Distance Learning

A Way of Life-Long Learning

Special Report #63
September, 2005

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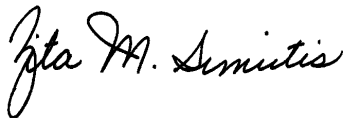
Foreword

The U. S. Army Research Institute for the Behavioral and Social Sciences (ARI) has conducted multiple research projects to identify technology and methodology which lead to high quality distance learning (DL). ARI completed these research efforts in coordination with the U. S. Army Training and Doctrine Command (TRADOC) under a Memorandum of Agreement signed in 1997 to examine the use of distance learning.

This report is intended to inform the reader about the potential of DL to meet life-long learning needs. To do this, the report places DL in an historical context and presents recent research completed by both ARI and others. The objective is to explain how instruction can be more applicable to real-world tasks and be engaging to learners while, at the same time, effectively bringing that instruction to learners and additional support to instructors. The report also provides a framework for developing more effective DL with a look towards ongoing progress.



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"All men by nature desire knowledge."
— Aristotle

Introduction

Modern learning technology assumes various names: distance learning, distributed training, computer-based training, web-based learning, or advanced distributed learning. No matter the name, the basic concept is using computer technology for instruction with no instructor or trainer immediately present. Technically, distance learning can include correspondence courses and other forms of "computer-free" instruction, but we will focus on the use of computer technology since it is the predominant form today, and will likely continue to be in the future.

The instructional approach of distance learning – or DL – has many benefits but has yet to reach its full potential. Emerging methods and technologies are improving the DL experience for Soldiers in three ways: (1) making it more realistic, applicable, and accessible; (2) making it more engaging; and (3) creating opportunities for better learner interactions without overloading the instructor. Such improvements offer enhanced learning opportunities for Army Soldiers and other learners. The following report explores the evolution of instruction and describes the

Soldiers using both computers and books to learn.

potential of DL as a way to meet life-long learning needs. This report places current DL practices and advancements in the context of the ongoing evolution of instruction.

Background

Evolution of Instruction

The earliest forms of instruction were realistic, engaging, and personal, but were not available to many people. In ancient Greece, philosophers taught the lucky few by lecturing and tutoring. For example, a young Alexander the Great had Aristotle as a personal tutor. For centuries after that, word-of-mouth played a major role in instruction since there were few written books and most people could not read or write. Learning occurred through personal experience and personal interaction with a mentor or teacher. Individuals studied with a philosopher to learn philosophy, a cobbler to repair shoes, a blacksmith to shape metal, and a warrior to fight. Apprenticeship or learning through experience with a seasoned professional was a way to get ahead. It best suited the learner by customizing education to individual abilities and interests. The disadvantage of such personalized instruction was its dependence on extensive instructor time that limited the number of people who could benefit.

The invention of the printing press in the mid-15th century brought a shift in potential learning opportunities for large numbers of people. The printing of books provided the opportunity for many to gather information and learn about new ideas. This established the foundation for a kind of “distance learning,” where learning could take place without an instructor present. However, the original distribution of books was organized poorly and the population’s literacy rate was low.

In fact, the use of books didn’t catch on for mass education in the United States until the Industrial Revolution required a large educated workforce. At that time, the school system was designed to cater to mass education. In a system with one instructor for many

students, textbooks were a way to supplement lectures and insure the constancy of what had to be learned. This “assembly line” education system, one of learning and recitation, was efficient and it churned out students ready to face the demands of our nation's industry. We were able to provide instruction to a large number of learners, but it led to an educational system that was less personal than before. Learning was standardized, boxed, and wrapped, no longer customized to the individual. As a result, advantages of learning in a personalized environment as with a one-on-one tutor were less likely to occur.

Education for Today’s Soldier

Today’s educational needs have shifted, with increased emphasis on decision-making, collaboration with others, and information management. This is particularly true for the U.S. Soldier who must supplement set routines with the ability to be flexible and adaptable (Campbell, Throne, Black & Lickteig, 2003). The need is for more individualized instruction which leads to improved learning outcomes (Bloom, 1984). It is essential we have a system that is readily available to everyone and teaches both content and cognitive strategies. In addition, such an instructional system will best serve Soldiers by being realistic, engaging, and personal. Regrettably, 20th century systems for mass-education do not meet these individualized needs of 21st century learners.

As with the printing press, DL technology has now become an engine of change. For example, the Internet provides access to an incomprehensible amount of information. Such a tool allows individuals to seek out what they want to know, putting the learner at the center of the process. To better understand the need for DL, consider two questions: “Where can I go to learn when there’s no scheduled class to attend or no instructors or mentors are immediately available? How often does that happen?” DL gives Soldiers the capability to learn what they need to know, when they need to know it, without waiting for an available seat in a classroom or for a subject matter expert. DL can allow instruction to continue beyond Advanced Individual Training (AIT), beyond the

schoolhouse, and in addition to New Equipment Training (NET). Continual training is a must to keep up in an Army where Military Operational Specialties (MOS), equipment, and missions are changing faster than ever before.

As Alexander the Great had Aristotle as a tutor, what each Soldier in the 21st century needs is a "personal Aristotle" — a system always available to provide customized quality instruction. Such a system will help to fill gaps in a Soldier's knowledge, to guide learning, and to answer questions at anytime and anywhere. With the Internet and use of other instructional technologies, such a personal learning system is both practical and achievable. Soldiers can get education outside the classroom, unrestricted by space and time with the potential for life-long continuous learning using DL.

Although we have the ability to create a 21st century system, one that provides the benefits of individualized instruction, a great deal of DL available today still relies on a 20th century model for instruction based on an assembly line system to train. While there is some cutting edge DL instruction, available courseware is often only a rendition of the textbook or class notes distributed through the Internet — uninspiring "page-turner" instruction with little interaction. This should not be the case; not only are there many options for DL, but also new technologies and methodologies are constantly emerging. DL must take advantage of many different media including the Internet, CD-ROMs, video teleconferencing, handheld devices, interactive gaming exercises, collaborative tool sets, and others that can make training realistic, engaging, and personal.

Current State of Distance Learning

The Army needs DL technologies because of their time and cost savings and also because they provide unparalleled flexibility for delivering instruction. However, successful transformation to DL is possible only if the Army can make it what Soldiers need and want. Soldiers would have to like and even prefer DL to the classroom. Unfortunately, Soldier's preference for DL is not always positive (Abell, 2000; Drenth, Kubisiak, & Borman, 2001; Army Personnel Survey Office, 2003).

In general, Soldiers are not always fond of DL instruction which they receive. The most evident problems for DL are low course completion rates and decreased learner satisfaction (Drenth et al., 2001). Distance learners miss the social contacts, support of others, and discussions that help the learning process (Drenth et al., 2001). Almost 50% of Soldiers report that they feel that classroom instruction is more effective than instruction provided over the Internet (Army Personnel Survey Office, 2003). This is further illustrated by reactions in a recent report focusing on Soldier attitudes toward "the delivery of standardized individual, collective, and self-development training to Soldiers and units anywhere and anytime through the application of information technologies" (Wisher, Sabol, & Moses,

An intelligent tutor system can supplement the sand table for mission planning training.

2002). This report provides further support that Soldiers believe current DL is boring and not as effective as classroom-based instruction.

While today's DL may not be receiving glowing reviews from the Soldiers, there is good news in terms of student performance. Learning scores generally are equivalent or even favor DL (Drenth et al., 2001). Additional research with DL shows that learners may need 30 percent less time to complete courses and they may score half a standard deviation higher on tests when compared to results from traditional instruction (Metzko, Redding, & Fletcher, 1996). With these benefits, strategic changes to increase learner satisfaction with DL implementation should result in even greater instructional benefits.

By considering some of the shortfalls of current DL, we can work to improve the effectiveness of its implementation. A problem is when DL is developed using the 20th century model of mass learning that presents books on-line or mimics the lecture and recitation of classroom instruction, often limiting learning outcomes and inhibiting student motivation. In the last few years, emerging technologies and advanced training methodologies have shown promise to leap beyond the shortfalls of mass learning. To further understand the training potential of these methods and technologies, ARI is conducting research in three areas: 1) making instruction more applicable to real-world tasks; 2) making the instruction more engaging; and 3) making better use of instructor time with increased productivity — providing improved availability and support from instructors without overloading them. The goal is to improve Soldier satisfaction with DL while improving training outcomes.

Making Instruction More Applicable to Real-World Tasks

DL can make training more applicable to real-world tasks in two ways: 1) by bringing more realism to classroom training through desktop simulations and gaming exercises, and 2) by bringing training to the field by being portable and distributed. Embedded

training and portable training tools allow for training material that used to be primarily accessible in an institutional setting to now be pushed out to a field setting. In addition, realistic training that was once available only through experience in the field can now be experienced in the classroom through desktop simulations and communication technologies. As technologies evolve, we are working our way toward overcoming the barriers that prevented these avenues of training from being fully integrated.

Converging classroom and field training provides more options for Soldiers to train realistically and efficiently (Figure 1). Classroom training and field training can be complementary, with each benefiting the other. With desktop simulations and realistic gaming exercises, some of the skills normally taught or demonstrated exclusively in a field training exercise can be introduced, practiced, or demonstrated with a computer. Such training options can decrease costs by providing an alternative to residential training and preparation for training in the field. For example, before going to a field training exercise, Soldiers could learn and practice certain

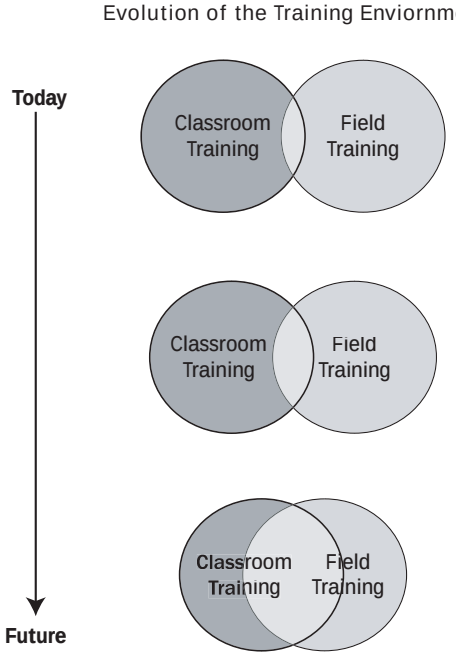
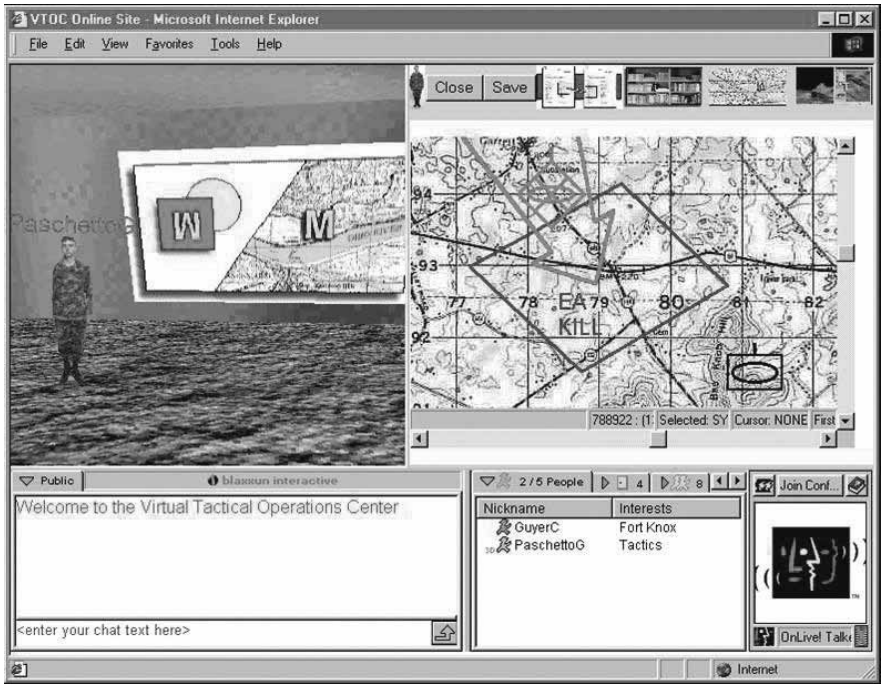


Figure 1: The gradual bridging of classroom and field training.

skills they will need in the field exercise. Preparation beforehand can lead to a deeper fundamental understanding, allowing Soldiers to take better advantage of the field training exercise by practicing higher-level skills earlier. Also, DL can be an effective way to provide refresher training when field training isn't available so that Soldiers can gain experience or maintain their skills.

In an attempt to identify how training can be made more realistic, ARI conducted two research projects. One project tested DL training using simulated real world tasks. The objective was to determine if such a training tool can aid in making training more realistic and thereby more applicable. Reserve officers took a blended course with both DL and in-residence components (Belanich, Orvis, & Wisher, 2003). The distributed portion of the course consisted of an asynchronous phase where officers individually completed lessons and a synchronous phase where they worked together in a virtual tactical operations center (VTOC). The Web-based VTOC allowed them to update maps, develop a battle plan, and access a variety of collaboration tools in a simulated



The Virtual Tactical Operations Center (VTOC) training program.

environment. Reserve officers from across the country practiced in a realistic setting, applying what they had learned during prior lessons. The overall course concluded with a face-to-face training session that was greatly reduced in time compared to previous versions of the course. The use of the VTOC system allowed course administrators to save both time and travel costs while maintaining (or improving) training quality in a realistic training setting.

While it is important to quantify the administrative benefits of using realistic DL environments, such as savings in cost and time, it is also essential to assess the influence on actual Soldier learning. In the second research project, ARI assessed what characteristics influence recall of information in an immersive first-person-perspective game (Belanich, Sibley, & Orvis, 2004). First-person-perspective PC-based games — very common in the general population today — use a screen view that is the perspective of the character the player controls. These games are psychologically immersive in nature and popular with players because they get absorbed into the experience. Also, they are relevant to Army training because of the features they share with simulators. Findings from ARI's research showed that simple procedures were learned better than factual information. In addition, information that was presented as graphic images or spoken text was more likely to be recalled than information that was presented as printed text. Other results showed that information either required or helpful to progressing in the game was remembered better than information tangential to the game's storyline. These findings suggest that realistic training which emphasizes the right kinds of information for the training medium may improve Soldier retention by 15-20 percent.

Making Instruction More Engaging

Learner motivation is a key issue for the development of DL courses. Frequently, distance learners complain about boring "page turner" courseware that leads to lower course completion rates. In general, courseware needs to be made more engaging and motivating. It has been suggested that presenting training in a game format is one way to engage learners and thereby increase the

effectiveness of the training (Garris, Ahlers, & Driskell, 2002; Gee, 2003; Gopher, Weil, & Bareket, 1994; Prensky, 2001). The PC/video gaming market has skyrocketed in recent years with annual revenues of almost $10 billion. People are paying nearly $50 for a single game and additional monthly fees to play on-line games, strong evidence that the gaming environment is engaging, if not addictive. It seems intuitive that immersive games, which captivate players for hours on end, can provide clues to making DL more engaging. ARI is doing research to identify methods that leverage the motivation inherent in successful games and how to incorporate lessons learned into the design of DL courseware.

Through research with a first-person-perspective game, ARI (Belanich et al., 2004) identified four game characteristics which influence player motivation: (a) challenge, where success at the game is challenging but not too difficult; (b) realism, where the sights, sounds, and actions of the game including player movement and capabilities are realistic; (c) control, where the game allows players to reliably determine their character's behavior or what happens; and (d) exploration, where players have opportunities to learn new things and can exercise curiosity. These game characteristics, also identified by Malone (1981) and Malone and Lepper (1987),

Screen shot of a game-based tactical training tool.

can be incorporated into DL to make course content motivating.

While providing DL that motivates learners, it also is important to keep instructional effectiveness high. Motivating learners to engage in their training environment is a waste of time unless course objectives are met. Engaging DL characteristics should be well integrated with the learning material. Research shows that the inclusion of extraneous information can lead to decreased learning and recall of the training material (Belanich et al., 2004; Harp & Mayer, 1997; Harp & Mayer, 1998; Mayer, 2001; Mayer, Heiser, & Lonn, 2001). For example, if the objective were to train small-group tactics for military operations in urban terrain (MOUT), then, for example, having players work together as a team competing against another team to complete a mission in a virtual Baghdad would be appropriate. However, having an extensive description about the history of Baghdad and its founding in the 8th century would deviate from the training focus and detract from the training. So, one way a Soldier can have an engaging and effective DL experience is to emphasize instructional material relevant to training objectives and embed it in a simulation game (Prensky, 2001).

Networked computers provide opportunities for players to compete or collaborate using game-based training.

Making Better Use of Instructor Time

A recent report indicated that Soldiers would prefer DL with better instructional support and additional social contacts (Wisher et al., 2002). In an effort to meet these needs, course developers have sought technologies and methods that expand instructional opportunities without overloading instructors or compromising instructional effectiveness. Two emerging approaches are to supplement an instructor's time with the aid of a computer and have Soldiers help one another through collaboration.

Supplementing an instructor. One way to moderate instructor load is by having an automated agent or intelligent tutor system (ITS) perform some of the activities normally assigned to the instructor. While ITSs can't replace instructors, they can act in a supporting role, allowing instructors to be more productive and to focus on teaching tasks that have no ITS alternatives.

An example of implementing an ITS approach is the Virtual Sand Table (VST) used in the Captains Career Course of the U. S. Army Field Artillery School (Wisher, Macpherson, Abramson, Thornton, & Dees, 2001). Traditionally, instructors conducted sand table training in small groups using a scaled model of a field artillery exercise in a box of sand. Soldiers work in groups around

Soldiers working with a sand table.

the sand table, get scored for degree of group success, and tested on their individual knowledge. While a group plans a mission on the sand table, an instructor provides occasional feedback. This requires at least one instructor for every few Soldiers.

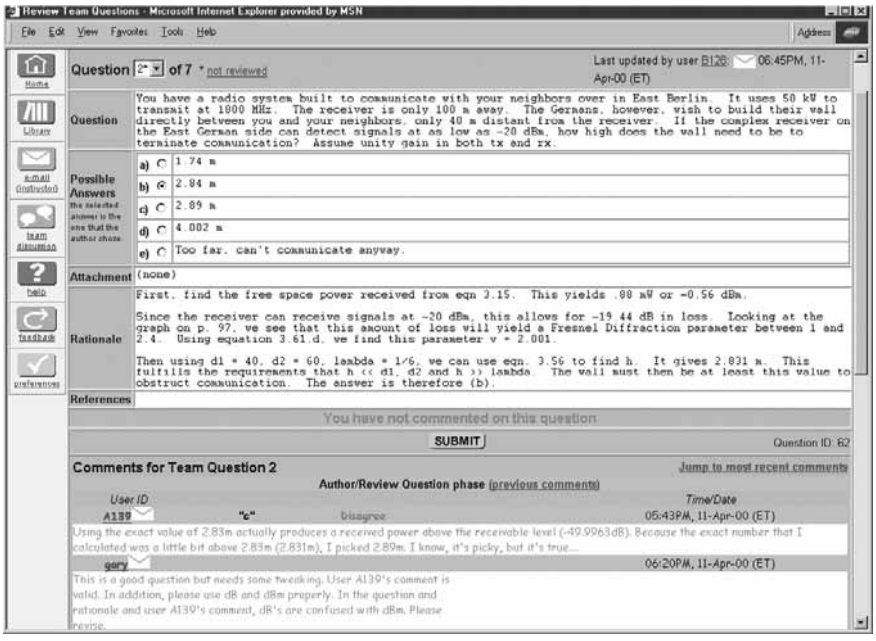
The VST alternative is PC-based with an ITS developed to conduct the same exercise at the individual rather than group level. The sand table's ITS does the tedious job of monitoring the manipulation of objects in a virtual environment and comparing them with an expert's solution. The ITS provides frequent assessment, coaching, and personalized feedback, and the Soldier can use it at any time. Researchers found that Soldiers trained via the VST significantly outperformed those students trained via the conventional sand table exercise (Wisher et al., 2001). In fact, they found a 35 percent increase in learning compared to the conventional sand table exercises, demonstrating that the VST tutoring system is an effective instructional tool. The VST gives Soldiers more individual attention than with the conventional approach. It tracks Soldier performance and gives feedback throughout the training task, not just at the end.

The VST implementation was not an attempt to eliminate the instructor, but to supplement his or her time by providing the learner increased access to suitable alternatives. The course still requires an instructor to introduce and explain material while monitoring successful completion of training objectives. However, the VST allows the instructor to focus on functions critical to learning that could not be accomplished by an ITS. Other ITSs use language-based interactions, such as typed text or speech (Kaplan, Sabol, & Wisher, 1998; Graesser, Person, & Harter, 2001). All of these ITSs provide continued instruction and useful feedback during training exercises to help conserve instructor time. The Soldier benefits by having greater flexibility for scheduling training with the advantages of excellent DL.

Collaboration and social contact. Another way to contain instructor workload is through collaborative learning where students share information and learn from one another. This also addresses the issue of limited social contact that DL students often complain about

(Abell, 2000; Drenth et al., 2001; Wisher et al., 2002). With DL-based collaboration, the constraints of location or schedule are minimized, providing the opportunity for Soldiers to interact across time and space boundaries.

ARI tested a DL tool for collaboration called TEAMThink, a question-authoring system where students worked together over the Web to learn about a topic through the process of writing and answering questions (Belanich, Wisher, & Orvis, 2003). Students wrote test questions that were edited and commented on by other students. Collaborators were then given an opportunity to modify their questions. Finally, everyone took part in a test that posed all the questions developed through this process. There was an average increase of more than seven percent in test scores after only a single iteration with the tool compared to students who did not use it. This process required minimal instructor supervision. In addition, the questions developed by the students could be repurposed for quizzes or tests, saving instructors' or training developers' time creating tests. This research suggests that implementing collaborative tools in a DL environment could relieve instructor workload while increasing social contacts and learning.



Screen shot of the TEAMThink program.

With the many communication tools available through the Internet, lack of interaction between students need not be a problem. An assessment of the on-line communication by Reserve officers using the VTOC for training (Belanich, Orvis, & Wisher, 2003) found that a majority of communication between learners was related to the training objectives, and students were able to help one another both with the course content and the mechanics of using the on-line tools. In addition, about 30 percent of the communication was social in nature. This demonstrated that even when learners are dispersed and working through Web-based tools, collaboration and social interaction can be supported with little to no additional load on the instructors.

A Look Toward the Future of DL

The field of DL has seen a great deal of recent change, and this is likely to continue. During its early years, DL evolved without a strategic plan. Although many tools and techniques were developed to improve learning outcomes and expand options for instruction, much of the courseware took an "assembly line" approach to learning and training that mimicked methodology from the last century. The time has come to take full advantage of the opportunities DL provides to effective and individualized instruction for learners (Abell, 2003; O'Neil, 2003).

A plan, even an imperfect one, helps to identify gaps in the technology and opportunities for enhancements. Our goal is to provide the most effective DL to each individual Soldier. One way to conceptualize the opportunities available through DL is by examining the various types of interactions that potentially benefit the learner. We started with the Soldier at the center of our model (Figure 2). The foundation for this conceptualization of DL comes from Moore (1989), whose work encourages us to think about how to foster three types of interactions: learner-learner, learner-instructor, and learner-content. Since the concern of this report is Soldiers as learners, let's substitute the term Soldier for learner in our discussion. In addition to Moore's three types of interactions, two other

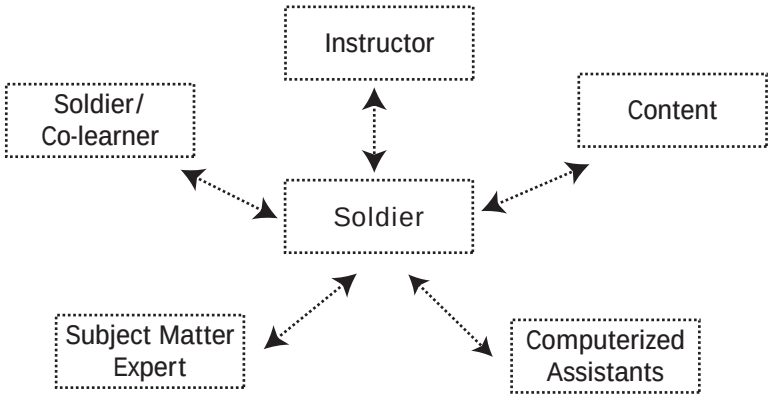


Figure 2. A model of inter-action types possible in DL environments.

relationships also are important in today's learning environment: Soldier-subject matter experts (other than the DL instructors) and Soldier-computerized assistant (i.e., automated agent or an intelligent tutor).

Soldier-Soldier Interaction

Soldiers can help one another learn. Research in collaborative learning demonstrates that co-learners can be a source of useful information and deeper learning than if they study individually (Shlechter, 1990). Both the VTOC and TEAMThink research projects provided examples of how Soldiers can learn from other Soldiers (Belanich, Orvis, & Wisher, 2003; Belanich, Wisher, & Orvis, 2003). Using VTOC, Soldiers learned from one another while working collaboratively to plan a mission. With TEAMThink, Soldiers learned from one another by developing, asking, answering, and critiquing one another's questions.

In a social learning environment, there are two types of Soldier-Soldier interaction to consider: task-oriented (where the focus is the course material) and social (where the Soldiers may build social networks). One example of task-oriented interaction in a cooperative DL learning environment is when co-learners temporarily take on the role of instructors, teaching course content to one another. An example of social interaction is when co-learners build social

relationships that provide a more cohesive and satisfying environment for learning.

One of the major concerns regarding DL is the lack of social interaction among dispersed learners (Drenth et al., 2001; Wisher et al., 2002). Research, however, shows that this barrier may be overcome through various collaborative tool sets and appropriate support. The most frequent forms of computer-mediated interaction are e-mail and text messaging. Kang (1998) demonstrated that text messaging allows relationships to develop and improves social bonds. In addition, text messages seem more thoughtful and content-rich than spoken conversations because text messages allow time to ponder and rework thoughts. Designing Soldier-to-Soldier interaction opportunities into DL can lead to a more social atmosphere and reduce the isolation that some users experience. The evidence is beginning to build, including TEAMThink and VTOC projects described earlier, that working collaboratively in DL leads to improved learning (Belanich, Orvis, & Wisher, 2003; Belanich, Wisher, & Orvis, 2003).

Soldier-Instructor Interaction

Interaction between the Soldier and the instructor should be bidirectional. The instructor provides information, helps Soldiers find materials, and gives feedback on performance. In turn, Soldiers need the opportunity to ask the instructor questions and to demonstrate what they have learned. The challenge is how to improve DL so that it satisfies those needs better.

Networked technology is expanding the opportunities for instructors to interact with Soldiers using electronic communication. E-mail probably is the most common, although relatively slow, method. However, other tools for communication are available such as text messaging, video conferencing, and voice-over-IP. These technologies allow for Soldiers to ask the instructor questions and the ability to observe the interactions between the instructor and other learners. Through these technologies many Soldiers may enter the discussion, drawing on the strength of interaction that was reserved previously for the classroom.

As another essential part of the learning experience, Web-based DL can enhance feedback about Soldier's coursework. For example, Soldiers may submit electronic coursework so the instructor can make comments, electronically send them back, and remotely discuss them as needed. Additionally, the instructor may monitor performance during Web-based work for one or many Soldiers and provide on-the-spot feedback. Interactions can be tracked among groups of Soldiers, project groups, or individually by having them produce Weblogs (blogs) for review, or participate in threaded discussion groups where particular topics are debated. The TEAMThink project (described above), where students collaborated on the development and answering of questions is another example of instructor monitoring. With TEAMThink, instructors could monitor the questions written and students' comments as well as write comments of their own. The instructor also could provide feedback to questions that students raised during a session and the accuracy of answers to specific questions. If DL is designed well, interaction with the instructor may be frequent and of high quality, which in turn may lead to a richer instructional environment.

Soldier-Content Interaction

A Soldier learns the content of a course by interacting with it. Simple examples are reading a textbook, using a video or audio clip, or in basic DL, clicking from one page to the next. Learning can take place this way, but the Soldier has to be motivated to initiate the learning and the flow of information runs primarily from the content to the Soldier; there is little true interaction. In contrast, the Soldier who actively practices and gets feedback about performance will learn faster, more accurately, and retain the information better. Dale (1946) put the concept simply when he said, "individuals learn best by doing." For example, a Soldier who wants to be a motor pool mechanic could read a book and learn. However, wouldn't it be better if, in addition to reading the book, the Soldier could practice what the book says on a damaged vehicle with the tools needed? In a virtual world, this can be possible. The Soldier could also receive

additional feedback about his or her efforts. Actively engaging the Soldier with content is possible using DL technology.

Perhaps the most useful feature of DL is that the Soldier can experience content with the computer as a substitute for the actual experience. Possibilities include allowing Soldiers to manipulate features on the screen linked to instruction. Imagine a virtual 3-D model of an engine that the Soldier can rotate and explore. The virtual engine could be damaged, and the Soldier would need to find and fix the problem. Such interactive learning is a great motivator that improves actual learning (James, Humphery, Vilis, Corrie, Baddour, & Goodale, 2002).

When will the Soldier see more of this virtual interactive instruction? We're just beginning to understand the ways to design it. For example, we should keep instructions about a topic grouped together — not scattered — and physically close to visual material to focus the Soldier's attention. For our vehicle repair example, the

Soldier in a tent working on a computer.

instructions would need to sequentially point out the right spots at the right time on the 3D image. Instruction about how to do the repair may be understood better using narration instead of written text. In addition, the use of identical printed text during narration can be distracting and so can nice-to-know background about the vehicle or its uses that distract from the primary topic. These illustrations summarize some principles about interactive learning that the interested reader can find in Moreno & Mayer (2000), Mayer (2001), or O'Neil (2003).

Another way to keep learners engaged is PC-based training games. Engaging environments can help motivate learners. As described earlier (Belanich et al., 2004), gaming environments can make the instructional content engaging and can be designed to promote learning. This seems to be why interactive PC-based games can provide effective instruction, and when appropriate, can be a helpful part of DL (Prensky, 2001).

Soldier-Subject Matter Expert Interaction

Learning can be expanded beyond a traditional environment with just teacher, content, and student. The Internet facilitates finding information and communicating with knowledgeable people beyond the confines of a course. With emerging technologies, students often have additional access to Subject Matter Experts (SMEs), people who may have insights into the material.

As an Internet user, you may already be aware of organized opportunities to share information. Examples of this type of interaction are Web-based forums and communities of practice sites, where individuals can ask questions or share information with others who are knowledgeable or interested in the particular topic. Asking for repair information in Web-based forums, for example, is very common when the manual isn't available or it lacks details. Users of such sites also can start debates about a topic that can be very enlightening. Existing topic-specific forums can be identified to support learning objectives in a DL course. One note of caution is that Soldiers should be aware of the creditability of the source of this SME information.

The Army Knowledge Online (AKO) Web site offers a few tools that can facilitate Soldier-SME interaction. In AKO there are groups and forums that can be joined or monitored to gain knowledge. AKO also has a search capability that can be used to find organizations or individuals who may possess sought after information. All of these tools can be used to find SMEs who may assist with a Soldier's learning.

Group of Soldiers using computers to conduct a team exercise.

Soldier-Computerized Assistant Interaction

Real people (instructors and SMEs) might not always be available to provide help to Soldiers. In such cases, computerized assistants (i.e., intelligent tutor systems and automated agents) are one means of accessing needed instructional aid. A computerized assistant is software that can simulate some of the functions of an instructor, tutor, or other help for the learner. A familiar example is a Web-based search engine, where learners can find targeted information from the boundless pages available on the Web. It would take humans an intractable amount of time to sift through all the information, while the search engine takes just a few milliseconds.

A different kind of example is a computerized assistant that provides targeted feedback in the learning environment. The intelligent tutor system for the Virtual Sand Table (VST) described earlier gives individual feedback to Soldiers learning artillery tasks. Since VST is just software, Soldiers can use the program individually and independently. VST allows numerous Soldiers to benefit at the same time and not have to compete for the instructor's limited time.

While computerized assistants can be helpful and cost-effective (Fletcher & Johnston, 2002), they will not soon replace instructors or SMEs. They are weak in some human skills such as abstract reasoning, complex pattern recognition, and understanding context. For example, a search engine doesn't always understand the context or logical parameters for a search and may return too much information - both useful and not so useful. However, computerized assistants have special benefits. They never get tired and can be on duty 24/7. In addition, they are relatively inexpensive to maintain once developed and can quickly access vast amounts of information. Computerized assistants, even in their current infancy, are a promising enhancement for DL and with future improvements will offer even greater benefits.

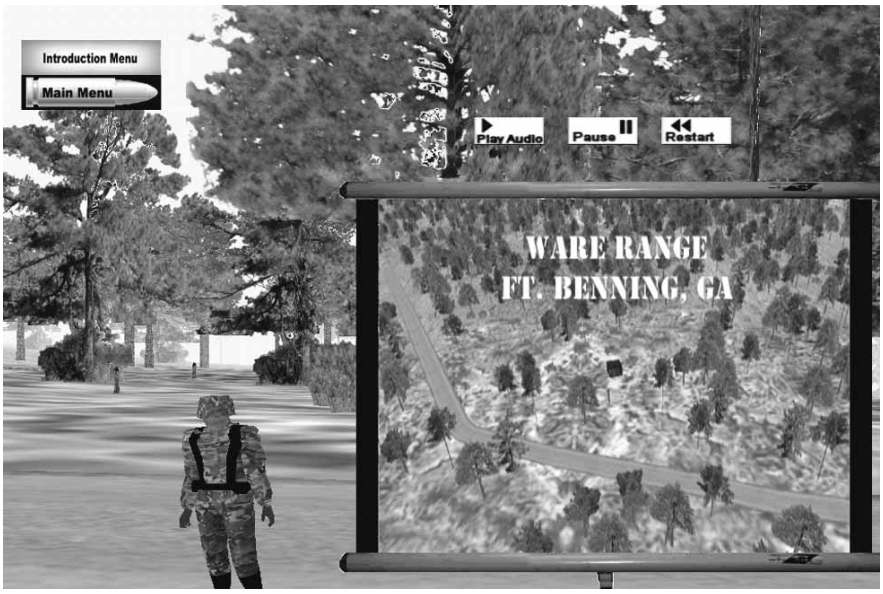
Summary and Conclusion

This report explores the potential of DL to meet life-long learning needs of Army Soldiers as well as other learners. Due to advancements in DL technology and methodology, the modern learning environment offers expanding options compared to just a few years ago. With DL technology, we have the opportunity to provide quality, individualized instruction and the possibility that each Soldier will have personalized tutoring, akin to their own Aristotle.

This report places current DL practices and advancements in the context of the ongoing evolution of instruction. We noted that early implementation of DL courseware evolved from an "assembly line" training model with one instructor lecturing to many learners or with traditional textbook-like presentations. By presenting current

research, this report provides evidence as to how improvements can make DL more applicable, realistic, and engaging. The result is a perspective on how DL technology can supplement the traditional classroom environment, help automate routine instruction, and provide instructors time to focus on critical tasks. The Army needs to take full advantage of the capabilities of today's DL, and not be satisfied with "page-turner" instruction with little interaction.

A satisfied Soldier-learner whose needs are met is central to the future success of DL. This report illustrates ways to enhance DL for that Soldier-learner and provides a framework for addressing DL problems both with technology available now and those being developed. Instructional developers, using the framework as a general guide, can determine if their DL courses incorporate the best possible learning tools and methods. While all types of instructional interactions may not be necessary for successful DL, developers should consider each to insure an optimal result. Educational and training researchers should use the framework for fostering ideas about how to improve both current and future DL. The goal should be to maximize Soldiers' benefits and to conserve instructors' time by taking advantage of advancing DL features and technologies.



The Rapid Decision Trainer, a game-based training tool for the Infantry Officer Basic Course.

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REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy)	2. REPORT TYPE	3. DATES COVERED (from. . . to)
September 2005	Final	March 2004 – April 2005

4. TITLE AND SUBTITLE	5a. CONTRACT OR GRANT NUMBER
Distance Learning: A Way of Life-Long Learning	
	5b. PROGRAM ELEMENT NUMBER 633007
6. AUTHOR(S) James Belanich (U. S. Army Research Institute for the Behavioral and Social Sciences), Franklin L. Moses and Kara L. Orvis (Consortium Research Fellows Program)	5c. PROJECT NUMBER A792
	5d. TASK NUMBER
	5e. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences Research and Advanced Concepts Office 2511 Jefferson Davis Hwy Arlington, VA 22202-3926	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences 2511 Jefferson Davis Hwy Arlington, VA 22202-3926	10. MONITOR ACRONYM ARI
	11. MONITOR REPORT NUMBER Special Report 63

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

Subject Matter POC: James Belanich

14. ABSTRACT *(Maximum 200 words)*:

The instructional approach of distance learning (DL) has many benefits but has yet to reach its full potential. This report critically examines how new DL technologies and methodologies are increasing instructional opportunities. These improvements are presented as an extension of an instructional evolution beginning with Aristotle tutoring Alexander the Great, progressing through the mass education method of the industrial revolution, and continuing today with DL and individualized instruction. Summaries of ARI's research highlight progress in three areas: 1) making instruction more applicable to real-world tasks; 2) making instruction more engaging; and 3) providing improved availability and support from instructors without overloading them. The report concludes by presenting a framework for developing more effective DL with a look at the promise of future benefits.

15. SUBJECT TERMS

training, educational technology, distributed learning, distance learning, collaboration, online instruction, web-based instruction

SECURITY CLASSIFICATION OF			19. LIMITATION OF	20. NUMBER	21. RESPONSIBLE PERSON
16. REPORT	17. ABSTRACT	18. THIS PAGE	ABSTRACT	OF PAGES	
Unclassified	Unclassified	Unclassified	Unlimited		Ellen Kinzer Technical Publication Specialist 703-602-8047

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