2012-03

Analyzing the Relative Cost, Effectiveness and Suitability of Synchronous Training Versus Traditional On-site Training Approaches.

Pryor, Benjamin A.; Betts, Willard

Monterey, California. Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

JOINT APPLIED PROJECT

Analyzing the Relative Cost, Effectiveness and Suitability of Synchronous Training Versus Traditional On-site Training Approaches.

By: **Benjamin A. Pryor and Willard Betts**

March 2012

Advisors: **David F. Matthews**
Brad R. Naegle

Approved for public release; distribution is unlimited

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			*Form Approved OMB No. 0704-0188*
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.			
1. AGENCY USE ONLY ***(Leave blank)***	**2. REPORT DATE** March 2012	**3. REPORT TYPE AND DATES COVERED** Joint Applied Project	
4. TITLE AND SUBTITLE Analyzing the Relative Cost, Effectiveness and Suitability of Synchronous Training Versus Traditional On-site Training Approaches.		**5. FUNDING NUMBERS**	
6. AUTHOR(S) Benjamin A. Pryor and Willard Betts			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000		**8. PERFORMING ORGANIZATION REPORT NUMBER**	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A		**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB Protocol number N/A .			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited		**12b. DISTRIBUTION CODE** A	

13. ABSTRACT (maximum 200 words)

The purpose of this Joint Applied Project (JAP) was to determine, through data collection, any life-cycle cost savings of a synchronous training approach versus the more traditional on-site new equipment training (NET) approach. With Army units and equipment deployed throughout the world, the cost of providing on-site training can be prohibitive.

The Army has made effective use of distance learning approaches to meet both career training objectives (e.g. Defense Acquisition University (DAU) and Naval Postgraduate School (NPS)) and workplace training requirements (e.g. ethics and security). Similar approaches to replace on-site training for equipment, especially NET, could result in not only cost savings, but also result in better use of training personnel due to reduced travel time.

The primary concern with this synchronous training approach is the quality and effectiveness of training. By drawing on expertise of both Program Management Offices as well as other life-long learning-based institutions (i.e. DAU, Naval Postgraduate School personnel for expertise in distance learning, the Army acquisition programs could be able to replace a significant portion of on-site training with synchronous training.

14. SUBJECT TERMS Synchronous Training Approaches, Measures of Effectiveness and Suitability, New Equipment Training (NET), Relative Training Costs, Learning Styles.			**15. NUMBER OF PAGES** 61
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UU

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

ANALYZING THE RELATIVE COST, EFFECTIVENESS AND SUITABILITY OF SYNCHRONOUS TRAINING VERSUS TRADITIONAL ON-SITE TRAINING APPROACHES

Benjamin Pryor
Department of the Army Civilian, Army
Bachelor of Science, Central Michigan University

Willard Betts
Department of the Army Civilian, Army
Bachelor of Science, University of Delaware

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN PROGRAM MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
March 2012

Authors: _____
Benjamin A. Pryor

_____
Willard Betts

Approved by: _____
Principal Advisor, David F. Matthews

_____
Associate Advisor, Brad R. Naegle

_____
William R. Gates, Dean
Graduate School of Business and Public Policy

THIS PAGE INTENTIONALLY LEFT BLANK

ANALYZING THE RELATIVE COST, EFFECTIVENESS AND SUITABILITY OF SYNCHRONOUS TRAINING VERSUS TRADITIONAL ON-SITE TRAINING APPROACHES

ABSTRACT

The purpose of this Joint Applied Project (JAP) was to determine, through data collection, any life-cycle cost savings of a synchronous training approach versus the more traditional on-site new equipment training (NET) approach. With Army units and equipment deployed throughout the world, the cost of providing on-site training can be prohibitive.

The Army has made effective use of distance learning approaches to meet both career training objectives (e.g. Defense Acquisition University (DAU) and Naval Postgraduate School (NPS)) and workplace training requirements (e.g. ethics and security). Similar approaches to replace on-site training for equipment, especially NET, could result in not only cost savings, but also result in better use of training personnel due to reduced travel time.

The primary concern with this synchronous training approach is the quality and effectiveness of training. By drawing on expertise of both Program Management Offices as well as other life-long learning-based institutions (i.e. DAU, Naval Postgraduate School personnel for expertise in distance learning, the Army acquisition programs could be able to replace a significant portion of on-site training with synchronous training.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

LIST OF TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

ADL	Advance Distributed Learning
ADLS	Advance Distributed Learning System
ALMS	Advance Learning Management System
APB	Acquisition Program Baseline
ASAALT	Assistance Secretary Army Acquisition Logistics Technology
ASAT	Automated System Approach
ATA	Automated Training Approach
BPS	Bits Per Second
CBT	Computer Based Training
CDD	Capabilities Development Document
CIF	Common Intermediate Format
DAU	Defense Acquisition University
DDTC	Deployed Digital Training Center
DET	Displaced Equipment Training
DoD	Department of Defense
DODEA	Department of Defense Education Activity
DSL	Digital Subscriber Line
DTT	Doctrine Tactics Training
ELO	Enable Learning Objective
GAO	Government Accountability Office
ICD	Initial Capabilities Document
IOT&E	Initial Operational Test and Evaluation
IP	Internet Protocol

IRR	Individual Ready Reserve
ISDN	Integrated Services Digital Network
IT	Information Technology
JAP	Joint Applied Project
K/BPS	Kilo Bits Per Second
KPP	Key Performance Parameters
MACOM	Major Commands
MATDEV	Materiel Developer
MOE	Measure of Effectiveness
NET	New Equipment Training
NETP	New Equipment Training Plan
NETT	New Equipment Training Teams
NPS	Naval Postgraduate School
OUSDP&R	Office Undersecretary of Defense Personnel and Readiness
PDI	Project Development Identifiers
PDSI	Project Development Skill Identifiers
PM	Program/Project Manager
PMO	Program Management Office
POI	Program of Instruction
SECDEF	Secretary of Defense
SIF	Single Input Format
ST	Sustainment Training
T2	Telehealth and Technology
TLO	Terminal Learning Objectives
TMH	Telemental Health

TRADOC	Training Doctrine
USAMITC	United States Army Medical Information Technology Center
VOIP	Voice Over Internet Protocol
VTC	Video Tele-Conference

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

The authors want to thank Professor David Matthews for his guidance, patience, and understanding during the work in performing this Joint Applied Project.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

"The budget should be balanced; the treasury should be refilled; public debt should be reduced; and the arrogance of public officials should be controlled." – Cicero. 106–43 B.C.

A. PROBLEM STATEMENT

With current financial constraints, Product Managers (PMs) are being forced to uncover more cost-effective approaches to reducing programmatic costs without impacting the warfighter. One possible solution to reduce costs is to assess the feasibility of implementing a blended training approach program, in which PMs provide New Equipment Training (NET) using video-teleconferencing technology as opposed to deploying a team of trainers on-site to various CONUS locations.

B. PURPOSE

This research paper has four objectives focusing upon the feasibility of implementing video-teleconferencing (VTC) in lieu of the more traditional approach of on-site training in order to reduce programmatic costs. The primary objective of this research paper is to determine life-cycle and relative cost savings by implementing a VTC approach rather than on-site training. The secondary objective is to identify measures of effectiveness of the VTC alternative. The third objective is to identify any influencing factors that impact the delivery and effectiveness of either training approach. And finally, the fourth objective is to address advantages, challenges, and limitation of implementing a VTC training approach to replace the on-site training approach.

C. BACKGROUND

With the unprecedented national debt growing at a seemingly uncontrollable rate, Congress is faced with reducing Department of Defense (DoD) appropriations across many acquisition programs. According to the United States Daily Treasury Statement dated 3 February 2012, the current national debt has surpassed the $15 trillion mark.

With the current national debt reaching an all-time high and without any signs of retraction, many agencies are bracing for severe budget cuts.

The Department of Defense is one of many agencies expected to have significant budget cuts estimated at $450 billion over the course of 10 years as part of the Budget Control Act of 2011. In preparation for this budget cut, the Department of Defense launched a comprehensive effort to reduce its overhead expenditures (Secretary of Defense (SECDEF), 2010). The goal of the initiatives was to sustain the U.S. military size and strength over the long-term by reinvesting those efficiency savings in force structure and other key combat capabilities.

Similarly to the Department of Defense goals, the Assistant Secretary of the Army Acquisition, Logistics, and Technology (ASAALT) is anticipating receiving significant funding cuts in FY2012. As a proactive measure, many of the program/product management offices falling under ASAALT's purview are reassessing and streamlining their business practices to reduce costs, either by means of cost-savings or cost-avoidance, without negatively impacting the mission.

Program managers are constantly scrutinized by their respective higher headquarters to streamline their fielding, equipping, and training approaches while balancing cost, schedule, and performance. Above these tasks, PMs must ensure their materiel solutions are sustainable, affordable, supportable, and effective. Unfortunately, Program Management Offices (PMOs) are not exempt from funding cuts regardless of the above mentioned tasks. At a bare minimum, they are still contractually obligated to meet their Acquisition Program Baseline (APB) of cost, schedule, and performance regardless of funding cuts. In other words, PMs must still delivery their systems on-budget, on schedule, and meeting all Key Performance Parameters (KPPs). If acquisition programs plan to survive these funding costs, then they must discover ways to reduce programmatic cost while meeting their programmatic objectives.

One possible solution to reduce programmatic costs, while potentially achieving similar end results, is to revise their New Equipment Training program from an on-site training approach to a VTC training approach.

D. SCOPE

The scope of this research paper is the relative cost-savings and effectiveness of implementing VTC training in comparison to on-site training during new equipment training (NET). In order to better guide the scope of our research, six project objective questions were developed.

1. Research Objectives

Q1: Can significant life-cycle cost savings be realized utilizing synchronous training?

Q2: What are the relative costs associated with conventional and synchronous training?

Q3: What are the measures of effectiveness and suitability for synchronous training?

Q4: How effective is the delivery of synchronous training in comparison to the traditional on-site training approach?

Q5: What are the relative advantage, challenge, and limitation of synchronous training?

Q6: What are the transition mechanisms and strategies for implementing synchronous training?

2. Limitations

This research paper does have a few notable limitations. First, this research does not address learning effectiveness or cost data associated with computer-based training (CBTs) modules, or other on-line recorded video training media. Second, this research does not address video-teleconferencing in a tactical/contingency environment (e.g. Southwest Asia, Afghanistan, Kuwait, Korea, etc). Lastly, the analysis of our research assumed the trainers are Army basic training certified.

E. RESEARCH METHODOLOGY

Our research methodology for obtaining information consisted of using a myriad of techniques. The primary means by which we gathered our information was through the internet. As a result of canvassing the internet, we were able to obtain various database reports, usage statistics, and trend data from the commercial, private, and military sectors.

In addition to the internet, our research includes blogs, articles, journals, books, magazines, brochures, and other thesis-related material from the Naval Postgraduate School as well as from other academic institutions.

Another technique used to gather information was personal correspondence with subject matter experts. By corresponding with colleagues and sending electronic inquiries to various institutional sites (e.g. Defense Acquisition University and Naval Postgraduate School), we were able to gather more insight into the steps and costs associated with creating a successful video-teleconferencing training program.

Finally, we were able to draw a significant amount of financial data and survey information on traditional on-site new equipment training based upon our current acquisition position. As a result of the sensitive nature of information regarding programmatic funding, the financial data will be reference in general terms. If specific funding data is required for follow-on research, submit an inquiry to the authors and a determination will be made by the program management officer as to whether data will be releasable.

F. STRUCTURE OF THIS RESEARCH PAPER

The remainder of this paper is categorized into seven main sections. Section II provides an educational overview on New Equipment Training. In Section III, we will compare the relative costs associated with implementing two types of new equipment training strategies: on-site training versus a video-teleconferencing (VTC) training approach. As part of a VTC training approach, Section IV will provide a myriad of measures of effectiveness addressed by other training institutions. Subsequently, in

Section V, we will address some factors to increase/enhance these measures of effectiveness from a soldiers' and trainers' perspective. In closing, Section VI will document some advantages, challenges, and limitation inherent in implementing a VTC training approach as opposed to an on-site training approach.

THIS PAGE INTENTIONALLY LEFT BLANK

II. NEW EQUIPMENT TRAINING

This section of the research paper provides general background information on new equipment training (NET). For starters and for those readers unfamiliar with the acquisition term, this particular section of the research paper provides a basic definition of NET. It also covers comprehensive information concerning the nuances behind developing and implementing a NET Plan (NETP) in order to gain a deeper appreciation of NET. In closing, this section addresses numerous approaches to performing NET from a most desirable to least desirable standpoint. Subsequent sections will dissect the most desirable approach into two types of training, either -on-site or video teleconferencing- to determine which type is more cost-effective without negatively impacting soldier training efficiency and effectiveness.

The New Equipment Training (NET) provides the war fighter with initial training concurrently with the fielding of the new system. Depending upon the complexity of the system, multiple training courses may be required for operations, maintenance, and tactics. NET is provided by the Materiel Developer (MATDEV) as part of the initial fielding package. NET is typically conducted on-site at the gaining unit, requiring significant resources in course development, facilities, and instructors, including their deployment costs and transportation.

A. DEFINITION

AR 350-1, *Army Training and Education*, defines NET as the transfer of knowledge on the operation and maintenance of new or improved systems from the materiel developer (MATDEV) to testers, trainers, supporters, and users. Other sources providing similar definitions can be referenced in AR 700-127 *Integrated Logistics Support* and DA Pam 350-40 *Army Modernization Training Plans for New and Displaced Equipment*.

NET falls under the Army modernization training umbrella, which also supports a handful of other training categories, such as, doctrine and tactics training (DTT),

displaced equipment training (DET), and sustainment training (ST). Although there are many types of Army modernization training programs, most PMs are only concerned with providing NET because the proponent schoolhouses are responsible for providing the other aforementioned training programs. For example, ST includes individual and collective training that is conducted within a unit or institutional schoolhouse after the conclusion of NET. Although the PM should assist in the development of sustainment training tools, the preponderance of responsibility falls upon the proponent schoolhouse to ensure a sustainment program is developed.

In general, weapon systems usually cannot deploy new equipment to the unit until the program has successfully completed Initial Operational Test & Evaluation (IOT&E) as required by law. On the other hand, some Information Technology (IT) Acquisition programs may commence new equipment training, after receiving a favorable Milestone C decision approval. This key milestone marks the program's acquisition life-cycle transition from the Engineering & Manufacturing Development Phase to the Production & Deployment Phase. However, the mere transition from one phase to the other phase does not authorize the program to procure, field and training units as these acquisition activities are dependent on receiving full funding authority. Interestingly, a query within the Defense Information Technology Portfolio Repository database, results in over 850 records of Information Technology programs. Of these programs, over 390 programs are categorized in the production and deployment phase. Based on this information, one can presume that 450 programs have the full approval, subject to availability of funds, to perform new equipment training.

Once the program receives full funding, a program office can begin their implementation plan to support a wide array of programmatic activities that include procurement, production, equipping, fielding, and training. Given the abundance of activities within the production & deployment phase, NET planning should begin as early as program initiation. Early planning will address many considerations, which will better position the program for success.

Below is a list of possible considerations for the PM to mull over when developing the new equipment training plan (NETP).

1. Similarity to previously fielded systems
2. Current state of the training base to support the equipment
3. Technical complexity of the equipment
4. Impact on training by interim contractor maintenance support and warranty restraints on equipment or systems
5. Fielding rate
6. Effect on unit readiness
7. Overall training strategy for the equipment
8. Planned density for the equipment
9. Available trainers in the Major Commands (MACOM) to proliferate training.
10. Quality and quantity of personnel to be trained
11. Available training devices, equipment, ranges, facilities, and training materials
12. Environment where equipment is to be issued
13. Capabilities and dispersion of Army National Guard and Reserve units, plus consideration of Individual Ready Reserve (IRR)
14. Personnel and funding
15. Ammunition and consumables to support NET and trainers
16. Sustainment training following fielding
17. Foreign language requirements and local national personnel.
18. Need to establish project development identifiers (PDI) and project development skill identifiers (PDSIs)
19. Depot training requirements

It is important to note that the PM's should not face independent development of their NETP in a stovepipe environment. Conversely, PM's are urged to collaborate with the Training and Doctrine Command (TRADOC) to assist in the development of their training plan. TRADOC has many internal regulations, such as TRADOC Regulation

350-70 Training Development and Management for New Materiel Systems, that prescribe policies and provide guidance for training development and management to support new systems. This regulation provides various methods to provide NET along with a brief description of the method.

B. METHODS OF PROVIDING TRAINING

TRADOC AR 350-70 provides six methods to provide NET. Below is an extract listing from the regulation along with a brief description of each of the methods ranging from most desirable (1) to least desirable (6). For the purpose of this research, we will focus particular attention on the most desirable approach as Section III will expand upon this type of NET approach.

1. Multimedia exportable training materials—Distance learning includes any formal approach to learning in which the majority of the instruction occurs while the educator and student are at a distance from each other. NET and Doctrine tactics training (DTT) are candidates for distance learning media. On-site training and video-teleconferencing training are two means of providing training under this category.
2. Train-the-trainer—This approach provides training to personnel in the unit. Once they become trained, they conduct follow-on training to personnel within their unit.
3. Institutional training—The proponent schoolhouses can provide NET.
4. Single-site training—NET is performed at a specific site.
5. Contract NET—contract a vendor to conduct NET
6. NET trainers—training performed by active duty soldiers.

C. FACTORS IMPACTING TRAINING SELECTION

PM's have the flexibility to choose any of the NET approaches. However, there are some influencing factors that may persuade a PM to select one approach over another.

In determining the NET strategy, the PM should keep these elements in the forefront of their decision process:

1. Maintenance of unit readiness
2. Flexibility
3. Complexity of the new system
4. Total number of personnel to be trained
5. Location of units to be trained
6. Duration of the training
7. Resource constraints

Regardless of the training approach, PMs must collaborate with TRADOC and the proponent schoolhouse to develop Program of Instructions (POIs). POIs are similar to scenario-type training objectives for the soldiers. They are the foundation of the NETP. Any training, regardless of the approach, being conducted must adhere to these POIs. Deviating from the POIs will foster an increased rate of inconsistencies and lack of standardization, resulting in the higher likelihood of training inefficiencies.

To recap this section, we provided the basic definition of NET, as well as some additional information regarding the development and implementation of NET. Hopefully, this information laid a stronger foundation of knowledge concerning NET. As we transition into the next section of the research paper, we will analyze and compare two specific NET training approaches under the multimedia exportable training materials, which are deemed the most desirable approach to NET. The two types of multimedia exportable training materials, which will be discussed in the following section, are on-site training and video-teleconferencing training.

THIS PAGE INTENTIONALLY LEFT BLANK

III. RELATIVE COSTS

Estimating the cost savings by use of VTC training is a difficult task. Great variations in types of systems, i.e. vehicles, weapons, software, etc., system locations, and number of fielding sites results in a great variation in basic parameters. Rather than try to providing a detailed analysis of costs, a simple estimate of relative costs has been prepared. This relative estimate can be used to analyze where the greatest cost savings will be likely to occur.

The costs of testing can be broken down into three phases, the development phase, the testing stage, and the fielding stage. Bartley and Golek (2004) recommend adding an additional step of evaluation to capture the effectiveness of the training. During system development, the training package must be an early consideration, and significant costs are incurred during this stage to develop the training as well as getting the trainers up to speed on the system. During the testing stage, the training team must provide the NET for the first time, evaluating the training package both during the actual training, as well as the effectiveness of the training during the tests. Finally, in the fielding stage, the training team provides the NET to the gaining units.

A. DEVELOPMENT STAGE

Ideally, the decision on whether to conduct NET via either face-to-face training or using VTC needs to be made early in system development. By developing the training to match the delivery mode, the training can be more effective. Costs during the development include instructor salary, travel costs to facilitate instructor familiarization with the system, graphics development, and development of multimedia for the training. Key differences in training development include delivery of multimedia, such as handouts and videos, as well as building in feedback loops for VTC training, since student feedback is much different depending on delivery method. Development of assessments for conduct during the class is essential to make sure that learning milestones are achieved.

Assuming that the training developer is familiar with developing training to be delivered with both methods , there should be minimal difference in development costs between face-to-face and VTC training.

B. TESTING STAGE

In the testing stage, not only is the system evaluated, but the NET is under evaluation as well. When using VTC for conducting NET, it would still be beneficial to have the trainers on-site during at least some of the testing, so that feedback from the systems users could be directly provided to the trainers. This is also an opportunity to increase the instructors' familiarity with the equipment and to develop insight into the users' views of the equipment. This feedback is essential for improving the NET package. If the trainers travel to each training site, then there will be little difference in cost between face-to-face and VTC training methods. Some savings could be realized by delivering training at some test sites via VTC.

C. FIELDING STAGE

In the fielding stage, significant cost savings are possible. Since systems must be fielded to many units could possibly be scattered across the globe, the cost of providing face-to-face training is significant. Costs include travel costs, including airfare, rental cars and per diem, instructor salary including travel time, classroom rental, and course materials such as handouts. By simply eliminating or reducing travel costs for the instructors, significant costs can be avoided. A relative cost comparison of face-to-face vs. VTC training is found in Table 1. The categories are comparable for the testing delivery methods:

Table 1. Relative Cost Comparison for NET Training Delivered by Face-to-face vs. VTC

Cost	Face-to-face	VTC
Computer development team	None	More
Equipment costs (includes cost of overhead projectors, computer resources, VTC equipment, etc.	Slightly less	Slightly more
Facility costs (includes cost of classrooms)	Slightly less	Slightly more
Travel costs (for instructors, includes airfare, rental car, per diem, etc.)	Significant	None
Connectivity (bandwidth required to both deliver and receive training)	None	More
Non-Productive Man-hours (Travel time for instructors)	Significant	None
Technical Support	None	Minor

By this comparison, it is obvious that the travel cost and non-productive man-hours that result from travel are the significant cost drivers for face-to-face training. Considering that the effective labor rate for a trainer is on the order of $100 per hour, lost travel days not only result in wasted money, but also depletes the availability of the limited resource that is qualified trainers.

THIS PAGE INTENTIONALLY LEFT BLANK

IV. MEASURE OF EFFECTIVENESS

This section captures various measures of effectiveness (MOEs) as they relate to the technology required to deliver video teleconferencing training. It is noteworthy to forewarn the reader that this section will not evaluate the following: effectiveness of the personnel providing the training, the effectiveness of the actual content of the training being presented, or the quality of the visual-aids being presented. The primary reasoning behind the exclusion of these subject headings is based upon these training elements being embedded into the program's approved training curriculum. Recall that in the previous section, TRADOC's role and responsibility is to validate and approve a program's training curriculum, to include the content as well as any audio-visual training aids. Therefore, regardless of whether trainer is teaching from behind a podium or through a display monitor, the content and audio-visual aids should be part of the TRADOC-approved training package.

The foundation of this section focuses on the measure of effectiveness from a technological perspective (i.e. hardware and data service). This section of the report will provide the general technological specification parameters necessary to promote ideal new equipment training utilizing the various VTC technologies.

As an outcome of this section, one of our remaining research objectives, which is to determine the measure of effectiveness of NET using a VTC training approach as opposed to on-site training approach, will be addressed. Since our original research objective was too broad, we had to revise and modify the scope of our objective to make it more parochial in nature. Our revised scope focuses primarily on the technology that enables the delivery of training.

As part of our revision, we made the following three assumptions regarding the personnel and materials being provided during NET:

1. Trainers have been certified under a Basic Training Instructor Program (e.g. Army, Navy, Marine, Air Force, etc).

2. Training plans and audio-visual training aids have been approved by TRADOC

3. Terminal Learning Objectives (TLOs) and Enabling Learning Objectives (ELOs) for the training plan have been approved by TRADOC.

A. DEFINING MEASURE OF EFFECTIVENESS (MOE)

The Defense Acquisition University Guidebook defines Measures of Effectiveness (MOE) as measures designed to correspond to accomplishment of mission objectives and achievement of desired results. Another source extracted from CJCSI 3170.01G defines MOEs as a measurement to "quantify the results to be obtained by a system and may be expressed as probabilities that the system will perform as required." In laymen's terms, "Does the system do what it was meant to do and can it be measured?" One way to measure the effectiveness on any particular system from a training perspective is to assess the student's ability to meet both the Terminal Learning Objectives (TLO) and Enabling Learning Objectives (ELO).

B. TLOs AND ELOs

TLOs and ELOs are very common in the teaching environment. For those of unfamiliar with TLO and ELO, these learning objectives are the foundation learning elements used by the military as well as other academic institutions to provide the teacher immediate feedback concerning the student's understanding of the lesson plan.

A simplified definition of TLO is a statement of the teacher's expectations for student's performance at the end of a specific lesson plan. The TLO is written from the perspective of the student as to what actions the students will do, not what the teacher is expected to do. An example of a TLO is: Given the appropriate tools, manuals, and hardware, the student will be able to properly document an electronic healthcare record into the healthcare database system by properly assigning the International Statistical Classification of Diseases and Related health Problems (most commonly known by the abbreviation ICD) in under 3 minutes. As you can see from the example, TLOs have the following characteristics:

1. Consist of three parts: Task, Condition, and Standard
2. Precise, observable, and measureable
3. Stated in active terms
4. Usually focus on a single lesson/topic

ELOs are concise statement of the teacher's expectations of student performance. They usually are decomposed into so-called steps in order to achieve the TLOs. Similarly to TLO, ELOs are written from the perspective of the student and what the student must do in order to accomplish the TLO. For example, in order for the student to meet the ELO from the example above, the student will need to look up the ICD codes in the manual and select the appropriate code in order to properly document an electronic healthcare record.

The reason for providing a brief explanation and purpose of TLOs and ELOs is because the development of these learning objectives play a vital role in determining the effectiveness of VTC training over traditional vis-à-vis training. TLO provides direction for a lesson as it guides the teacher to think through a number of questions such as: 1) What will the students be able to do as a result of completing the lesson?, 2) Under what conditions (setting, supplies, equipment, etc.) will the student be required to perform the task?, and most importantly, 3) How well must the student perform the task to achieve a passing mark?

By stating and reviewing the TLOs and ELOs with the student, they acknowledge the learning objectives for the lesson. Now, the next phase of training is to determine if VTC training is effective as vis-à-vis training. In order to ensure VTC training is postured for success, we need to establish some measure of effectiveness from a technological perspective.

C. DEVELOPING MEASURE OF EFFECTIVENESS

For most acquisition programs, MOEs are linked to an operational document such as an initial capabilities document (ICD) or a Capabilities Development Document (CDD). These documents have specific traceability to technical and operational system

requirements. Basically, they document what the system must do and how well the system must perform. However, in our case, with evaluating the use of technology (i.e. VTC platforms) without an associated operational system, we are stranded with developing our own MOEs on the technology. As a result of being stranded without any sense of direction on development of MOEs, we turned to the Space and Missile System Center SMC System Engineering Handbook. This document is considered the requirement development requirements analysis bible, as it provides a handful of MOE characteristics to assist in the development of establishing sound and measureable MOE. Below are a handful of MOEs characteristics that we used to determine our MOEs:

1. Relates to performance
2. Simple to state
3. Testable
4. Complete
5. States any time dependency
6. States any environmental conditions
7. Can be measured quantitatively
8. Easy to measure

We referred to the aforementioned list to guide us in the development of the key technological measures of effectiveness. We utilized various internet metasearch engines (e.g. Google, Yahoo, Dogpile, and Webcrawler) to find various manufactures that provide video teleconferencing technology, our common findings across the various manufactures presented general technical categories. Most of the manufactures focused on visual display acuity, audio quality, latency, down-time (drop connection), set-up time, and system availability.

1. Visual Display Acuity

Visual display acuity is the sharpness of the video. Depending upon the kind of videoconferencing system (i.e. dedicated systems and desktop systems), the visual display acuity can vary significantly due to the level of technology within the components.

Furthermore, the visual acuity can be negatively/positively impacted by the technical quality of the video input (i.e. video camera or webcam) and video output (i.e. computer/display monitor).

For example, dedicated systems have all the required components packaged into a complete system such as a Polycom VSX 7000 systems. This system is one of the top-of-the-line products from Polycom with technically superior quality in the video in and out category. On the other side of the spectrum, the Desktop system is a hodgepodge of add-on components such as, a notebook, a headset, a web camera, and an audio device integrated together to form a teleconferencing system. Depending upon the quality of the product, the video input and output ratings can range from poor to superior. Of course, there is usually a direct correlation in regards to quality and cost.

With the advent of advanced technology, most video add-on components have the capability to provide high-definition video at a reasonable cost, but also have add-in capabilities such as echo and noise reduction technology. A prime example is the Logitech QuickCam Connect PC Webcam with a built-in Microphone for only $39. The capability to capture video in 640 x 480 pixel, which is the highest standard graphic resolution for most desktop computers, has been deemed acceptable for most healthcare providers providing tele-behavorial health consultation in remote areas of the world in support of Operational Enduring Freedom (Sullivan, 2011).

It is important to note that DoD organizations should comply with any requirements for using approved equipment that exist (e.g. Joint Interoperability Test Command). In addition, as stated in TRICARE Policy Manual 6010.57-M that providers of Telemental Health (TMH) services “shall have video technology components meeting or exceeding” American Telemedicine Associations (ATA) standards (DoD Telemental health Guidebook).

Although, we could not definitively determine the most ideal technical parameters of the video input/output for VTC training, there is evidence from VTC end-users that video quality does have a direct impact on how the students respond to training/class.

For example, DoD Education Activity (DODEA) provided a VTC training class in Schweinfurt, Germany that resulted in several suggestions from the students that the screens were out of focus and student found themselves having to yell into the speakers in order to be heard (Stars and Stripes, 2011).

2. Audio Quality

Based on the Government Accountability Office (GAO) Video Teletraining Guide, the quality of the audio system has a significant influence on the participants' reaction (GAO TI-95-1). In order to ensure the VTC session is postured for success, the VTC equipment must consist of quality audio input and output devices. Some commonly used audio input and output devices are microphones and loudspeakers, respectively.

As can be imagined, the cost for audio devices has a significant cost disparity depending upon the quality and capability of product. Some microphones are equipped without noise cancellation functions while some have sophisticated noise cancellation capability. In either case, the measure of effectiveness is simple. Can the end-user clearly understand the person speaking? Utilizing quality add-on components such as an audio headsets, microphones, and video cameras does not necessary mean the audio and video quality will be superb. Bandwidth plays a significant role in the audio and visual quality.

3. Bandwidth

Bandwidth, in computing terms, is the rate of data transfer. It is measured in bits per second (bps) during any connection. The higher the rate of connection, the more likely that the audio and video package will be of better quality. Most VTC connections use principal communication protocol, or Internet Protocol (IP). There are many forms of secondary connection types: Integrated services digital network (ISDN), plain old telephone system, Digital Subscriber Lines (DSL), Satellite and cellular communications. The key is for the both parties on each end of the connection to be able to see and hear accurately and effectively. It is documented by the National Center for Telehealth & Technology (T2) that the ability to operate at a minimum bandwidth of 384 Kbps or

higher is suggested when conducing telemental health services, due to research showing noticeable difference in perception when using lower bandwidths (DoD Telemental Health Guidebook).

Bandwidth is important in dealing with VTC as it has a direct quality impact on video and audio quality. Even though the students and teacher can utilize high-quality microphones and headsets to offset any audible distractions generated from either location, the means in which the video and audio signals are transmitted is predicated on the availability of bandwidth. In the end, if there is limited bandwidth available, then the quality will be significantly impaired.

As a measure of effectiveness in VTC training using desktop videoconferencing, the minimum standard telephone transmission rate is 8 kbps/s (Wikipedia, 2011). For business-oriented videoconferencing quality using video compression the standard transmission rate should be between 128–384 kilo bits/s (kbit/s). Together, desktop videoconferencing can leverage the existing public telephone network, a private IP network or the internet. The target bandwidth for interactive video communications should to be 300 to 400 kbps. However, it is recommended that PM's abide by program-specific policy and other DoD guidelines to ensure compliance as these documents may provide more stringent VTC parameters.

4. Down-time (Drop Connection)

Those of us familiar with commercial telecommunication software (e.g. Apple Facetime, Skype) have probably been subject to a few dropped video connections or some other technical-related glitch that required you to relaunch the program. Numerous attempts to reconnect with friends and family can be frustrating. Drawing from personal experience as well as from speaking with some colleagues, similar frustrations can be seen with on-line video training. So what is the measure of effectiveness as it relates to down-time in VTC training?

After long hours of perusing through various literatures, we were unable to obtain any statistical data that indicates the how many times a connection can be dropped before students *drop* interest in a training session. Therefore, it is difficult to determine a happy

medium between frustration and contentment. However, an internet blogger on geekzone.co claims on 25 August 2010 that Telecom's policy of 8–10 drops a day is an acceptable level of service as well as the industry standard.

The Army Learning Management System (ALMS) provides on-line synchronous and asynchronous training. The program office generates a monthly metric report on system availability. Based on the June 2011 metric report, ALMS provided a chart that indicated system availability was between 95% to 99% throughout the month of June. Although ALMS does not define 'system availability' in the metric report, it does provide a sense that the system has an exceptional accessibility rating. The report did not indicate any statistical data regarding reliability or maintainability. In order to ascertain a system's overall operational readiness rating, ALMS should provide a chart that addresses reliability, availability, and maintainability.

5. Set-up Time

Set-up time can vary depending upon the type and complexity of VTC system. Recall that there are two types of VTC systems: dedicated and desktop. As one can imagine, the desktop set-up should be the easier of the two systems, given most technology these days has plug-and-play capability. In other words, the operating system automatically knows new hardware is available and installs the necessary software drivers to ensure that it is functioning properly.

Some other factors impacting set-up time are location, technical experience/knowledge, and manpower. Couple these factors with the complexity of a sophisticated, dedicated VTC system, and the initial installation and set-up time could range from 30 minutes to a few hours. Of course, once the initial installation set-up is complete, then the routine VTC set-up should be significantly reduced. Similar to any new task, set-up time can be further reduced as individuals conduct more VTC sessions.

A prime example of set-up time as a measure of effectiveness is the Army's Distributed Learning System (ADLS). As part of an education initiative for deployed Soldiers, ADLS has set-up over 50 Deployed Digital Training Campus, or DDTC. These

mini-schoolhouses are constructed to provide deployed Soldiers with access to work on their military education while overseas. In some instances, these DDTCs, are so portable that one unit in Afghanistan created a plywood structure to house a VTC system. Most DDTC consist of computer stations, internet, accessibility, video tele-training, voice over internet protocol (VOIP), designated satellite access, teleconferencing capability, and can be set-up in less than two hours (Hemmerly-Brown, 2011).

To recap this section, we have defined measures of effectiveness in the most generic sense from the DAU Guide book as measures designed to correspond to accomplishment of mission objectives and achievement of desired results. As academic discussion points, we briefly explained the relevance and importance of Terminal and Enabling Objectives as they directly provide an immediate feedback to the instructor on how well students are learning the new material. In regards to actual MOEs for VTC training, some measures of effectiveness include visual and audio quality, bandwidth, down-time, and set-up time. All these MOEs are critical to ensuring that the students remain focused and attentive during the lecture. Any issues arising from visual, audio, system availability, or disconnections could significantly impair the student's ability to achieve/perform the necessary enabling learning objectives.

In the following section, we will provide some recommendations to ensure that the video and audio devices are set-up properly to ensure better reception. These recommendations can be documented in a GAO training manual, *A Guide to Design, Development, and Use of Video Teletraining.* This manual basically highlights various set-up configurations in different environments to obtain the best video and audio input/output during a VTC training session.

THIS PAGE INTENTIONALLY LEFT BLANK

V. HOW TO ACHIEVE BETTER VTC SESSIONS

This section will highlight a few recommendations extracted from both the DoD Telemental Health Guidebook and GAO Video Teletraining Guide on the proper set-up of a VTC session to ensure both parties obtain the best possible audio and video quality in a VTC session. Some recommendations that will be covered in this section include physical dimensions of equipment, room design, and placement of video and audio components to achieve the most optimal level of video and audio quality. By following these quick and simple recommendations, the VTC session will have a better look and feel for both parties.

A. EQUIPMENT

As stated in the previous section, there is an abundant array of VTC systems on the market. Agencies could order the most sophisticated brands such as Tandberg, Polycom and Lifesize, or procure a less sophisticated, yet still effective, desktop system consisting of components such as desktop computer, headset, and webcam. Based upon the research, it appears that individual component services or agencies may have a specific needs based on preference or operational need.

For example, the United States Army Management Information Technology Center (USAMITC) has deployed the Tandberg systems to support their VTC communication needs, while the Army Medical Department has procured and deployed the more economical VTC desktop system to support tele-behavorial health missions in various theaters of operations. Regardless of the system being used, the DoD Telehealth Guidebook and the GAO Video Teletraining Guide provide some recommendations to achieve better video and audio quality in a VTC session.

1. Monitors

For starters, the monitor should be large enough to make the instructor/provider more life-like to the end-user. It is stated in the guidebook that smaller display monitors may force the individual to look downward, making it more difficult to interpret facial

expressions. Depending on the type of training session, facial expression may not be important. In either event, the recommendation is to have a minimum of 16" diagonally. Of course, if conducting a larger group training session, a larger monitor will have to be used to accommodate the large group environment.

Utilizing an additional monitor is another recommendation. Equipping the instructor with another monitor may serve as immediate visual feedback to ensure the VTC session is working properly. By observing the other monitor, the instructor will know immediately of any technical glitches hampering the VTC session. Given today's technology, many monitors are equipped with picture-in-pictures capability, so this may serve as another viable option in lieu of procuring another monitor.

2. Video Camera

Video cameras should be of sufficient resolution to capture the intent of the training. Some VTC sessions may require detailed images, while other training sessions require little to no images. Again, depending upon the agency, some policy may dictate. For example, TRICARE Policy Manual requires a minimum video resolution of "one Common Intermediate Format (CIF), or One Source Input Format (SIF)." Some agencies may require the cameras with pan, tilt, and zoom capabilities.

3. Microphones

High quality audio components (microphones and speakers) are highly recommended to ensure effective communication between both parties. It is important to be aware of the placement of these devices to capture the best audio sounds. Most microphones are suitable when placed on a hard, flat surface at head-level.

4. Telephone

In the event of any technical difficulties, it is highly recommended to have an alternative means to conduct operations. The primary purpose of the telephone line is to conduct technical support as well as the other party to ensure measures are being taken to re-establish connection. It is helpful to establish a technical support team early in the

VTC planning to ensure personnel is ready to assist in case any technical issues may arise. Although the regular telephone is ideal, cellular phones are an acceptable alternative.

B. ROOM DESIGN AND SET-UP

Mission requirements will dictate the amount of space your agency needs to properly set-up a VTC session. Some elements to consider during the initial planning phase are installation, operation, and physical security of the VTC equipment. Furthermore, depending on the type of VTC system and the security level of the training, a secure space may be required to prevent tampering or unauthorized access of personnel. It is imperative to consult with technical and network staff prior to and during all phases of the VTC training.

Proper lighting is vital to any VTC session. In order to obtain the most optimal lighting, one needs to consider choice of lighting as well as the placement of the lighting. Consider a room that is well lit and the light is positioned in a way that prevents casting of facial shadows on the individuals. It is recommend that the best source of lighting is fluorescent lighting (non-directional) as it creates a soft image as opposed to the direct lighting that creates a spotlight effect.

Another factor to consider is the placement of the light. Lighting placed in front of an individual may display incorrect skin color (e.g. pale), while lighting placed directly behind an individual may darken the picture. In order to optimize the viewing quality, both parties should experiment with the lighting as well as with the video control settings to ensure the appearance is acceptable.

Some other factors impacting the picture quality is the color of the wall and the background of the room. The best color is neutral, solid, and one that does not produce glare from the light. For example, light blue has been considered by the tele-health experts to be the most optimal color. Some other colors that work well and are deemed acceptable are light grey and beige. Conversely, white and black are the less desirable colors as they make the individual appear too light or dark, respectively. Both parties

should be cognizant of any clutter or other visual distracters, particular patterns that can impair the picture quality. It is recommend that these items be removed or place to the side to ensure the highest visual quality can be achieved.

1. Acoustic/Sound

Audio quality is generally considered more important than video quality in creating a favorable VTC experience **(DoD Telehealth Guidebook).** As one would suspect, the audio should be loud enough that both parties can be heard. It is important to note that most individuals tend to speak louder than normal during VTC session as opposed to face-to-face sessions. Isolating the VTC session from a heating/cooling system, water pipes, and other associated mechanical noises may enhance the audio quality. Another approach that can be used to increase the audio quality, and frequently performed in many of the Naval Postgraduate School sessions, is to manually turn-off the video session which will reduce the percentage of loss video/audio package during the VTC session. Again, manually turning off the video session should be done only if video is not required.

2. Furniture and Equipment Placement

Although there are not any known restrictions on the type of furniture to conduct a successful and meaningful VTC, there are some considerations to keep in mind when placing equipment and ordering furniture. One consideration is to ensure the VTC camera is placed as close to instructor's end of the table to reduce any perceived distance between the teacher and the individual. A VTC sessions showing part of the table creates a sense of distance between the teacher/student(s) and could inhibit a productive dialogue. Another consideration in regards to furniture is to understand that swivel chairs create excessive movement that may cause blurring, which may impair the video quality. One recommendation is to engage the locking mechanism that prevents the unwanted movement and noise.

Similarly to the position of an audio device, the video component is just as important to ensure a good video quality session. The camera should be positioned and

angled in a manner that best captures both parties. The optimal camera placement should be about six feet (6') between the teacher/students and the camera. In addition, both parties should position the camera or themselves straight-on, centered, and at eye-level with each other.

3. Clothing

If the video quality is important to the VTC session, then both parties should be aware that clothing may impact the video quality. Keeping in mind that the room color should be light blue, the instructor should consider wearing dark, solid colors. Personnel wearing non-solid colors (plaid, stripes, complex pattern, etc) will also negatively impact the video quality.

THIS PAGE INTENTIONALLY LEFT BLANK

VI. KEY ADVANTAGES, DISADVANTAGES, AND CHALLENGES

This section will address the key advantages, disadvantages, and challenges facing program managers with implementing a VTC training approach. Much of the data presented in this section are extracts from research papers from the U.S. Army Research Institute for the Behavioral and Social Sciences, whitepapers, brochures, and website articles. The goals of the U.S. Army TRADOC include increasing training opportunities for soldiers, improving the quality of instruction, increasing access to training, and reducing the time solders spend away from their units.

The goals of the Army TRADOC are to provide digital training facilities within 50 miles of 95 % of Army duty stations and develop more than 525 distributed learning courses (Wisher and Olson, 2003). While the effectiveness of traditional Computer-Based Training Instruction has been reviewed quite thoroughly (Kulik, 1994; Lou, Abrami, & d'Apollonia, 2001), the effectiveness of online instruction (VTC) has received little analysis.

A. ADVANTAGES

The primary advantages of VTC will be cost savings. These cost savings will primarily be realized through the reduction of travel costs, as well as decreased lost time due to instructor travel. Lost travel hours can be better utilized as additional classroom hours, resulting in increased utilization of a scarce resource, qualified trainers. Additional advantages are more flexibility in training schedules, since the instructor has more availability and the ability to teach more than one class simultaneously. Quality of life for the instructors, due to decreased travel, may result in better retention. For the students, the ability to have collocated students take different classes, rather than having everyone out of service for a single training class is an advantage. Training can also be scheduled on shorter notice. Also, adding the ability to conduct VTC may offer other opportunities to the warfighters in ways other than conducting NET.

B. DISADVANAGES

The key disadvantage to VTC training is meeting the technology requirements to conduct the classes as discussed in Section V. The cost to achieve the minimum technical requirements for some units may exceed the cost savings resulting from reduced travel costs. These technical requirements include the system hardware, including video and audio equipment, as well as the network capability.

Additionally, VTC training will result in additional requirements for technical support, which will have to be provided by the PM. VTC can be less effective without buy-in from both the instructors and the students, to trust and utilize the VTC to best achieve the training. The final disadvantage is the inability of some students to learn via VTC, due to their learning style.

C. CHALLENGES

The biggest challenge in converting NET delivery to VTC is the cultural shift. Tradition in the military, and traditionally NET is conducted face-to-face, often by instructors who are retired military. Breaking out of this mold will be a major obstacle to the success of NET by VTC. A related challenge is that NET development must be refocused for VTC delivery from the start. Simply developing a traditional NET class, but delivering it by VTC is unlikely to be an effective replacement for conducting face-to-face training. GAO Video Teletraining (GAO/TI-95-1) indicates the following categories for training development:

- Accessibility
- Interoperability
- Reusability
- Durability
- Affordability

Developing training from the ground up to be delivered by VTC is especially important for complicated weapons systems, where traditional training is more “hands on” than is possible via VTC. Another challenge is the commitment level of the students.

Since many of the students are low grade warfighters, the ability of the instructor to maintain student commitment is more difficult from another site. As Shanley et al (2005) note “While collaborative learning environments have been shown to be effective in academic settings, the participants who use these tools are often self-selected and have a strong personal preference for that method of instruction. The same success is not assured if the method is applied to all students.”

THIS PAGE INTENTIONALLY LEFT BLANK

VII. CONCLUSION AND RECOMMENDATION

In an organization as large and diverse as the DoD, there is seldom a "one size fits all" answer. This is certainly true for conducting NET through VTC. While there is certainly an opportunity for cost savings and more efficient use of personnel and facilities, the use of VTC may not be appropriate for every PM. NET through VTC is just another tool in the PM's toolbox to be given consideration. Early consideration is key in choosing to use VTC. A detailed cost benefit analysis conducted early in the system development process will enable the PM to make an informed decision on conducting NET for his program. System details such as number of systems, system complexity, and number of fielding sites should be considered in making such a decision. The type of system also plays into the decision. For example, the trainers and users of IT systems may be more amenable to VTC training than infantry soldiers. IT users are also more likely to have the required infrastructure for the classrooms. Institutional change is likely to be one of the greatest obstacles to implementing this approach. Military institutions are built on tradition and the NET is traditionally conducted face-to-face.

The best way to implement the VTC approach is through a trial program. One or more systems could be pilot programs to conduct NET through VTC. By tracking the programs more closely and using some of the metrics identified herein, a detailed analysis could be conducted to verify the effectiveness and realized savings from this approach. Based on analysis, an Army program, preferably an IT system, would be the best candidate for this trial. It seems extremely likely that significant cost savings can be realized with no change in the quality of the training. In closing, Bartley et al (2004), referenced a study documented in the American Journal of Distance Education, which evaluated the learning in the online and "traditional" classroom. The study (Aragon, 2001) reported an insignificant difference on how the individuals within the group obtained their education goals. In other words, both training approaches produced similar learning objectives.

This article also indicated that given the lack of conclusive research concerning the effectiveness of online education, cost comparison factors may serve as the primary criterion between the two training approaches.

LIST OF REFERENCES

Acevedo, D. P. (n.d.). *Video Teleconferencing: The Future Ahead*. Retrieved January 28, 2011, from http://ac-support.europe.umuc.edu/~meinkej/inss690/acevedo.htm

Advance Distributed Learning. (2011). *Top Ten Interstring Mobile Statistics from July 2011*. Retrieved from Advanced Distributed Learning: http://adlnet.gov/top-ten-interesting-mobile-statistics-from-july-2011

Allan, L. The Myth of the Silver Bullet--And How to Improve the Effectiveness of Training. *Learning and Development in Australia , 29* (1).

Annual Report Automated System Approach to Training (ASAT). (2011). Retrieved November 1, 2011, from http://www.atsc.army.mil/ATSCAnnualReport.pdf

Aragon, S.R., S.D., & Shaik, N. (2002). The influence of learning style preferences on students success in online versus facet-to-face enviornments. *The American Journal of Distance Education*, 16 (4), 227–244.

Archibald, T., Brown, T., Hag, J., & Hahn, S. (2011, August 22). *Mobile Learning: The Current Landscape in the Department of Defense (DoD).* Retrieved September 1, 2011, from Advance Distributed Learning (ADL) Co-Laboratories: http://ww.adlnet.gov/wp-content/uploads/2011/08/Mobile-Survey-v1.0_2011822.pdf

Automated Systems Approach to Training (ASAT). (2008, April).

Bartley, S. J., & Golek, J. H. (2004). Evaluating the Cost Effectiveness of Online and face-to-Face Instructions. *Educational Technology & Society , 7* (4), 167–175.

Blottenberger, D. (2011, September 4). Virtual Classes Aid Roving Military Students. *Stars and Stripes* , 5.

Bowman, W. R., Crawford, A., & Mehay, S. (2009). *An Assessment of the Effectiveness of Computer-based Training for Newly Commissioned Surface Warfare Division Officers*. Monterey, CA: Naval Postgraduate School.

CITRIX (Ed.). (2010). *Video Conferencing: ROI, TCO and QOS*. Retrieved November 14, 2011, from SearchUnifiedCommunications: http://www.ivci.com/pdf/whitepaper-video-conferencing-roi-tco-and-qos-techtarget.pdf

Clark, D. R. (2010, June). *Estimating Costs and Time in Instructional Design.* Retrieved April 15, 2011, from http://www.nwlink.com/~donclark/hrd/costs.html

Copyright Management Training & Development Ltd. (n.d.). *How to Measure the Effectiveness and ROI of Your Training*. Retrieved March 11, 2011, from http://www.training-manager.co.uk/returnoninvestment.html

Defense Finance and Acccounting Services. (2011, March 11). *Test and Evaluation Master Plan.*

Distributed Learning System. (2011, October). *The Army Learning Management System (ALMS) Metric Report.* Retrieved from Army Learning Management System: https://www.dls.army.mil/pdf/ALMS_Metrics.pdf

Drueke, J., Emmanuel, N., Kennedy, C., Polite, M., Schaefer, R., & Sullivan, B. (2001). *How Well Do Students Learn With the On-Line Curriculum Delivery Method?* Retrieved September 7, 2011, from http://www.siue.edu/TLTR/GrpB3.html.htm

Hiltz, S. R., Coppola, N., Rotter, N., Turoff, M., & Benbunan-Fich, R. (1999). *Measuring the importance of collaborative learning for the effectiveness of ALN: A mult-measure, multi-method approach.*

Hrastinski, S. (2008). Asynchronous and Synchronous E-Learning: A study of Asynchronous and Synchronous E-Learning methods discovered that each supports different purposes. *EDCAUSE Quarterly , 31* (4).

Joy, E., & Garcia, F. E. (2000). Measuring learning effectiveness: A new loook at no-significant-difference findings. *Journal of Asynchronous Learning Networks , 4* (1).

Kirkpatrick, D. (1959). *Evaluating Training Programs* (2nd ed.). San Francisco: Berrett Koehler.

Knowledgeadvisors. (2010). *Case Study: Defense Acquisition University (DAU).* Retrieved March 10, 2011, from http://www.knowledgeadvisors.com/archives/case-study-dau

knowledgeadvisors. (2010). *Metrics that Matter: the Details, the Tour.* Retrieved March 10, 2011, from http://www.knowledgeadvisors.com/metrics-that-matter

Lewis, M. W., Bower, A., Cuyler, M. T., Eden, R., Harper, R. E., Morganti, K. G., et al. (2010). *New Equipping Strategies for Combat Support Hospitals.* Santa Monica, CA: RAND Corporation.

Miller, S. (2011, September 18). *Measuring Training Evaluation Effectiveness.* Retrieved November 1, 2011, from College Education Guide: http://collegeeducationguide.net/measuring-training-evaluation-effectiveness/

Morrison, T. (2011, July 6). Symposium Focuses on Improving Army Learning. *The Bayonet , 69* (20), pp. A1, A8.

Office of the Under Secretary of Defense for Personnel and Readiness (OUSD P&R). (n.d.). *Survey Report on the Mobile Learning Landscape within DoD.* Retrieved August 30, 2011, from http://www.adlnet.gov/survey-report-on-the-mobile-learning-landscape-within-dod

Polycom. (2010). *Polycom.* Retrieved November 14, 2011, from http://www.ivci.com/pdf/whitepaper-top-benefits-of-video-conferencing-polycom.pdf

Secretary of Defense (SECDEF). (2010, March 14). *Track Four Efficiency Initiatives Decisions.*

Sener, J. (2005). *Some Thoughts on the Value of Course Completion as a Measure of Effectiveness*. Retrieved March 10, 2011, from Senerlearning.com: http://senerlearning.com/?q=node/144

Shacklett, N. J., Shanley, M. G., Leonard, H. A., & Winkler, J. D. (2001). *Rebuilding the Schoolhouse: Making Army Training More Efficient and Effective*. Santa Monica, CA: RAND Corporation. Retrieved August 15, 2011, from http://www.rand.org/pubs/research_briefs/RB3025

Shanley, M. G., Crowley, J. C., Lewis, M. W., Masi, R., Straus, S. G., Leuschner, K. J., et al. (2005). Transformation and The Army School System. *Arroyo Center* , 181.

Sitzmann, T., Kraiger, K., Stewart, D., & Wisher, R. (2006). The Comparative Effectiveness of Web-Based and Classroom Instruction: A Meta-Analysis. *Personnel Psychology , 59*, 623–664.

Stephen, M. (n.d.). *Why Video Teleconferencing is Gaining Popularity.* Retrieved March 10, 2011, from ezinearticles.com: http://ezinearticles.com/?Why-Video-Teleconferencing-Is-Gaining-Popularity&id=308639

Sullivan, F. (2010, June). *US Military Training and Simulation Market Assessment.* Retrieved August 1, 2011, from https://www.asdreports.com/shopexd.asp?id=4821

Tandberg. (2009, May 31). *The Benefits of Video Teleconfernecing.* Retrieved March 10, 2011, from http://blog.tandberg.com/publicsector/index.php/2009/05/videoconferencing-takes-telework-to-the-next-level/

The eLearning Guild. (2002). *The e-Learning Development Time Ration Survey.* Retrieved July 15, 2011, from THe Elearning Guild: http://www.elearningguild.com/pdf/1/time%20to%20develop%20Survey.pdf

The Military Simulation and Virtual Training Market 2011-2021. (2011, August). Retrieved September 1, 2011, from Visiongain: https://www.asdreports.com/shopexd.asp?id=4965&desc=The+Military+Simulation+and+Virtual+Training+Market+2011%2D2021

Thompson, C. (2007). *Successfully Implementing an ELearning Solution.* Retrieved March 11, 2011, from The Sideroad: http://www.sideroad.com/elearning/elearning_solution.html

TRADOC Regulation 350-70 *Systems Approach to Training Management, Processes, and Products*. (1999, March).

Videoconferencing. (2011). Retrieved April 1, 2011, from Wikipedia: http://en.wikipedia.org/wiki/Videoconferencing

Visiongain. (2010). *Military Communicaitons and COTS Market 2010–2020.*

Webb, M. (2005). *Measuring Training Programs: Cost vs Benefit.* Retrieved November 14, 2011, from http://ezinearticles.com/?Measuring-Training-Programs:-Cost-Vs-Benefit&id=62320

Wikipedia. (n.d.). *Military budget of the United States*. Retrieved March 8, 2011, from http://en.wikipedia.org/wiki/Military_budget_of_the_United_States

Wisher, R. A., & Olson, T. M. (2003, January). *The Effectiveness of Web-Based Instruction*. Monterey, CA: Naval Postgraduate School.

Wisher, R., Sabol, M., & Moses, F. (2002, May). *Distance Learning: The Soldier's Perspective.* Retrieved October 15, 2011, from http://www.au.af.mil/au/awc/awcgate/army/s49.pdf

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, Virginia

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, California