Assessing the Effectiveness of A Networked Virtual Training Simulation: Evaluation of the Close Combat Tactical Trainer

Thomas W. Mastaglio, Ph.D.
MYMIC LLC
200 High St, Suite 308
Portsmouth, VA 23704
tom.mastaglio@mymic.net

Stephen Goldberg, Ph.D.
PEOSTRI -Army Research
Institute
Simulator Research Field
Office
Orlando, FL

Michael R. McCluskey
NAVAIR Orlando
Training Systems Division
Orlando, FL

ABSTRACT

The Army Research Institute (ARI) with contractor support surveyed users of the Close Combat Tactical Trainer (CCTT) to determine the training approaches they are utilizing and the role CCTT is playing in their overall training strategy. This survey provides information about how well CCTT has been assimilated into unit training programs and the value its users perceive they derive from its use. This effort was a first attempt to assess the perceived training value of CCTT to Army units and to tryout a cost-effective, practical alternative to an empirical evaluation. An empirical one-shot data collection effort suffers from serious problems in collective training environments. It is difficult if not impossible to collect data from enough units in a short period to obtain sufficient statistical power, costs are prohibitive, and controlling for all of the independent variables that impact on the effectiveness of an Army unit is difficult if not possible. This study explored survey and interview approaches to determine value and user satisfaction. The study obtained user feedback from Battalion Commanders through Platoon Sergeants. The primary source of conclusions reached from this study came from interviews and surveys of the leadership of six Close Combat Battalions at two CCTT fixed sites. This paper provides an overview of the methodology used to develop the data collection instruments, the results of that collective effort and the analytic results from assessments of that data.

ABOUT THE AUTHORS

Dr. Thomas W. Mastaglio is the President and CEO of MYMIC LLC, a high technology firm in Portsmouth, Virginia specializing in modeling, simulation and computer visualization support. Dr. Mastaglio holds a Ph.D. and MS from the University of Colorado in Computer Science. He is a retired U.S. Army officer who has worked in industry as a member of the senior technical staff and senior program manager. Prior to establishing MYMIC Dr. Mastaglio was a Research Professor of Electrical and Computer Engineering and the Founding Executive Director of the Virginia Modeling, Analysis and Simulation Center at Old Dominion University in Norfolk, Virginia.

Dr. Stephen Goldberg is Chief of the US Army Research Institute's Simulator System Research Unit in Orlando, Florida. He holds a Ph.D. in Experimental Psychology from the State University of New York at Buffalo. Dr. Goldberg also serves as the Chair of the Training Technology Technical Panel of The Technical Cooperation Program. Dr. Goldberg has also served at ARI locations in Alexandria, VA, Ft. Knox, KY, and Ft. Monroe, VA.
His research interests include assessment of the effectiveness of military simulation, human performance in virtual environments, and learning and retention of military skills.

Michael R. McCluskey is a Research Psychologist at NAVAIR Orlando. He has a MA in General-Experimental Psychology. He has conducted research in the areas of instructional systems development, collective training analysis, performance measurement, human performance requirements for military equipment and systems, and large-scale distributed training in synthetic environments.

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INTRODUCTION

The US Army Research Institute in partnership with the lead author's company assessed user perceptions regarding their use of the Close Combat Tactical Trainer and the importance they ascribe to it in their overall training strategy. This paper will describe the data collection and assessment approach and present findings on how well CCTT has been assimilated into unit training programs and the value its users perceive they derive from its use. The project had a two-fold purpose: to obtain feedback on the training value of CCTT to Army units and to tryout a cost-effective, practical alternative to an empirical evaluation of collective training devices that could provide useful results and insights. New approaches to training system assessment are needed as alternatives to empirical one-shot data collection, which suffer from serious problems in collective training environments. This project explored survey and interview approaches to determine value and user satisfaction by collecting user feedback at unit level. The methodology assessed how CCTT is being used by small unit leaders and their perceptions of its value. Unit leaders, Battalion Commander through Platoon Sergeant in six Close Combat Battalions stationed on installations hosting CCTT fixed sites were interviewed, data already collected by the Army was reviewed, and site procedures and policies assessed to accumulate a base data set for analysis. This paper will overview the methodology used to develop the data collection instruments, the process employed to analyze that data, and lessons learned.

CCTT BACKGROUND

The Close Combat Tactical Trainer was the first full scale development of a networked simulation system designed to support team and collective training. Its pre cursor, SIMNET, was developed by DARPA as a demonstration of the feasibility of networking simulators and of the potential to provide effective virtual field training using a network of simulators. CCTT applied the technology developed and lessons-learned from SIMNET to design, develop and field a capability for the U.S. Army to train armored and mechanized infantry combined arms teams in an immersive virtual world as part of a total unit training approach. Other Battlefield Operations Systems do participate in the training in order to portray a more realistic battlefield and derive some training benefit from use of this system as well.

During the development of CCTT a concerted effort was made to develop a training- effective system. These efforts involved applying user-centered design principles [Mastaglio and Williamson, 1995] [Mastaglio 1994], integrating users into a concurrent development environment [Mastaglio and Thompson, 1993], conducting scheduled formal evaluations of the development effort via periodic user exercises [Goodwin and Mastaglio, 1994] and exploring how to best use the capability CCTT would offer to the military [Goldberg, Johnson and Mastaglio, 1994].

CCTT was accredited [U. S. Army, 1999] then fielded at multiple installations throughout CONUS and to overseas locations for use by deployed U.S. Army units. It is therefore an appropriate time to assess the effectiveness of those facilities to determine the value added to unit training plans by have the system available and its impact on unit combat capabilities. Therefore we designed a training effectiveness assessment of CCTT to gauge its value and evaluate, at least subjectively, the efforts made during development to ensure it would meet user needs. However, a comprehensive assessment is probably neither feasible nor would its true cost be justifiable.

ASSESSING TRAINING EFFECTIVENESS OF COLLECTIVE TRAINING TECHNOLOGY

A complete training effectiveness analysis of any system requires controlled-use scenarios, access to and control of subject units throughout their training life cycle, significant data collection, and analysis [Boldovic, Bessemer & Bolton, 2002]. Some would argue that it must include a comparison to alternative training methods (e.g., a baseline training approach such as a field training exercise) to truly assess whether the system is worth the invested development funds and commitment of a unit's available time. Such a study would be costly and time consuming.

MIL-PRF-29612B [Department of Defense, 2001] contains limited guidance for assessing training product effectiveness relative to their ability to affect battlefield performance. Its purpose is to establish contractual baselines for instructional material, primarily courses and overall training programs assessing them for either traceability to articulated design requirements or the military mission they are intended to support (Type A) or evaluating their life cycle maintenance costs (Type B). The methodology required for a collective training device to assess its effectiveness is in the Type A assessment category as specified in MIL-PRF-29612B, but requires user feedback; mere traceability of technical capabilities will not provide insight into the value provided by the simulation to using units in terms of their combat capabilities. The latter requires a qualitative assessment that captures user level satisfaction and use of the device within its overall training strategy. The use of qualitative assessment or evaluations that use mixed methods [National Science Foundation, 1997] is not a problem that is unique to collective training programs. Others have also examined how to best perform programmatic assessments where analytic methods are difficult, at best, to employ [Rogers and Sando, 1998].

The significant issues for CCTT are what value do its users perceive they achieve, are they satisfied with the technology and implementation approach, and do they use it to their advantage to improve unit performance, hence combat readiness. This type of assessment can be more properly termed a training utilization assessment or study. In an empirical sense, a system cannot be training effective unless it is used properly: training utilization is a necessary condition for training effectiveness. Therefore, studying the training utility of CCTT provides a first step in a potentially longer term and more comprehensive effort to evaluate training effectiveness. This effort also provides valuable insight, from a customer perspective, into the technology and the context in which it is used today. The results will also help the Army determine where technology improvements (P^3I) are warranted and how to improve training strategies or site operational policies.

Assessing training effectiveness of computer-based simulations designed to support collective training has long been a challenging issue for training developers and researchers. Cost savings are often cited as valid proof that the use of wargames or constructive simulations to support collective training are a wise investment of government resources. It is appropriate to now determine the value that our using units have realized from investment in developing and fielding such systems. A first step in making that determination is to assess training utilization in terms of the following:

Is the device being used as it was designed?
Do its users perceive the device as having value to them?
Are the results of training events in the device integrated with and used to inform other training events?

This project developed and implemented a methodology to provide this level of insight for CCTT. The methodology has potential value as an approach to assessment of a broad range of collective training simulation systems.

The military's previous interest in and efforts to assess the effectiveness of their training systems have focused on the actual technology and its effectiveness. This is still a valid perspective, however we would like to suggest that effective use of CCTT as a system is a customer relationship management or CRM challenge. CRM, as the term is used in industry, focuses on meeting the needs of a particular customer or class of customers. Effective training utilization is in reality a CRM challenge for the Army's Training and Doctrine Command. Regardless of the quality of the technology or investment of development funds, the system will only be of value to its ultimate customer, units in the field, if they are able and motivated to use it effectively. A training utilization study to base point the current situation is a first step in determining current device usage and customer satisfaction on a pathway to determining the effectiveness of a training device.

METHODOLOGY

The Army Research Institute sponsored a contractor to conduct a training utilization evaluation of the Close Combat Tactical Trainer (CCTT). This evaluation provides valuable insight for the Army about how well CCTT has been assimilated into Army unit training programs and the value its users perceive that it provides to them. This report is based upon information resulting from a data collection and assessment methodology that has demonstrated its value and is reusable in any future efforts to expand the evaluation. The methodology assessed utilization of the CCTT facilities and the perceptions of its value within a sample population of users from 6 Battalion-equivalent units. Ninety Company Grade Officers/unit Non-Commissioned Officers were surveyed and 26 Field Grade Officers and Command Sergeants Major were interviewed. Both the methodology and data collected provide precursors to either a more comprehensive evaluation of the effectiveness of training at CCTT Fixed Sites or future more intensive assessments of the technology or both. The Study Team visited two CCTT fixed sites to conduct interviews of selected combat arms units that use those sites, and reviewed data already collected by the Army. Site procedures and policies were evaluated to accumulate a base data set for analysis and the final report.

This study concentrated on the use and perceived value of CCTT at the Battalion and Company levels with input from Platoon Sergeant up the chain of command through Battalion Commander. To focus the study effort the following issues were developed for approval by Army Research Institute and TRADOC Program Integration Office-Virtual (TPIO-Virtual) to guide the effort:

1. Are CCTT Fixed Site facilities being operated in accordance with established PM-CATT policies and prescribed procedures?
2. Does CCTT contribute to the combat readiness of using units in the opinion of combat arms commanders and staff officers?
3. How is CCTT training being integrated into overall armored and mechanized unit training strategies and plans?
4. Do junior officers and non commissioned officer consider CCTT a valuable resource and how do they manage their training time to use it effectively?
5. Can CCTT's contribution to Army readiness be assessed for its value and its cost effectiveness?
6. Are there innovative approaches to using the system appropriate for sharing Army-wide?

These six issues were decomposed into 32 sub issues. An additional 4 issues were identified during initial site visits that while not directly related to the six major issues could provide valuable feedback to the study sponsors, therefore the study team determined they should also be investigated. Sub issues were used to generate the questions that were then presented to the unit personnel using surveys and interviews. A detailed description of the methodology followed is contained in the next section of this report.

Our approach to assessing training utility of CCTT leveraged existing data already being collected, accessed the contractor support organizations at the sites, and input from the primary CCTT user community. This community included: platoon leadership, company and Battalion commanders, Battalion Command Sergeants Major, Executive Officers and S3's. A data collection effort at two fixed sites located within CONUS was selected as the most cost effective method for obtaining a representative user sample population. An assessment of that collected data resulted in findings that should by representative of the entire CCTT program and its community of users. ARI and TPIO-Virtual determined which units were most appropriate in order to obtain feedback that was representative of the entire population of users.

This study was conducted in three phases:

Preparatory Phase

The preparatory phase involved writing the study plan, identifying available data, developing the survey instruments, and initial coordination with the study sites and units.

a. A formal study plan was developed and delivered to the government for review and approval.
b. Survey and interview forms were developed as data collection tools. Survey questionnaires were designed so that they could be completed at the conclusion of a CCTT training event at the Fixed Site or returned later to the study team. Interview protocols were designed to be used in sessions with individual officers and Command Sergeants Major.
c. An MS Access Database was developed for use as a repository for the results of all interviews and surveys. This database was delivered to the government for use in future studies or analyses.

d.   Schedules for team visits were finalized during this phase, based upon input from TRADOC System Managers office.

Data Collection Phase

During the data collection phase the study team visited two active installations to assess the operational practices at fixed site facilities and collect survey data from three heavy battalions at each post.

a.   During the initial visit to each site, the team reviewed operating procedures, calendars and interviewed the facility management team. During this trip we also conducted an in briefing and coordination meeting with the operations officers of the combat arms battalions which were to be surveyed. A follow up visit to each site was scheduled to conduct unit interviews. Dates for survey questionnaires to be administered to each company were coordinated,

b.   During the follow up visits the team interviewed the CCTT Fixed Site Management teams, Commanders, S3's, Executive Officers, and Sergeants Major in the selected Battalion-size units. Company/Troop commanders, platoon leaders and platoon sergeants in these same units completed surveys on the date coordinated with the unit S3.
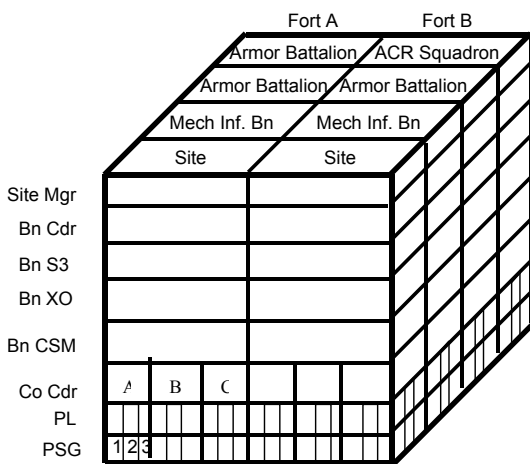

FIGURE 1: Data Space Model

c.   The answers resulting from the interviews and surveys were input into an MS Access Database. Respondents were broken down by position, with each position occupying a separate table in the database. Rows in each table represent an individual's answers to questions, while columns represent a specific question posed to all respondents of that position. Figure 1 represents the data space.

Data Analysis Phase

During the data analysis phase the team compiled and studied the data collected in phase 2 to generate their findings, observations and recommendations.

a.   The study team used a multi-pass analysis effort to study the responses as seen in Figure 2. In the first pass, the data was analyzed to determine a consensus answer for each question for every position. These responses were then used to determine a finding for each sub issue by position.

b.   Subissue findings were in turn used to determine a finding for each issue by position.

c.   A final pass examined the collective responses by issue by position to determine to the overall findings reported in Section IV.
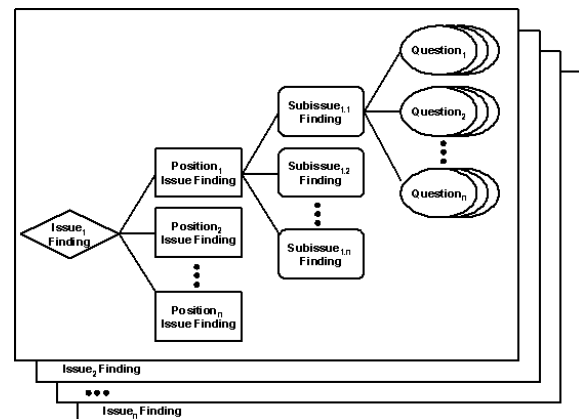
FIGURE 2: Multi-Pass Analysis Approach

STUDY RESULTS

The study team made the following observations, conclusions and recommendations based on the surveys and interviews of unit leaders:

A.   CCTT is being integrated into unit level training strategies. Units consider it a valuable and critical resource that is especially effective for company and platoon level collective task training. While it is used extensively to train unit level collective tasks, the user community has also adapted it and embraced it as a full crew gunnery skills training device.

B. That it is effective as a gunnery trainer is evidenced by the fact that units who have previously used it in preparation for gunnery tables now include its use in their strategies and plans as a mandatory preparatory event. Use of CCTT to conduct Task Force level training is not extensive, except when preparing for an NTC rotation. Again, units who have gone through an NTC rotation after using CCTT to help them prepare, now require its use as part of their train-up plans. Those plans include up to Task Force level exercises using the CCTT facility.

C. There is wide variability at the unit-level in both the planning phase and execution of exercises in CCTT. Some units, either intentionally or by default, use a hands-off approach; they leave the process of developing the training event primarily in the hands of Company/Troop Commanders and Platoon Leaders. Some units use a closely managed approach with strong involvement of the Battalion Command Group and S3 in monitoring preparation for a CCTT exercise. The conduct of the training event is mostly left up to the training unit, with, at most, a visitation to the site during an event as the extent of oversight from senior leaders. This is probably an effective way to create a secure environment in which junior leaders can operate without the pressure created by external monitoring, however the experience of more senior unit personnel is not being leveraged the way it should, particularly in the conduct of AARs. We did not find any explicit effort by brigade staffs to monitor or support CCTT training events.

D. Published command guidance for use of CCTT is non-existent and accounts for a disparity of usage levels between Battalions. Within a given battalion usage at the company and platoon level is fairly equal and a function of the importance the Battalion Commander and S3 in particular place on the value of CCTT. The Army should consider publishing or promoting standard requirements for the amount of training each combat arms unit conducts using CCTT or a gated strategy that requires its use prior to other events (e.g., External Evaluation, a rotation to the National Training Center, etc.). Those units that have adapted it will not have a problem with such a requirement, while those units that object are probably the very ones that need encouragement to train using CCTT. Units that regularly use the system are enthusiastic supporters and develop creative ways to expand usage and capabilities. We also believe that the Battalion S3 is key. An effort should be made to insure they understand the capabilities of CCTT and that they need to be the primary advocate for its use. If there is specific training for officers assigned to S3 positions recommend the Army consider including this in the curriculum.

E. There is little doubt that close combat units, particularly those who have become regular user, believe strongly in the value of CCTT. Determining a way to measure for its explicit value to Army or units is not easy; quantifying that value is difficult if not impossible. First, these units are not willing to give up or offer to give up opportunities to train with their actual combat vehicles in the field. This goes against the warrior ethos for leaders of close combat units and current generations of combat leaders still prefer actual live training to any other alternative. User do not believe it is possible for the Army to rationalize a cost trade-off for using the simulations in terms of fuel or repair parts cost avoidance or OPTEMPO savings. The major justification for CCTT is the value it adds to combat preparedness and its availability when live training opportunities are limited for whatever reason.

F. Units do not make extensive use of supporting training material; this includes the Commanders Integrated Training Tool (CITT) and Training Support Packages (TSP). While there does not appear to be anything inherently wrong with these tools, user do not view them as critical to effective training or a key step in their training development process. Future investment in training support material should be carefully considered; most users would prefer such resources be used to make the virtual environment better or increase the availability of training devices (i.e., more modules in CCTT's case).

G. CCTT is a key contributor to effective unit performance during evaluated live training events or combat. Users are convinced of its importance and those units that use the system most are the strongest proponents. They become the biggest advocates for this viewpoint. A study of units returning from Operation Iraqi Freedom that assesses the value they would put on virtual training in general and CCTT in particular was recommended and is being performed by TRADOC together with other surveys and post combat reviews that certainly planned as part of debriefings and after action reviews.

H. Unit Mission Essential Task Lists (METL) are key drivers for developing plans for CCTT training events, specific scenarios, and guiding after action review. There is some variability between units, but in general the use of METL is a key part of the Army training culture in regards to training in virtual environments. The study recommended that ARI and TRADOC continue to reinforce this valuable

management tool and develop technology to assist units monitor, evaluate, and document their METL proficiency levels. The development of better tools or technology based on principles of learning theory and cognitive science to support the AAR process in terms of METL performance as also recommended.

I. There needs to be a better way to disseminate best practice and lessons learned about using the CCTT environment. Users and sites are developing creative ways to make use of the technology. Unfortunately, except for bilateral coordination between sites and units, these ideas are not being shared between units at a local installation let alone Army-wide. One of the study sponsors should initiate a program to facilitate the sharing of CCTT experiences and lessons learned. There are several potential approaches, among them would be a published newsletter or a website highlighting good ideas and unique applications.

J. Company training in CCTT was almost exclusively conducted in armor or mechanized infantry pure company configurations, rather than as combined arms teams with cross attached platoons. The only exception was an armored unit that had cross-attached one of its platoons with a mechanized infantry unit to support the latter while deployed to Kuwait on a security mission. All other companies were configured during CCTT training exercises as purely armor or mechanized infantry. It will be a challenge to overcome this tendency, because of the difficulty of coordinating training schedules and unit training cycles, as well as dealing with operational command and control in garrison. However, it is unrealistic to exclusively train in pure formations. Brigade level strategies to change this situation should be considered. This is one argument for getting Brigade Command Groups and their operations staff more involved in CCTT.

CONCLUSIONS

This study developed and successfully employed a methodology for evaluating the effectiveness of a collective training device that is based on assessment of user acceptance and adoption of that device. Evaluating collective training technologies has been an unanswered challenge for the Army, it is a particular problem for its supporting corps of scientists and analysts who have worked to define and divine quantitative approaches for assessing

either individual and crew training devices or training programs (courses for example) designed to produce a qualified soldier with a well defined set of skills or knowledge. Collective training device assessment may not be a totally intractable challenge, but developing quantitative instruments or methods is certainly problematic. The reality is that the Army (and other services) have and will continue to invest significantly in technology-based collective training systems, therefore qualitative methods, such as used in this study need to be developed and applied in order to determine how effective these technologies are in meeting user needs. This study should be considered a pilot of a qualitative approach and a sampling of the user population for a particular system, CCTT.

This methodology has proven successful in its ability to collect data, the analysis of which provides answers to specific issues. The success of this pilot approach should be extended. Within the CCTT community a larger sampling of users is certainly warranted. This study was limited due to time and funding to two sites that were some of the last fielded in CONUS. A more extensive study that collects similar data from all CONUS sites, overseas commands and mobile sites is warranted. It is not necessary to collect feedback from all users but simply extend the sample population to include users (units) from more CONUS sites, at least one overseas site and 2-3 mobile sites. If this study is expanded, rather than paper surveys and individual one-on-one interviews, data can be collected in the future using web-based tools and servers. The instruments developed for this pilot effort can readily be adopted for web-based use.

A second level approach that would extend and validate the methodology developed for this study by applying it to another collective training device or simulations is also warranted. Other Combined Arms Tactical Trainer (CATT) programs could serve as the next venue as could any of the Army constructive training simulations. A closely monitored development and employment of this methodology to assess users' acceptance and adoption of one or more other collective training aids, devices, or simulations would yield additional insight. This should lead to a generalization of the approach that could become part a standard step in the procurement process as a key part of a post fielding evaluation.

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