U.S. Army Lifelong Learning: Program Assessment Metrics and Initial Results

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ABSTRACT

The same factors that create a greater need for U.S. Army Soldiers and leaders to learn quickly make it more difficult to receive instruction via the traditional Army education system. Lifelong Learning Centers (LLCs) leverage advanced technologies to enable anytime, anywhere learning throughout the career of Army personnel (Wilson & Helms, 2003). In the present research, a comprehensive, generalizable framework was developed to conceptualize the effectiveness of LLCs and was used to conduct a formative evaluation of a pilot LLC situated at the U.S. Command and General Staff College. The framework, based on public sector program evaluation techniques, was a useful tool for capturing LLC functioning, from the acquisition of resources to the achievement of organizational impact. The evaluation findings indicated that although the pilot LLC was technologically stable and cost-effective, system adoption rates were lower than criterion due to human factors involved in collective information management and organizational change. Recommendations for further validating the LLC assessment framework and enhancing LLC implementation are provided.

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INTRODUCTION

The U.S. Army's contemporary operational environment is characterized by frequent and lengthy tours of duty, the introduction of new equipment and technology immediately prior to and during deployment, and a volatile global political situation. All of these factors result in a greater need for Army personnel to obtain the education and training that will help them to learn rapidly and adapt quickly in the field. The traditional Army education system primarily serves students in residence at bricks and mortar schoolhouses, however, providing instruction in lockstep with students' career milestones. Consequently, instruction often is received at a time other than when it is needed at a place other than where it is needed.

The lifelong learning concept has been advanced as an Army-wide solution to this problem [U.S. Army Training and Doctrine Command (TRADOC), (2004); see also Wilson & Helms, 2003]. Lifelong learning has been defined as "the ability of Soldiers to learn, grow and achieve technically and tactically throughout their career, wherever they serve… It's a mixture of traditional schoolhouse resident education with education presented in other locations at the individual's teachable moment" (TRADOC, 2004).

Lifelong Learning Centers (LLCs) comprise a suite of technologies that enable, among other things, online posting of schoolhouse curriculum materials, courseware, and equipment simulations. They also support synchronous and asynchronous collaboration among students, instructors, curriculum developers, and field Army users to enable the exchange of advice, mentorship, and lessons learned. These technologies connect the field Army to Army schoolhouses, with the potential to improve course currency while simultaneously supporting training and education in the field through just-in-time reachback capability.

The impact of lifelong learning on organizational excellence seems clear--mission readiness should be enhanced over the short and intermediate term, with obvious implications for operational success. Over the long term, lifelong learning should foster a cultural shift in the Army toward collaboration, information sharing, knowledge management, and enhanced professional self-development.

What is less well understood is how the implementation of the lifelong learning concept, LLCs, promote readiness and cultural shift through the use of educational technology and how the effectiveness of LLCs should be captured. Although numerous studies of the effectiveness of various educational technologies in both military and civilian settings have been conducted (see e.g., Barry & Runyan, 1995; Bernard, Abrami, Lou, Borokhovski, Wade, Wozney, et al., 2004; Hiltz, 1990; Phelps, Ashworth, & Hahn, 1991; Sitzmann, Kraiger, Stewart, & Wisher, 2006), few of these studies provided a comprehensive examination of technology-assisted instruction that captured both instructional strategies and multiple levels of outcomes (Cukier, 1997; Lockee, Burton, & Cross, 1999; Resta & Laferrière, 2007).

The purpose of the present study was to research and develop a comprehensive, generalizable framework for conceptualizing the effectiveness of LLCs in enhancing learning and readiness and for capturing the drivers of LLC success. The goal was to conduct a formative program evaluation of a pilot LLC situated at the U.S. Army Command and General Staff College while simultaneously producing an assessment framework that would be applicable across current and future LLCs.

METHODS FOR EVALUATING EDUCATIONAL TECHNOLOGY

Quasi-Experiments

Numerous studies exploring the effectiveness of technology-assisted instruction have used a quasi-experimental design to compare the achievement (assessed or self-reported) of students enrolled in a course using a specific educational technology against students enrolled in the same course using more

traditional means of curriculum delivery (see, for example, Barry & Runyan 1995; Bernard et al., 2004; and Sitzmann et al., 2006). Learning effectiveness was demonstrated if students using educational technology performed as well or better than students completing the course of study using traditional means.

The measures of learning achievement used in these studies generally corresponded to the first, or affective, level of Kirkpatrick's (1994) four levels of evaluation. That is, surveys or interviews were used to capture students' reactions to/satisfaction with the course they took, including their perceptions of how much they learned or how beneficial they thought the course was. Several of the studies also compared student achievement using Level-2 measures--measures of actual learning. Investigators either used existing course assessment materials or they developed special purpose measures related to course content, such as mastery tests (e.g., Hiltz, 1990; see also Feldon & Yates, 2007).

The large body of research demonstrating that technology can have a positive (or no negative) effect on learning achievement generally is taken as evidence that technology-supported education is effective. A primary limitation of this research, however, is that it cannot explain *why* technology enables effective learning or *when* and *how* to use technology to achieve a specific learning outcome (Bernard et al., 2004; Feldon & Yates, 2007; Lockee et al., 1999). Moreover, the impact of technology-assisted instruction beyond the educational setting [i.e., Kirkpatrick's (1994) third and fourth levels of evaluation] has not been addressed by most empirical studies.

Cost Analyses

Proponents of technology-supported instruction, especially distance education, claim that educational technology can achieve organizational impact by reducing the costs associated with faculty and administrative staff salaries, materials production, storage, and shipping, and student travel and housing. Even though the fixed costs associated with procuring instructional technology (e.g., servers) will be greater, variable costs (e.g., salaries, supplies) will be lower due to fewer instructors and printed course materials (e.g., Whalen & Wright, 1999).

Relative to the amount of discussion on the cost of technology-supported education, few published studies appear to actually calculate cost savings (though see Phelps et al., 1991). In addition, discussions and analyses of cost savings generally have focused solely on models and methods for cost accounting and rarely discuss such savings in the context of educational benefits (Cukier, 1997). Assessing financial and educational impact within the same evaluation would enable decision makers to make informed judgments about cost-benefit tradeoffs (Cukier, 1997).

Formal Models

Multiple factors, such as learner and/or instructor readiness, technology usability, curriculum quality, and organizational support for continuous learning, play a role in the learning and cost-effectiveness of any educational solution (e.g., Dean, Biner, & Coenen, 1996; Resta & Laferrière, 2007; Salas, Rhodenizer, & Bowers, 2000). A handful of formal models outline these factors as they relate to the success of technology-supported education (see, e.g., Belanger & Jordan, 2000; Ehrmann, 1994; Harrison, Seeman, Behm, Saba, Molise, & Williams, 1991).

For example, Harrison et al. (1991) identified four categories to assess when evaluating distance education: (1) instruction (e.g., student-instructor interaction); (2) management (e.g., technical support and planning); (3) telecommuting (largely the unique features of distance education); and (4) support (e.g., organizational support for the program). Ehrmann (1994) targeted teaching-learning strategies especially relevant to technology-supported instruction and faculty roles and attitudes towards instructional technology. He argued that improvements in learning outcomes, access, and costs on a departmental and/or institutional scale required changes in teaching practices and learning environments, which in turn required changes in institutional patterns of technology use.

The previously described research exploring the effectiveness of technology-assisted education provides a firm foundation for developing metrics to assess the learning effectiveness and organizational impact of Army LLCs. One could conclude from this body of work that (a) it is important to use multiple levels of analysis to conceptualize educational outcomes; (b) cost metrics should capture the full cost of technology-supported instruction, not just hardware and software expenses; (c) cost effectiveness metrics should enable the concurrent review of costs and benefits; and (d) factors leading to educational outcomes, such as organizational support and technology usability and access, should be measured in order to fully understand the learning effectiveness of technology-assisted education.

LOGIC MODELING – AN EXTENSION OF PREVIOUS APPROACHES

The fundamental limitation of the above-described methods is that they narrowly focus on limited aspects of the effectiveness of educational technology. They therefore do not represent a unified, systematic approach to understanding the functioning and impact of technology-assisted instruction. An alternative approach to assessment—logic modeling—addresses this limitation and extends previous approaches by using a qualitative modeling technique that is built upon quantitative components.

Logic Modeling Defined

Logic modeling is a tool for conceptualizing how a program transforms resources (i.e., funding, personnel, etc.) into impact through activities, output, and multiple levels of outcomes. It is an approach commonly used in public sector program evaluation that enables cost-benefit analyses of initiatives not associated with easily-definable return on investment metrics. Logic models are used as advanced organizers for program evaluation, providing a basis for identifying high-payoff targets for assessment (McLaughlin & Jordan, 2004, p. 7). Logic modeling requires a multidisciplinary approach to educational assessment, drawing on such fields of study as instructional technology, organizational psychology, and cost accounting.

Advantages of Logic Modeling

Qualitative modeling of a program's drivers of success—in addition to its impact—tells a story about program functioning and makes it plausible to assess the validity of program outcomes in the absence of controlled, quasi-experimental conditions (Cianciolo, Heiden, & Prevou, 2006; McLaughlin & Jordan, 2004). Equipped with a story that links program outcomes to process, decision makers can determine whether success is due to factors influenced by the program or whether continued funding can be expected to address impact shortfalls.

Logic models prevent the focus of an educational program evaluation from becoming too narrowed on a particular aspect of the program, such as outcomes—which cannot be used to diagnose problems—and activities (e.g., number of courses taught)—which are easy to measure but largely meaningless when disassociated from outcomes (Cianciolo & Prevou, 2006). In addition, by linking resources to outcomes through processes, logic models provide a way to consider cost and learning benefits together.

THE LLC LOGIC MODEL

Building the LLC Logic Model

The logic model construction process began with a review of the LLC planning and communications documentation. Review of this documentation identified the core structure of the LLCs—their technical and staffing components—as well as the envisioned impact of the LLCs on Army education and training, operational performance, and organizational success.

In addition, the director of each of three pilot LLCs was asked to explain how he thought the technology comprising the LLCs would lead to organizational impact through enhanced learning and behavior change. Discussions with key LLC personnel also were conducted in order to identify the activities of each and their expected contribution to LLC functioning.

Concurrently, an extensive review of the literature on technology-assisted learning was conducted. The literature review covered a broad range of topics, including (a) the anticipated behavioral outcomes of learning in a technology-supported environment; (b) the social impact of involving technology, especially networked computers, in the learning process; and (c) the individual and organizational determinants of effective learning. A review of the military technical and professional literature was conducted to understand more concretely such organizational outcomes as mission readiness and culture shift.

Finally, face-to-face interviews and focus groups were conducted with more than 40 curriculum developers, instructors, and students at the U.S. Army Command and General Staff College (CGSC). The intent of these conversations was to capture the modifications that must be made to the general logic model in order to make it applicable to the CGSC LLC in particular, which was the assessment focus in the present study.

Components of the LLC Logic Model

Figure 1 shows a high-level depiction of the LLC logic model. This model was used to specify metrics that would capture LLC effectiveness at each link in the casual chain between the investment of resources and organizational impact. The scope of this conference paper precludes a detailed explanation of the LLC logic model and its associated metrics, but some key

characteristics are highlighted below (see Cianciolo, 2007 for a complete description of the LLC assessment framework).

"Effects-based assessment"

The first key characteristic is that the logic model makes explicit the distinction between personnel activities and the presence of a technology-enabled learning environment that is both accessible and usable. Although it is relatively easy to measure and evaluate the amount of activity generated by LLC personnel, additional metrics are required to determine whether that activity results in something that consumers of the program can and do use. Making this distinction allows hypothesis testing regarding the link between factors internal to the program and the effects, or outcomes, of the program (Cianciolo & Prevou, 2006; McLaughlin & Jordan, 2004).

Technology versus quality

A second key characteristic of the LLC logic model is the distinction between the presence of educational technology and the quality of the learning environment. This distinction enables the specification of evaluation metrics that capture both the effectiveness of LLC personnel in creating a technology-enabled learning environment and the change in instructional behaviors affected by such an environment. Changes in teaching and learning thought to be enabled by educational technology include more learner-centered instruction (Bernard et al., 2004; Firdyiwek, 1999), increased classroom efficiency (Bourne, 1998), and the emergence of learning communities (Bernard et al., 2004; Wellman & Gulia, 1999). If these changes do not occur after the introduction of educational technology, relatively little improvement over the traditional classroom may be expected.

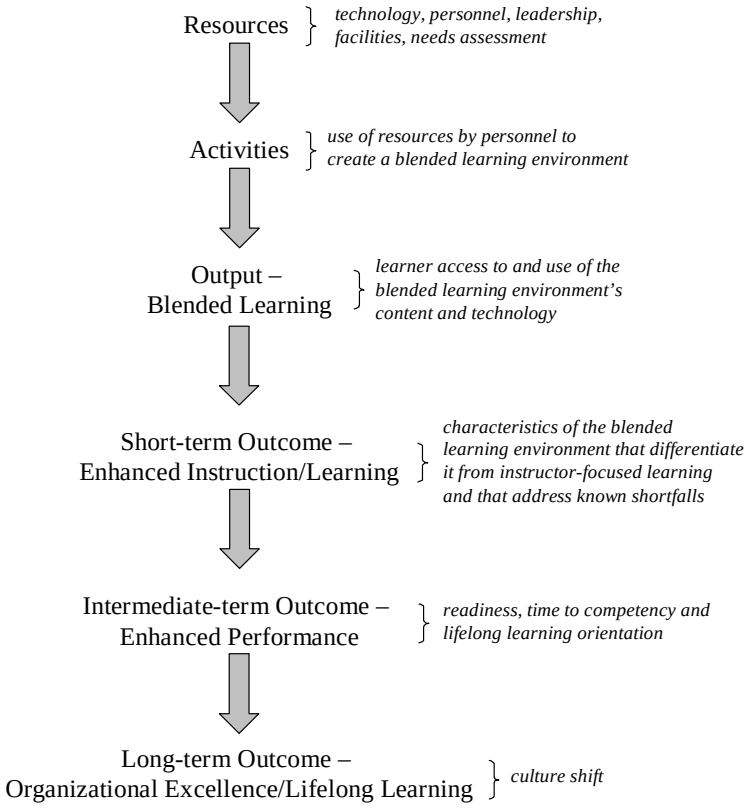

Figure 1. The LLC Logic Model

Multiple levels of outcome

A third key characteristic of the LLC logic model is that it allows for the specification of three levels of outcome metrics. This enables one to capture the impact of the LLC on individual teaching and learning competencies independently of course grades (e.g., greater frequency of independent study and reflective practice), on learner performance outside of the formal learning environment (e.g., shorter time to competency upon encountering new equipment or tactics), and on the organization's performance as a learning institution.

Importantly, each level of outcome and its associated metrics were defined such that they were within the sphere of influence of educational technology. That is, outcomes and metrics that could be influenced by multiple external factors (e.g., command climate, personnel policy, etc.) that would overwhelm the contribution of technology-supported instruction were not included in the assessment framework. For example, in defining culture shift, metrics were designed to capture the pervasiveness of intent to participate in the learning of others and of the internalization of the anywhere, anytime learning concept.

EVALUATING THE CGSC LLC

Overview of the CGSC LLC

At the time of this study, the main purpose of the CGSC LLC was to deliver online the standardized curriculum materials used to provide intermediate-level education to field grade officers. With the recent requirement to deliver intermediate-level education to all U.S. Army majors (Bralley, Danley, French, Soby, & Tiberi, 2003), online posting of course content became necessary to reach the numerous officers who could not take the course in residence and to provide up-do-date curriculum materials unfettered by a lengthy printing and reproduction process, regardless of course location.

Non-resident students using the standardized curriculum materials may participate in intermediate-level education via satellite campus locations and Total Army School System (TASS) battalion classrooms. Students in residence at Fort Leavenworth may participate in intermediate-level education as part of a first-start (August) or second-start (February) cohort.

Measures and Metrics Used

Of the 229 metrics developed based on the LLC logic model, a subset of 53 was selected to capture aspects of each of the model's high-level components. The selected metrics captured the following characteristics of CGSC LLC effectiveness: quality of learning environment (course content relevance, instructor facilitation of adult learning, presence of learning community, and instructional efficiency), quality of learner characteristics (student responsibility for own learning, learning self-efficacy, and motivation to learn), impact on individual readiness (affective organizational commitment), cost-effectiveness, actual system use, and personnel activity (technical staff, curriculum developers, instructors, and leadership).

Because a relatively short time was available for data collection, metrics were selected for their direct importance to the project stakeholders and for the ease with which they could be measured. Measures associated with the complete set of metrics in the assessment framework included survey items, system data (e.g., log-ins), archival data (e.g., enrollment data), special purpose assessments (e.g., measures of reflective questioning skill or transfer of training), and interviews. For the present study, most metrics were captured using survey items, although some system analysis was conducted as well as some archival data collected and a handful of interviews conducted.

Data Collection and Participants

Data collection was conducted during September and October of 2006 and largely focused on the use of the CGSC LLC to deliver intermediate-level education to students in residence. Surveys therefore were administered to curriculum developers, instructors, and students directly involved with the resident program, including both the 2006 February-start August-start cohorts. Candidate survey respondents received an invitation to participate in the online survey via an email from the CGSC Quality Assurance Office. Response rates ranged from 30-67%. Ten of 15 curriculum development team leaders responded to the survey, 69 of 201 instructors, and 251 of 837 students. Additional interviews were conducted, where applicable, with intermediate-level education instructors at satellite campuses and at TASS battalion sites.

General Findings

This section summarizes the findings of the CGSC pilot LLC program evaluation with regard to the quality of the learning environment produced, quality of learner characteristics, cost-effectiveness, actual system usage, and personnel activity. These general findings represent a snapshot of the LLC's functioning and effectiveness

that is continually being enhanced. More detailed discussion of these findings can be found in Cianciolo (2007).

Cost effectiveness

Overall, the evaluation results indicated that the CGSC LLC is a cost-effective solution for enhancing the educational outreach of intermediate-level education (ILE) curriculum materials. It cost more per student to deliver instruction using the CGSC LLC than to deliver instruction via traditional means. However, the increase in cost due to technology procurement and associated personnel and facilities expenses was a vanishingly small fraction of the total amount spent to deliver ILE. Moreover, the relative cost-per-student to the Army will decrease as the printing and shipping of course materials to remote sites is completely phased out over the next few years. For what amounts practically to the same amount of money, ILE delivered online using the CGSC LLC is in the process of eliminating the one- to three-year lag in curriculum content between the schoolhouse and Army reserve facilities. It also supports anytime, anywhere learning for ILE students in residence and at satellite campuses, as was reflected in system usage data.

Course currency and relevance

Unfortunately, there was relatively little the CGSC LLC could do to reduce the 6-10 month lag between changes in the operational environment and revisions to the standardized ILE curriculum due to a lengthy institutional curriculum review, revision, and vetting process. However, the CGSC LLC may assist in circumventing this problem by making it easier for instructors to supplement curriculum materials with up-to-date articles, professional discussions, and emerging doctrine. Twenty-nine percent of ILE instructors surveyed reported that they supplemented the curriculum materials more frequently than in pre-CGSC LLC conditions. This proportion is likely to increase as faculty become more facile with LLC technologies. In addition, substantial proportions of students (>85%), instructors (74%), and course authors (80%) surveyed reported that the ILE course content was relevant to the jobs of ILE graduates.

System use

There do appear to be some challenges to the envisioned full-scale adoption of the CGSC LLC by course authors, instructors, and students in the schoolhouse. Although the rates of active adoption (i.e., primary use of the system components) increased during the first-year pilot, they remain below 100% (between 5% and 40%, depending on the system component and purpose for which it was accessed). A combination of survey and interview data indicated that technical difficulty was not the main barrier using the system as intended. First, a weighted average of student, course author, and instructor survey responses indicated that the CGSC LLC technical support was accessible (62%) and useful (66%). Moreover, the system workarounds they reported using involved typically some other form of technology. For example, Microsoft SharePoint (one component of the CGSC LLC) was the most frequently cited alternative to Blackboard (a second component of the CGSC LLC) when posting or accessing curriculum materials.

The main barriers to system use appear to have been (a) ready availability of alternatives to the system that were more familiar and easier to access; (b) inconsistent or absent information management procedures necessary to make posted content easy to find; and (c) lack of instructor and course author involvement in and buy-in to the lifelong learning concept. As has been found in previous evaluations of this kind (Cianciolo et al., 2006), greater success has been achieved in the technical implementation of the initiative than in the cultivation of stakeholder enthusiasm and investment.

When asked what they thought was the Army's main reason for implementing the CGSC LLC, a minority of students surveyed (33%) responded that the Army had made the decision in the best interests of leader education. Although the Army surely had multiple reasons for adopting the new instructional technologies—including enhancing leader education—actively using the CGSC LLC to foster students' perception of organizational support for leaders would make it a more effective asset in enhancing organizational commitment and cultural shift.

Learning quality

The challenges to the active adoption of the CGSC LLC did not appear to hamper the academic experience of ILE students and instructors in the first-year pilot. A very high proportion of surveyed students (79% on average) reported that ILE instructors generally demonstrated the classroom facilitation behaviors recognized as critical to developing adult learners. In addition, survey responses indicated that a majority of students (a) took responsibility for their own learning via independent study (70-98%); (b) reported high learning self-efficacy (88%); and (c) were motivated to learn the topics taught in ILE (91%). Fifty-eight percent of instructors reported that the CGSC LLC did not have an impact on classroom efficiency, and a small minority of instructors (10%) reported that the CGSC LLC enhanced their classroom efficiency. Although it may seem insignificant, this result is noteworthy given the

fact that the introduction of instructional technology often is associated with increased workload for faculty (Willis, 2000).

CONCLUSIONS

Logic modeling proved to be a feasible and useful technique for capturing and representing the functioning of technology-enabled learning initiatives such as LLCs, from the acquisition and use of resources to the achievement of organizational impact. The findings of the CGSC LLC evaluation indicated the importance of taking a causal approach. Assessment of outcomes alone would have indicated that the initiative had achieved its goals but would have obscured the fact that a subset of these goals—teaching and learning effectiveness—was achieved largely independently of the use of educational technology. Taking a causal approach more frequently in educational technology evaluation studies would enhance understanding of why, when, and where technology-assisted education is effective (Bernard et al., 2004; Feldon & Yates, 2007).

Study Limitations and Future Research

This present study is not without its limitations. First, strategies for evaluating educational effectiveness have historically assumed that institutional goals for education are aligned both with student learning objectives and with those learning objectives that must be met to further society or organizational performance. The design of the LLC assessment framework is consistent with this historical assumption. That is, outcome measures reflecting the alignment (i.e., content coverage) between what is taught via LLCs and what must be taught in order to advance student's expected achievement and organizational excellence were not included in the framework. The alignment between what is taught and what must be taught is critical to achieving organizational impact via an educational initiative (see e.g., Cianciolo et al., 2006; Frank, Gemeinhardt, & Ostyn, 2005), and should be included in a comprehensive picture of LLC effectiveness.

Second, the limited scope of the present study prevented an explicit test of the validity of the assessment framework developed. Additional research should determine whether the framework (a) applies as expected to other LLCs, especially those with curricula that differ from ILE; (b) produces the same results using quasi-experimental evaluation, where possible; and (c) accurately predicts the future status of an LLC based on initial evaluation and implementation of recommendations.

Third, limitations in scope also prevented more creative application of measurement methodology to capture the evaluation metrics of interest. Further research should explore the use of classroom (traditional and virtual) observation, existing educational performance data, and automated measures of system activity in conducting comprehensive educational program evaluation.

Recommendations for LLCs

Like any new initiative, future LLCs will achieve the greatest success by engaging all stakeholders in the design and implementation process in order to win the buy-in of instructors, other staff, and learners. A consensus-building approach (see Susskind, McKearnan, & Thomas-Larmer, 1999) to achieving stakeholder agreement and buy-in with regard to initiative objectives, design, and implementation would accelerate progress between system launch and organizational impact.

Enhanced implementation also may be fostered through (a) engaging other schoolhouse components, especially faculty and staff development, in viewing and cultivating technology-assisted teaching as a critical instructor competency; (b) encouraging and shepherding the involvement of instructors and course authors in the development of information management procedures through needs assessment and iterative system design; and (c) spreading strategic communications that explain the purpose and goals of the system, that anticipate technical limitations of the system (i.e., login requirements), and that immediately follow system outages.

The enhanced functioning of the initiative resulting from stakeholder engagement will enable the LLC to serve as a powerful driver of lifelong learning and organizational change.

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REFERENCES

Barry, M., & Runyan, G. (1995). A review of distance-learning studies in the military. *American Journal of Distance Education, 9*(3), 37-47.

Belanger, F., & Jordan, D. H. (2000). *Evaluation and implementation of distance learning: Technologies, tools, and techniques*. Hershey, PA: Idea Group Publishing.

Bernard, R. M., Abrami, P. C., Lou, Y., Borokhovski, E., Wade, A., Wozney, L., et al. (2004). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research, 74*(3), 379-439.

Bourne, J. R. (1998). Net-learning: Strategies for on-campus and off-campus network-enabled learning. *Journal of Asynchronous Learning Networks, 2*(2), 70-88.

Bralley, N., Danley, J., French, D., Soby, C., & Tiberi, P. (2003, July 18). Understanding Intermediate Level Education: How is it different from the former Command and General Staff Officer Course? *TRADOC News Service*. Retrieved January 26, 2006 from the World Wide Web. Available at: http://www.monroe.army.mil/pao/TNSarchives/July03/ILE.htm.

Cianciolo, A. T. (2007). *Program evaluation metrics for U.S. Army Lifelong Learning Centers* (Technical Report No. 1196). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Cianciolo, A. T., Heiden, C., & Prevou, M. (2006). *Assessing Army professional forums: Metrics for effectiveness and impact* (Research Report No. 1862). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Cianciolo, A. T., & Prevou, M. (2006). *Effects-based KM metrics: Defining impact in terms of outcome instead of activity*. Seminar presented at the e-Gov Conference. Washington, DC.

Cukier, J. (1997). Cost-benefit analysis of telelearning: Developing a methodology framework. *Distance Education, 18*(1), 137-152.

Dean, R., Biner, P., & Coenen, M. (1996). Distance education effectiveness: A systems approach to assessing the effectiveness of distance education. *Education at a Distance Journal, 10*(3), J17-J20.Ehrmann, S. (1994). *Project "Flashlight" planning grant: Final report* (Report No. HE030726). Washington, DC: Corporation for Public Broadcasting.

Ehrmann, S. (1994). *Project "Flashlight" planning grant: Final report* (Report No. HE030726). Washington, DC: Corporation for Public Broadcasting.

Feldon, D. F., & Yates, K. A. (2007). Increasing validity in the evaluation of new distance learning technologies. *Computers in Human Behavior, 23*, 2355-2366.

Firdyiwek, Y. (1999). Web-based courseware tools: Where is the pedagogy? *Educational Technology, 39*(1), 29-34.

Frank, G., Gemeinhardt, D., & Ostyn, C. (2005). Linking reusable competency definitions to learning activities. *Proceedings of the Interservice/Industry Training, Simulation, and Education Conference*. Orlando, FL.

Harrison, P. J., Seeman, B. J., Behm, R., Saba, F., Molise, G., & Williams, M. D. (1991). Development of a distance education assessment instrument. *Educational Technology Research & Development, 39*(4), 65-77.

Hiltz, S. R. (1990). Evaluating the virtual classroom. In L. M. Harasim (Ed.), *Online education: Perspectives on a new environment* (pp. 133-183). New York: Praeger.

Kirkpatrick, D. L. (1994). *Evaluating training programs: The four levels*. San Francisco: Berrett-Koehler.

Lockee, B. B., Burton, J. K., & Cross, L. H. (1999). No comparison: Distance education finds a new use for "No Significant Differences." *Proceedings of selected research and development papers presented at the National Convention of the Association for Educational Communications and Technology*. Houston, TX.

McLaughlin, J. A., & Jordan, G. B. (2004). Using logic models. In J. S. Wholey, H. P. Hatry, & K. E. Newcomer (Eds.), *Handbook of practical program evaluation* (2nd ed, pp. 7-32). San Francisco: Jossey-Bass.

Phelps, R. H., Ashworth, Jr., R. L., & Hahn, H. A. (1991). *Cost and effectiveness of home study using asynchronous conferencing for reserve component training* (Technical Report No. 1602). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Resta, P., & Laferrière, T. (2007). Technology in support of collaborative learning. *Educational Psychology Review, 19*, 65-83.

Salas, E., Rhodenizer, L., & Bowers, C. A. (2000). The design and delivery of crew resource management training: Exploiting available resources. *Human Factors, 42*(3), 490-511.

Sitzmann, T., Kraiger, K., Stewart, D., & Wisher, R. (2006). The comparative effectiveness of web-based and classroom instruction: A meta-analysis. *Personnel Psychology, 59*(3), 623-666.

Susskind, L., McKearnan, S., & Thomas-Larmer, J. (1999). *The consensus-building handbook: A comprehensive guide to reaching agreement.* Thousand Oaks, CA: Sage.

U.S. Army Training and Doctrine Command. (2004). The growth and future of lifelong learning. Retrieved February 18, 2006 from the World Wide Web. Available at http://www.tradoc.army.mil/pao/web_specials/lifelong_learning/lllgrowth.htm.

Wellman, B., & Gulia, M. (1999). Virtual communities as communities: Net surfers don't ride alone. In M. A. Smith & P. Kollock (Eds.), *Communities in cyberspace* (pp. 168-194). London: Routledge.

Whalen, T. & Wright, D. (1999). Methodology for cost-benefit analysis of Web-based tele-learning: Case study of the Bell Online Institute. *The American Journal of Distance Education, 13*(1), 25-43.

Willis, B. (2000). Effective distance education planning: lessons learned. In K. Mantyla (Ed.), *The 2000/2001 ASTD distance learning yearbook* (pp. 43-48). New York: McGraw-Hill.

Wilson, W. R., & Helms, R. F., II. (2003). A business model for lifelong learning. *Proceedings of the Interservice/Industry Training, Simulation, and Education Conference*. Orlando, FL.