will take to make such centers work, but with the compelling evidence in support of computer-based learning and the growing array of learning opportunities available through the Internet, it seems worth the effort to experiment, study, refine and disseminate knowledge about this new approach to education and training.

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