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ECONOMIC EVOLUTION, HUMAN CAPITAL INVESTMENT, AND ADULT DISTRIBUTED ELECTRONIC LEARNING: A LITERATURE REVIEW

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ABSTRACT

The nation's social agenda for improving education and training has converged with national economic forces. The emphasis on educating and training the workforce, growing demands for ever-improving productivity, and significant technological advancements have resulted in new tools to deliver education and training when and where it is required. This paper discusses the economic revolution and its impact on the workforce. The emergence of an effective, proven, and pedagogically sound way to deliver education and training through Adult Distributed Electronic Learning is providing new opportunities for gaming and simulation to impact learning as never before.

FROM INDUSTRIALIZATION TO KNOWLEDGE AND INFORMATION

In *The Knowledge Value Revolution*, Sakaiya (1991) took the reader through the evolution of society from hunter-gatherers, into agricultural societies, and then on to industrialization. In the 1980's, significant declines in the market share of manufactured products exposed a crisis in quality, and W. Edwards Deming's methods for continuous improvement (in what became known as Total Quality Management) were the focus of the nation's organizations. His system for improvement, published in *Out of the Crisis* (Deming, 1986), had business, industry and government embracing quality circles, increasing employee participation, and implementing statistical process controls. His list of 13 points for constant improvement included: "Encourage education and self-improvement for everyone" (p. 86). Deming emphasized that advances in competitive position have their roots in knowledge, that people must constantly improve through education, and that there was no way to know when the learning obtained by an investment in education would contribute in the future. Conceptual learning by workers today has a direct affect on quality improvement as employees assess cause/effect relationships and design abstract concepts and theories to explain their experiences. As members of teams, their use of this conceptual learning helps them to understand why events occur through the use of scientific principles, determination of variability, and data analysis (Mukherjee, Lapre, & Wassenhove, 1998).

Technology has evolved from supporting industrial processes to saving energy, creating adaptable and multi-functional products, and disseminating information. The concurrent introduction of robotics, computer-controlled machinery, and the spread of high-speed Internet access have fundamentally changed the world of work (Baldwin, Damielson, & Wiggenhorn, 1997; Organization for Economic Co-Operation and Development [OCDE/GD], 1997).

THE KNOWLEDGE WORKER AS A CAPITAL ASSET

The early 1990s brought increasing emphasis on the need to invest in people. Human Capital has been defined as: "The acquired skills, knowledge, and abilities of human beings. Underlying the concept is the notion that such skills and knowledge increase human productivity, and that they do so enough to justify costs in acquiring them" (Hornbeck & Salamon, 1991, p. 3). This remains the generally accepted definition today.

Crawford (1991) and Sikaiya (1991) emphasized the central role that information and knowledge play throughout the economy as they replace physical capital as the source of competitive advantage. These changes in society, the economy, and the business world have resulted in the rise of Crawford's "gold-collar workers". These college-educated professionals apply highly specialized knowledge to areas of business, government, and industry such as finance, marketing, materials, education, and health care (Hagen, Hassan, & Amin, 1998). This move to a knowledge and information based economy has also changed the very nature of work itself. For example, the widespread deployment of computers and advances in software has allowed users to do the work once reserved for specialized computer operators and data entry personnel. Today, managers and workers also find themselves responding to an explosion in information and data, higher levels of responsibility, and increasing demands to constantly improve their cognitive skills (Greenspan, 2000; Parks, 1995).

These changes have resulted in a dramatic shift in the emphasis of educating and training the workforce. Competitive advantage in a technological world is found in managing information, and the most important means of production has become the human mind. The knowledge possessed by the workforce is the key to innovation and is a rare expandable, self-generating resource. Corporate Chief Executive Officers know the impacts of these changes. In a study of 1,000 CEOs, Hagen et al. (1998) found that while determining strategic direction was the first of six options of importance in executing corporate

strategic leadership, 91% ranked developing human capital number two; above the researcher's expectations.

In the 1950's, a high school graduate could reasonably expect to know as much as 75% of everything that was required to remain successfully employed for life, that figure is now approaching 2% (Guglielmino & Guglielmino, 2001). The global economy has been fundamentally changed, and those organizations that hope to be successful in this new reality will have to continually expand their knowledge base by constantly investing in the education, training, and development of the workforce through a lifetime of learning.

THE GROWING FOCUS ON EDUCATION AND TRAINING

Kuchinke (1995) and Senge (1990) encouraged management to respond to this new environment by leading a major change effort. No longer would business as usual lead to greater organizational performance, rather "Learning Organizations" would strategically encourage and support learning at all levels from both past experience and by acquiring new knowledge. In *The Fifth Discipline*, Senge applied systems thinking principles to help managers understand the interrelationships of personal mastery (placing knowledge into practice), shared vision, and team learning (combining personal mastery within and among teams). And, this constant learning takes place not only in organized education and training programs, but also through unsystematic, self-selected education (Trentin, 2002). Those individuals with strong educational backgrounds have an increased ability to synthesize information, generalize concepts, divide information into categories, draw inferences, and separate fact from opinion (Crawford, 1991; Hitt, Bierman, Shimizu, & Kochhar, 2001).

The retention of top talent has also become a key management focus in the new economy. Wellins and Byham (2001) estimated that as many as one in five senior (and one in four middle) management positions could be vacant by 2005. In government, Figura (2001) reported that the GAO had added human capital to their list of high-risk management issues as more than 900,000 government employees neared retirement eligibility. Figura attributed poor succession planning, mismanaged downsizing in the 1990s, and a previously low emphasis on education and training as contributing factors to improperly preparing for these losses.

Today, employees with the highest levels of intellectual capital have become volunteers. If these workers are not happy and committed to the organization they will leave, negatively impacting organizational cognitive systems and institutional memory (Bernhut, 2001; Kuchinke, 1995; Popper & Raanan, 2000). This point was reflected in Ferguson's (2001) study of the real estate investment trust industry, which found that the firms with the highest employee retention rates were also the ones who provided the best education, training and development programs. The demand for highly skilled and knowledgeable employees has also vastly increased the need for development plans that provide promising candidates with detailed education and training goals (Kwang & Creighton, 2000; Tansky & Cohen, 2001). Chief Financial Officers (who are deeply involved in corporate long-range planning) should be including human capital positioning, succession plans, and human capital investments as a significant part of their efforts (Zwell & Ressler, 2000).

The military has recognized the growing importance of their workforce education and training programs. Each of the services is encouraging officers and enlisted personnel to seek increased education because it broadens the individual, develops critical thinking skills, and teaches how to thoroughly research, analyze and articulate problems and their results (Schmidt, 1996). In 2002, the Department of Defense released a Rand Corporation study (2001) as the *Military Personnel Human Resources Strategic Plan* that documented the changing role of work in the military as technology moves many tasks once completed by managers to the enlisted employee.

The attention being paid to employee development is not restricted to business, government, and the military. In 2001, the Chicago Federation of Labor began the Manufacturing Workforce Development Project, whose goal was to redesign and reform workforce education and training to contribute to retaining and developing high wage manufacturing jobs. Swinney (2001) attributed inadequate development programs for the movement of high wage jobs out of the area, and noted that these programs are the entry point into understanding management issues such as production systems and technology design.

Whether in corporate America, government, non-profit organizations, the military, or the labor movement, workforce education, training, and development have taken center stage. Clearly, if organizations are to remain competitive, employees at every level must be encouraged to strive to increase their education, seek regular training opportunities, and recognize the need for a lifetime of learning.

LEARNING AT A DISTANCE

For organizations to innovate, remain competitive and increase productivity, they need all of the benefits a well-educated workforce provides. They have, however, encountered employees who are time stressed, increasingly resistant to loosing family time, and who want alternatives to travel, night school, and traditional classroom and seminar instruction. The need to support lifelong learning in the workforce has driven the demand for new methods of delivering education and training when and where it is needed.

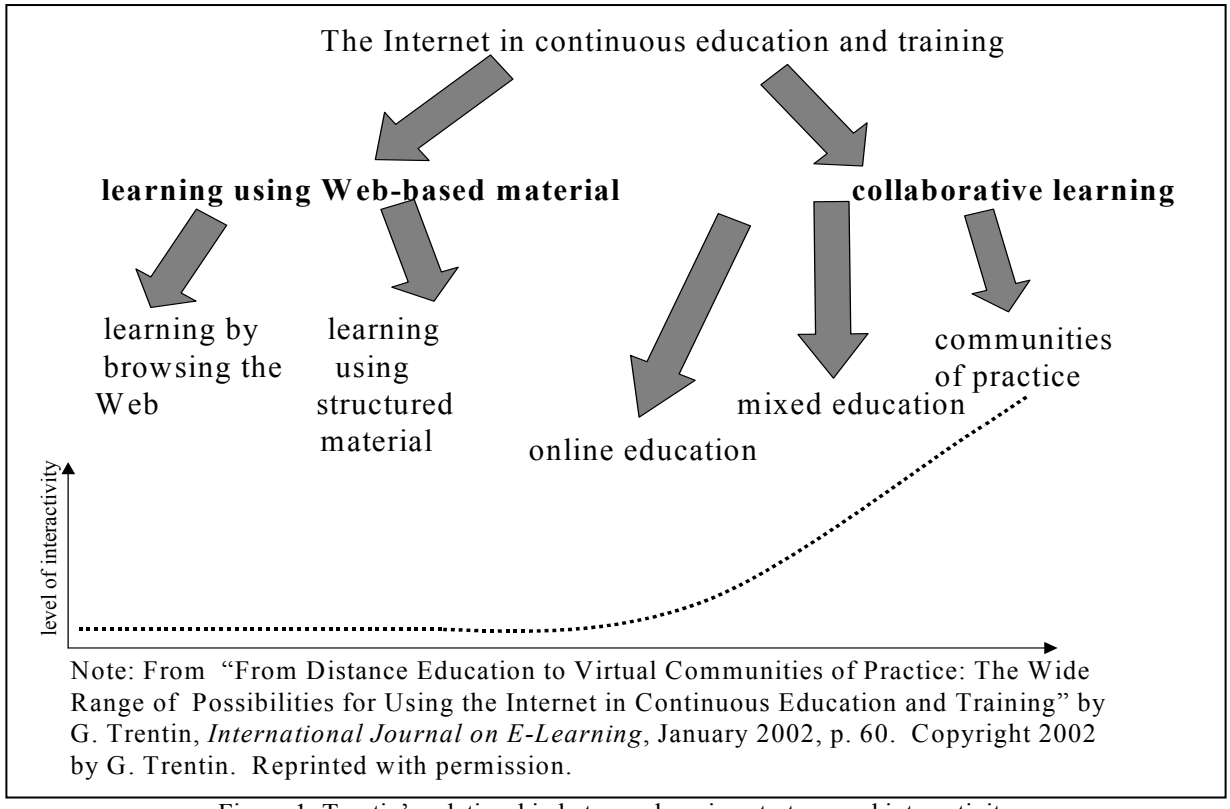
Appelmans (2002, p. 2) reviewed technology's impact on higher education and marked the period 1984-1993 as the start of a major evolution in the classroom with the introduction of desktop computers to provide multi-media capabilities and computer-based training. In his timeline, he also placed the first wave of electronic learning in the 1994-1999 timeframe as email, media players, HTML and basic JAVA programming began to see the Internet augment classroom courses and/or take learning into the virtual classroom, albeit at what has become known as low fidelity technologies. An IBM White Paper (2002, p.3) by Lotus Software described this learning as Tier 1, with basic page turning (and possibly viewing audio/video recordings) as the prime pedagogical method.

In 1999, an Institute for Higher Education Policy report discussed the deployment of these new technologies, and the

need to develop a new understanding of what "distance learning" meant. They found that as technology had evolved, the definition now had to include synchronous learning (teacher and student present at the same time in two different places), and asynchronous learning (students/teachers do not have person-to-person direct interaction at the same time or place). Adult Distributed Electronic Learning (ADEL) had advanced to a point where experience and research had proven that the delivery of education and training content to adults at a distance through the use of computer technology and the Internet was a safe, dependable, pedagogically sound learning option. ADEL is now conducted to fully deliver content (e.g. online and Computer Based Training [CBT] courses), and/or through "mixed learning" (face-to-face teaching combined with self-study [reading articles, doing research, etc] through an online component).

Appelmans (2002) placed the advent of electronic distributed learning (the second wave of e-learning) as we know it today around 2001, with high fidelity multi-media applications, streaming audio/video, web-based learning modules and courses, and IP network applications dramatically impacting the delivery of education and training. It was in this period that technology brought the rapid implementation of active learning methods to the delivery of education and training with case-based studies requiring students to do research online, then analyze and synthesize the problems presented. As well, interactive games and multi-media (or actual) simulations grew in their use (Lotus' Tier 2). These new methods have also placed training on the desktops of employees, permitting the delivery of just in time learning and performance support.

By 2001, the growth of the Internet was fully challenging course designers/instructors to re-think their pedagogical approaches. In distributed learning, a direct relationship between the level of interactivity (interpersonal communication) involved and the approaches for applying them effectively developed. As shown in Figure 1, Trentin (2002) described how at the low end of the application of technology to learning, delivery of the course materials is structured for individual study at a distance. This end of the spectrum uses the web to convey the material, but it could be delivered by other means (e.g. CD-ROM, correspondence courses). As the course's use of technology rises, assisted learning still has the student downloading the material, but a tutor or instructor is available to provide assistance. At the high end (what Lotus [2002] described as Tier 3), learning takes place through the full range of course materials, learning support, and collaborative learning activities between and among instructors and students. Virtual classrooms, electronic teams, threaded discussions, and web conferencing now permit collaborative and experiential learning to take place worldwide and in real time. A major impact of this change should not be missed. The ability to provide for electronic teams, web conferencing, and distributed work has now permitted the learning environment to fully reflect how many employees are expected to actually accomplish their tasks in the workplace today.



Note: From "From Distance Education to Virtual Communities of Practice: The Wide Range of Possibilities for Using the Internet in Continuous Education and Training" by G. Trentin, *International Journal on E-Learning*, January 2002, p. 60. Copyright 2002 by G. Trentin. Reprinted with permission.

Figure 1: Trentin's relationship between learning strategy and interactivity

Oblinger et al. (2001) and Webb (2001) found that ADEL was delivering high quality education and training services with the introduction of abstract concepts through text, and with the full range of multi-media stimulations to merge into active and experiential learning environments that let students learn through discovery and at their own pace. Research has also shown that the students most likely to succeed in ADEL programs possess the traits that businesses prize: attention to detail, perseverance, they are highly organized, and they set and achieve their goals (Diaz, 2002; Rosenbaum, 2001).

EDUCATION AT A DISTANCE

In 2001, 84% of colleges and universities were offering some form of online distance education and the fully accredited virtual university had arrived (Oblinger et al., 2001), permitting the student to select from colleges and universities worldwide. An analysis of the ADEL marketplace among British colleges and universities by the Council for Excellence in Management and Leadership (2002) found that there was considerable market potential for a diverse range of business school offerings through distributed learning.

Gartner Dataquest (2001) conducted primary research with 110 CIO-level personnel at colleges and universities that focused on distributed learning technologies. They found that the adoption of ADEL in higher education was based on a group of divergent forces that included a commitment to customer service, protecting the integrity and relevance of the institution's brand, and to maintaining a competitive position for the working adult's tuition. On the downside, they also found that interest in ADEL, especially among senior academic program policymakers, was being driven by unrealistic ideas about the potential financial and pedagogical benefits. And, Jeffries (2000) also noted that one of the key problems schools often face in their ADEL programs is that it requires the structure and management of a business enterprise, which is very often different from traditional approaches to academic programs.

Higher education is finding benefits to embracing ADEL. For example, cost avoidance has been identified as a major benefit [e.g. distance learners do not need additional classrooms, dormitory facilities, and parking] (Oblinger et al., 2001). Hartley (2000) documented benefits to both teachers and students as the student becomes more involved in their own learning, and Trentin (2002, p. 56) also noted benefits in communication in that: "…the real educational value of the Internet lies not so much in substituting the telephone or mail service, but rather the potential to bring about new forms of distance interaction". These benefits obviously relate to the delivery of high quality training as well.

There are also problems being documented such as Greenagel's (2002) overview of the issues facing higher education as they moved to e-learning. Among those discussed were that many content developers do not understand how people learn, measures of effectiveness are based on such easy to gather data as student throughput, technology was driving strategy (i.e. what was created was based on the technology available rather than improving the technology), and inexpensively developed (but poor) courses were pushing more expensive (and effective) courses out of development consideration.

Trentin (2002) discussed course design issues. When ADEL material is simply developed by placing existing material on the Internet, designers often only replace the post office with the web when new pedagogical approaches using active learning and collaborative technologies are called for. Heerema and Rogers (2001) attributed part of these issues to be related to a push for quantity over quality, and a Web-Based Education Commission (2000) report also expressed concern over student access to ADEL courses over the web, noting that there were clear institutional disparities. Their research found that 58% of all postsecondary students owned their own computer, but that this included a high of 79% of students at private universities, with only 39.6% of those attending public two-year institutions owning their own. Their concerns centered on the fact that community colleges enroll higher percentages of the postsecondary student population and have a larger percentage of higher education's minority students. The education community is realizing the benefits of ADEL and studying and improving their approaches, while challenges remain.

TRAINING AND THE NEW DELIVERY METHOD

The business community and government have also embraced Adult Distributed Electronic Learning (ADEL) for the delivery of training and development material (including from institutions of higher education). Fry (2001) discussed some of the key drivers of this investment in ADEL systems and software that include cost savings, convenience, the rapid obsolescence of knowledge and training, and the need for scalable, cost-effective delivery methods that efficiently support lifelong learning. In an industry specific example, Asirvatham (2000) encouraged those in the real estate industry to investigate the benefits of synchronous and asynchronous delivery to overcome issues of divergent work schedules and a geographically disbursed workforce, and Robb and Geffen (2000) added those related to professional education such as the instant access to continuing education, and the flexibility of tailored training.

One key point for managers to consider is that delivering training and education through electronic means requires corporate training specialists and managers (and college and university staff as well) to delve deeply into information technology aspects that they once left to the specialists (Masino, 1999). Yet, despite the need to truly understand the technology involved and the relatively high initial investments in hardware and software to be made to bring an ADEL course online, once organizations do so they are finding that they have the ability to keep course content current relatively easily, and to provide just-in-time learning and performance support both synchronously and asynchronously.

Other benefits that have been documented include the reduction (or elimination) of travel costs for employees (which also contributes to increasing productivity as the worker remains in the workplace). Human resource overhead can be reduced through systems that track employee course progress, completion, and aptitude for the subject matter automatically,

and the American Society of Civil Engineers found a direct return with the cost of training seminars going from $700 to $99 per participant (Oliver, 2001; Rosenbaum, 2001). Rosenbaum also found that among engineers, who like those in several fields are required to obtain continuing education credits, online systems placed training into the hands of junior personnel who would not normally be high on the list for travel to seminars.

Aldrich (2003, p. 7) stated that: "the United States military may be the greatest training organization of all time". There may be agreement (or not) with his statement, but one fact is clear, the military is moving rapidly to ADEL education, training and development deployment. In addition, their research and development efforts through organizations such as the Army's Simulation Technology Center, the Navy's Orlando, Florida research center, Defense Advanced Research Projects Agency (DARPA), and their cooperation and funding for the Advanced Distributed Learning (ADL) program with leading academic institutions shows that they intend to take distributed learning simulations to new heights. The General Accounting Office (2003, p. 13) estimated that, as of April 2002, potential ADEL students from all of the services had reached 2,940,737; clearly they have a vested interest in the successful application of ADEL technologies. In one example of how the services are embracing ADEL, a Navy website (http://www.excel.navy.mil/training_rev.htm) discusses their future:

> eLearning, distance education or computer-based training is going to be a standard part of Navy training. The ability to provide efficient and effective, interactive, self-paced learning opportunities on demand will give Sailors greater control over their career. For the Navy, these tools will improve readiness and reduce the amount of time Sailors spend away from their command attending schools.

TECHNOLOGY INFUSED PEDAGOGY AND DELIVERY: NEW FRONTIERS

Electronic learning has presented pedagogical opportunities that were simply unavailable or far too costly to deliver before. The ability to reach the cognitive knowledge and comprehension levels of Bloom's taxonomy through electronic distance learning methods has been clearly demonstrated in high quality content that has been successfully delivered for several years. Evolving technology such as simple audio and video streaming permit the student to select from options for the delivery of information in ways that best suite their learning styles. The availability of high quality simulation technology on personal computers and advancing technology now assists in providing flexible pedagogical approaches to be used that were once too difficult to design or often too time consuming to deliver. True, high quality computer-based games and simulations can be expensive to develop when done right (Bosman, 2002), but the cost per student drops significantly over time and the potential is unlimited.

The content portion of education and training programs is, of course, still viably (and often most appropriately) delivered in the classroom, as well as through online courseware. Business games, for example, have been successfully used for many years and are still widely employed to teach problem solving and decision-making skills through experiential and action learning approaches (Lainema, 1999; Pivac, Dziabenko, & Schinnerl, 2003). However, games and simulations delivered through computer technology (i.e. CD-ROM, school intranets and online) are becoming widespread in classroom courses, in mixed learning, and online. These games are now increasingly taking advantage of lessons learned from the computer gaming industry.

Where games and simulations in the classroom have often presented time and logistical issues, learning content delivered through computer gaming and simulations has been shown to fully engage and immerse the student(s) in the learning environment, many times without them even being aware that learning is taking place (Klaila, 2001; Ravid & Rafaeli, 2000). Possibly, one of the key benefits to business education and training through the new technologies is that they more accurately reflect a business environment that is increasingly distributed, with technology being used for collaboration across the organization, and for collaborative decision-making. Individuals now work in an environment where space and time do not drive the organization, and employees routinely work both synchronously and asynchronously (Klein & Guler, 1998). Thus, distributed learning with these technologies is more accurately reflecting the real world of work for the student and it presents course developers with real opportunities for the delivery of games and simulations that can place the student into an environment that fully reflects the ever-evolving business world.

Technology-based distance learning also permits new ways to approach the application, analysis and synthesis levels of Bloom's taxonomy through the use of high-level games, scenarios, and simulations. These methods present the opportunity to meld more traditional education and training with experiential learning by placing the learner into a realistic environment to practice and apply knowledge and skills, including self-organizing, assigning tasks within teams, and being able to work with real world interdependencies and management domains (Kindley, 2002a; Klein & Guler, 1998). These are clear advantages of technology-based computer gaming and simulation. Others include dynamic environments that immerse the student in both (or either) internal and external business environments, with time not only being a factor but also a flexible one to be employed and manipulated by the instructor and/or course designer so that students can be time stressed in their decisions, forcing mistakes and learning.

In these games and simulations, Lainema (2000) argued against conventional batch processing (all decisions are made and input prior to time moving forward and all behavioral choices are pre-defined) approach in business games because it does not adequately reflect real world decision-making. Batch processing (discrete event) also does not permit the student(s) the possibility of changing decisions based on their competitor's actions. By adopting continuous interaction in real-time, games and simulations will more accurately reflect the real world's turbulent business environment where many decisions have an immediate impact. And like the real world, students can also see the business environment comprehensively while performing their tasks (Kindley, 2002b; Lainema, 1999; Lainema, 2000).

Games and simulations can also be developed that contain a wide variety of complexity (e.g. decisions to be made, number of companies involved, number of products, amount of interactivity, etc), permitting the instructor to tailor each game/simulation to the appropriate level for the group being taught. Kindley (2002b) described several simulation types that also contribute to flexibility (i.e. activity, soft skills, process, business, product, etc), and Bosman (2002) and Rafaeli, Raban, Ravid, and Noy, (2003) described many current uses of simulations in business such as in teaching software applications, situational, technical and procedural simulations, management skills, and in creating virtual worlds. Other pedagogical advantages not to be overlooked are that online games and simulations provide a wide degree of flexibility to the online or classroom developer and deliverer of education and training content. Individual students can be assigned student on computer games/simulations at any time, including nights and weekends, and even with multiple students these can be executed outside of classroom course time (Ravid & Rafaeli, 2000).

CONCLUSION

The core of the business world has been fundamentally changed, and the rapid advance of technology has contributed to knowledge and information becoming the center of wealth creation. Students at every level of education and training today can fully expect the future to demand constantly increasing skills, distributed work environments, and the need to collaborate. These requirements are not only pushing the ADEL market for student convenience, but also because it places learning into an environment that the student is (or will) becoming familiar with in the world of work.

While PowerPoint presentations, graphics, hyperlinks and multimedia clips have been the predominant uses of ADEL technology, online discussions and debates, group projects, role-playing, virtual laboratories, interactive games and simulations are expanding (Bates, 1999; Hiltz & Wellman, 1997). However, as Head, Lockee, and Oliver (2002. p. 262) cautioned education and training professionals must remember that it is not technology that produces learning outcomes, it is merely one of many variables that contribute to learning. It is here that the rich history (Faria, 2001) of gaming and simulation (and the research associated with it) in business education has much to contribute. The knowledge and experience gained, in the author's opinion, must contribute to the pedagogical foundations of future distributed learning systems.

Aldrich (2003) discussed the future of e-learning (ADEL) at length. The move of modeling, gaming and simulations onto computers and the Internet is unlimited, and he clearly shows how this can bring distributed learning to its full potential. If distributed learning is to achieve this potential, ultimately it will likely not be found in page turning courses (though they have their place), but rather it will be through placing the student into an experiential learning environment where the application of learning takes place through games and simulations.

The future will surely be exciting. Ongoing research and development is now beginning to bring intelligent agents into learning software tools in a wide variety of subjects. These agents will react to actual performance of the student (or team) in the environment, pushing them to their limits, and with the potential to enhance learning as never before. One of the key needs if the possibilities are to be achieved will be to ensure that affordable tools directly contribute to learning, especially in the gaming and simulation world where the potential for costly, ineffective learning tools may be greatest. The experts in the field must take the lead in researching and developing the best applications of these tools.

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