Mastering the Battle Command Digital Environment through Team Training

Michael Tremlett, Dynamics Research Corporation, Enterprise, AL
Dr. Belinda Hartnett, Dynamics Research Corporation, Andover, MA
Dr. Sharon Riedel, Army Research Institute, Fort Leavenworth, KS

ABSTRACT

The core competency required for mastering and employing this digital environment in combat lies with a distributed human decision-making process which is supported by technology but governed by human interactions. The Army's digitized Army Battle Command Systems (ABCS) require extensive training in the latest technological advancements. Research on decision-making while immersed in the digital environment has revealed that the greatest opportunities to increase battle staff proficiency will result from a focus on the human interaction through team training. Battle command training in a digital Tactical Operations Center (TOC) environment provides team skills training that enable the effective and efficient use of digital ABCS.

The Digital Battle Command Team Training (DBCTT) project is an Army Research Institute (ARI) research and development project focused on providing collective team training to digital TOC battle staffs. Because individual and teamwork skills are perishable, the DBCTT program will provide a predeployment capability to address the problem of maintaining critical battle command skills by applying emerging technologies and techniques at the Brigade Combat Team (BCT) and below level. This research program will evaluate the effectiveness of the training on digital battle staffs communication and information management skills in a mission oriented environment. The resulting prototype training products will support operational, tactical and self-development training by providing examples of team-thinking behaviors and a team performance review. Through the development of Training Support Packages (TSP) and support products, DBCTT will become the gap-filler between garrison individual training and tactical deployment. It's envisioned that DBCTT will provide guidelines for the training support package (TSP), which will become the authoritative resource for commanders to train their staffs in teamwork and digital skills.

ABOUT THE AUTHORS

Michael Tremlett is the Deputy Director of Dynamics Research Corporation's Center for Team Performance and is the Program Manager for the Digital Battle Command Team Training (DBCTT) program. Mike is a former military officer with recent command and battle staff experience in both Afghanistan and Iraq. As a former Army aviator and Army special operations soldier, he has over twenty years experience in developing and training high performance teams in the coordination and execution of complex military operations. Mr. Tremlett was involved in developing realistic and relevant scenarios for the Ground Systems Team Training and Battle Captain Advanced Team Training programs. He led the effort at the Center for Team Performance to incorporate the latest digital Army Battle Command Systems (ABCS) into the realistic battle command training scenarios.

Dr. Belinda Hartnett is a research scientist at Dynamics Research Corporation and the principal investigator for the DBCTT program. Dr. Hartnett was a program manager for the Department of Defense Joint Knowledge Distribution Capability project and was the task lead for the Standing Joint Forces Headquarter Course for the project. Belinda is a former Air Force officer with experience as a squadron commander. She holds a Ph.D. in Human and Organizational systems and a M.A in Organizational Development from the Fielding Graduate Institute; a M.S. in Public Administration from Troy State University, and a B.S. in Biology from Sul Ross State University.

Dr. Sharon Riedel is a Senior Research Psychologist with the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). She works with the Leader Development Research Unit branch of ARI, located at Ft. Leavenworth, Kansas, where her work involves research on critical thinking skills for military leaders and teams. In addition to numerous scientific and professional publications, she is the co-author, with Leonard Adelman, of the book, *Handbook for the Evaluation of Knowledge Based Systems: Conceptual Framework and Compendium of Methods.* Dr. Riedel holds a Ph.D. in Experimental Psychology from Southern Illinois University, with an emphasis on social psychology and measurement.

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INTRODUCTION

The U.S. Army Research Institute for Social and Behavioral Sciences (ARI), along with Dynamics Research Corporation (DRC), is undertaking a research and development effort to determine whether training methods and lessons learned from initial Battle Command research, Ground Systems Team Training (GSTT), and Aircrew Coordination Training Enhanced (ACTE) projects can be applied effectively to Army digital battle command teams within the brigade and below digital Tactical Operations Center (TOC) environment.

Team coordination training promotes a set of team coordination skills that can increase mission effectiveness, while decreasing errors that can lead to mission degradation and failure. The goal of this new research effort is to develop a prototype Digital Battle Command Team Training (DBCTT) program that will improve the effectiveness of Army battle staff teams in risk analysis, dynamic mission planning, and mission execution within the digital TOC.

The Army's Current and Future Forces increasingly rely on lethal, highly complex technologies to accomplish their missions, often under severe environmental conditions. Leader and team training plays a key role in the successful employment of these sophisticated assets. Good digital battle command leader and team training can ensure the effective use of these digital battle command systems.

This project builds on and extends ARI's GSTT and ACTE programs. These projects have shown that team coordination training improves mission performance and reduces error. The training that was developed and lessons learned from these programs have been extended to include a fully integrated battle staff in the brigade and below digital TOC.

At the center of the Army's digitized battle command system lies a distributed human decision-making process. This process can be supported by technology, but it is still governed by human interactions. How individuals, teams, and organizations adapt to change remains at the heart of Battle Command performance. Good battle command team coordination training can ensure that dynamic mission planning and execution actively take into account and pre-empt the risk factors that all too often lead to mission degradation, mission failure, and loss of life on the battlefield.

TRADITIONAL BATTLE STAFF TRAINING

Chapter 1 of the Army's Field Manual Interim (FMI) 5-0.1, The Operations Process, states, "Upon receipt of a mission, commanders form a clear situational awareness. They base it on information and such knowledge products as the Common Operational Picture (COP) and running estimates." Traditionally, this guidance has translated into a multi-level training strategy for the staff as outlined in FM 7-1, Battle Focused Training.

First, the unit conducts home station staff training using FM 5-0 and focuses on the Military Decision Making Process (MDMP) in both garrison and field environments. Second, the staff and commanders typically participate in Combat Training Center (CTC) or Battle Command Training Program (BCTP) sponsored pre-event training to allow them to refocus their efforts prior to a unit deployment. Finally, the unit deploys to a capstone event such as a CTC or Warfighter exercise. While the emphasis remains on the battle staff support to the commander's situational awareness and understanding, the systems by which this process is conducted have changed dramatically.

Analog systems no longer dominate the TOC. As digital systems have proliferated, the information available to the typical staff officer has grown exponentially. Systems have become more complex and require more emphasis to ensure that the unit maintains the highly perishable individual-technical skills needed to operate the Army Battle Command Systems (ABCS). As these skills are mastered and maintained, the unit enters the next level of battle staff training which focuses on the Battle Captain and Battle Staff NCO tactical-roles and responsibilities training across the ABCS functional cells. Further, digitally enabled battle staff collective task training requires the support of a fully operational ABCS architecture which virtually ensures that this training must be conducted as part of a formal training exercise. Finally, battle staff

collective training tasks are tactical training oriented and provide the opportunity for team training but not the necessary content in terms of team specific knowledge, skills, and abilities to achieve high performance team effectiveness.

DIGITAL BATTLE COMMAND TEAM TRAINING

The DBCTT project offers commanders and battle staff the ability to train team specific knowledge, skills, and abilities at home station. Phase I of the DBCTT project was begun in June 2005, Phase II started in June of the following year, and the final Phase III research is scheduled for completion in September 2008.

Background

The DBCTT focus is on the digital battle staff operating as a team not the highly perishable individual-technical skills needed to operate the ABCS. DBCTT is not designed to assist in the individual training effort and should not be confused with "button pusher" training. DBCTT will help to reinforce individual skills by providing additional training opportunities in a team environment. DBCTT assists in the unit's battle staff training program. The DBCTT program only requires the battle staff members' recognition and application of a standard set of team coordination skills and performance competencies.

Research Approach

The research approach for the DBCTT program includes an in-depth task and database analysis. This needs analysis aimed at identifying current negative trends and problem areas in brigade and below battle staff training and in current operations supporting Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) in order to identify team coordination skills to mitigate these trends and problems.

The Center for Army Lessons Learned (CALL) database was targeted for the database analysis to collect information that identified current negative trends and problem areas in brigade and below battle staff performance at the CTCs (Tremlett, 2006). The CALL database was also searched for Initial Impression Reports (IIR) from brigade and below battle staff operations in OEF/OIF.

Battle staff teams today have a dramatic increase of available information through the digitization of brigade and below TOCs. Commanders rely on the timely and accurate management and interpretation of mission information to effectively make decisions that affect the outcome of combat operations. The ability of these battle staff teams to maintain situational awareness through the management of this information is critical in supporting the commander's situational understanding. The battle staff must provide the commander with enough information to effectively reach decision points.

The CALL database analysis yielded four clearly identifiable problem areas that could be linked to ineffective team skills. The problems focused primarily on the brigade and below battle staff's inability to manage the high volume of information that is available to the digital TOC. The specific problem areas that were identified were: information flow, push/pull of critical information, redundant reports, and battle staff synchronization.

Once these specific problems were identified, an analysis was conducted to determine the relationship between problem areas and team coordination skills (McPhail, 2005). The skills of previous members of a digital TOC were analyzed and developed to provide the battle staff with effective means by which they could prevent and mitigate the identified problems. The result of this task analysis was a hierarchical structure of Team Coordination Objectives (TCO), Coordination Skills (CS), and Performance Competencies that would provide battle staff team members with the necessary tools to ensure mission success (Gelke, 2005).

DBCTT Team Coordination Objectives, Coordination Skills, and Performance Competencies

A three-level hierarchy serves as a framework for organizing team coordination principles and training and evaluating team coordination skills. Table 1 shows the top two levels of the hierarchy (i.e. team coordination objectives and coordination skills) and their relationships. The labels and definitions for these three levels of team coordination are derived from proven research and training programs conducted by industry, academia, and government agencies. The basic labels for each level have been approved by ARI.

The first level in the hierarchical structure is Team Coordination Objectives (TCO). TCOs are defined as five objective outcomes common to well-functioning teams, each comprised of a related set of team coordination skills. The five Team Coordination Objectives form the abilities foundation of DBCTT. Abilities in this foundation are defined as a competence to perform an observable behavior that involves the adaptive application of skills and knowledge.

The second level is Coordination Skills (CS). Coordination Skills are defined as a set of adaptive skills that are observable as team coordination behaviors that support effective team functioning. The twelve Team Coordination Skills are the basis for rating team coordination performance. The use of skill is defined as an observable competence to perform a learned action.

The third level is Performance Competencies (PC). Each of the 12 DBCTT Coordination Skills is further associated with one or more Performance Competencies. Performance Competencies are defined as actions occurring at the team level in the form of observable team enabling behaviors and output at the individual team member level reflecting knowledge, situational thinking and cognitive processing of information. DBCTT training incorporates 31 performance competencies. These five Team Coordination Objectives, twelve Coordination Skills and 31 Performance Competencies form the basis for the DBCTT Training Support Package (TSP) and measures of team performance.

Table 1. Relationship between DBCTT Team Coordination Objectives (TCO) and the Coordination Skills (CS)

TCO1: Establish Teams and Procedures	**TCO 2: Plan and Problem Solve**	**TCO 3: Exchange Mission Information**	**TCO 4: Manage Situations and Workload Levels**	**TCO 5: Monitor and Adjust Team Processes**
CS 1: Clarify roles and contributions	CS 4: Conduct situational planning and rehearsal	CS 6: Communicate Effectively	CS 8: Maintain situational awareness	CS 11: Cross-monitor Team members actions
CS 2: Establish strategy for knowledge management	CS 5: Apply appropriate decision making methods	CS 7: Manage and prioritize information flow	CS 9: Prioritize actions and distribute workload	CS 12: Conduct teamwork-focused AAR
CS 3.Establish strategy management			CS 10: Manage unexpected events	

Courseware Design

The DBCTT program builds on and expands knowledge gained from the successful ACTE and GSTT programs. The training provided within the DBCTT product focuses on team coordination. The training is presented linearly to the learners to maximize the effectiveness of the training. The four modules built into the DBCTT TSP product were developed using the Army's building block strategy (DRC, 2006). Module 1 provides a general course introduction and Module 4 is a course summary and critique. Module 2 presents knowledge and concept information about the TCOs, CSs, and PCs. Module 3 with application based training and exercises reinforce the objectives, skills, and performance competencies taught earlier. The main focus of the training is on team coordination and the practical exercises to reinforce the learning.

Module 3 lesson designs provide a three-tiered, progressive (Crawl-Walk-Run) series of practical exercises (PE) that will enable users to practice application of the knowledge and skills acquired in the earlier modules (DRC, 2005). Two of the three PEs in Module 3 consist of a team play environment with feedback and the last PE includes a facilitated Team Performance Review (TPR). Feedback, discussion questions, and evaluation criteria are provided for the user to make this team exercise as beneficial as possible when no external facilitation is available. The environment for the exercises is extracted from lessons learned in digital TOCs deployed during OEF/OIF.

PE 1 allows the battle staff soldier to apply the training received in a scripted vignette and also allows them to determine which team coordination objectives and coordination skills are depicted in the exercise. This "crawl step" practical exercise is designed to have the learner establish confidence in observing and correctly identifying TCOs and CSs presented in vignettes of actual battle staffs performing mission planning, execution, and AAR activities.

PE 2 requires the learner to interact as part of a team to evaluate a scripted scenario in terms of "Enhancing", "Contributing", or "Jeopardizing" the outcome of a mission segment. The class instructor-facilitator organizes the class into four digital TOC functional teams, i.e., Battle Captain, Battle NCO, Intelligence, and Fires. Each team is located at one of four computer stations designated in advance to be used in the team PEs.

The lesson introduction provides evaluation criteria for each TCO. This "walk step" PE is designed to have the learner collaborate with other team members to observe, evaluate, and discuss TCOs and CSs. PE 3 requires the learner to interact as part of a team, this time, actively performing as a team member applying TCOs/CSs rather than observing a digital TOC team training scenario. The class instructor-facilitator retains the class in the four digital TOC functional teams, i.e., Battle Captain, Battle NCO, Intelligence, and Fires established in PE2. Each team is instructed to set up their respective ABCS station emulated on their computer workstation, i.e., Maneuver Control System (MCS), Force XXI Battle Command, Brigade-and-Below (FBCB2), All Source Analysis System (ASAS), or Advanced Field Artillery Tactical Data System (AFATADS).

Evaluation of DBCTT Awareness TSP

Formative evaluations were conducted with operational end users at Fort Hood, TX, and Fort Lewis, WA. A summative evaluation was conducted at Fort Bragg, NC to determine the effectiveness of the training. The results from each of these events demonstrated an improvement in situational awareness and team performance in the digital TOC.

Formative Evaluations

The first research event was at Fort Hood, TX in March 2006. ARI and DRC coordinated with United States Army Forces Command (FORSCOM) for units at Fort Hood, TX. DRC conducted a two-day usability assessment and evaluation test of the initial prototype DBCTT TSP. Participants included a total of six personnel of which there was one Battle Captain (CPT), one Battle NCO (E7), and four TOC Cell Chiefs (E6), (Figure 1). These participants represented the digital TOC end user community. Contractor instructors presented the initial prototype DBCTT TSP in one training day.

Figure 1. Usability Assessment 1 at Fort Hood, TX.

Table 2 shows a summary of selected usability assessment data collected and preliminary analysis in terms of findings for the initial prototype DBCTT TSP. The 21 item questionnaire evaluated the usability and perceived usefulness of the training. Participants were generally very positive about the usefulness of DBCTT.

Table 2. Mean response and count by scale value to selected course critique items by Ft. Hood participants

Survey Item		Response Counts by Scale Value					
		1	2	3	4	5	Mean
1.	The mission vignettes in the lessons allowed observation of Team Coordination Objectives and Coordination Skills relationships				3	9	4.8
2.	The training increased my ability to function as a team member			1	6	5	4.3
3.	The training helped me to understand how to apply Team Coordination Skills during mission performance				7	5	4.4
4.	The mission scenarios enabled me to practice decision making processes			1	8	3	4.2
5.	The courseware will have a positive effect on mission performance			1	6	5	4.3

Note: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree or Disagree,4 = Agree, and 5 = Strongly Agree

The second research event at Ft. Lewis, WA was a formative evaluation of the complete TSP. Four Soldier participants were mid-level noncommissioned officers and four were captains and majors.

All Soldiers reported having combat experience in either OEF or OIF. The results from this research event are in Table 3. Based on user feedback from both formative evaluations, design improvements were made to the TSP.

Table 3. Mean response and count by scale value to realism, relevance, and effectiveness course critique items for Ft. Lewis respondents

Survey Item	Response Counts by Scale Value						Mean
	0	1	2	3	4	5	
Realism							
PE 1 (Observe and Identify TCOs and CSs)	1			3	3	1	3.3
PE 2 (Observe, Evaluate, and Discuss TCOs and CSs as a Team)			2	2	3	1	3.4
PE 3 (Perform as a Team member applying TCOs and CSs)			1	1	5	1	3.8
Prototype Courseware - Overall				2	4	2	4.0
Relevance							
PE 1 (Observe and identify TCOs and CSs)				2	5	1	3.9
PE 2 (Observe, Evaluate, and Discuss TCOs and CSs as a Team)			1	3	2	2	3.6
PE 3 (Perform as a Team member applying TCOs and CSs)			1	1	2	4	4.1
Prototype Courseware - Overall				2	3	3	4.1
Effectiveness							
PE 1 (Observe and identify TCOs and CSs)		1	1	2	2	2	3.4
PE 2 (Observe, Evaluate, and Discuss TCOs and CSs as a Team)			2	3	2	1	3.3
PE 3 (Perform as a Team member applying TCOs and CSs)			1	1	3	3	4.0
Prototype Courseware - Overall			1	1	3	3	4.0

Note. Scale values: 0 = Not observed 1 = Low 5 = High
Team Coordination Objectives (TCO), Coordination Skills (CS), Practical Exercise (PE)

Summative Evaluation

Fourteen Soldiers from various units at Ft. Bragg, NC served as subjects for the evaluation. Experimental and control groups were formed as convenience groups determined by personnel availability from the cooperating units. That is, for one of the two training days, participants were detailed to report to the training site. Researchers assigned the first day's group of arriving Soldiers to the control condition and the next day's new group of arriving Soldiers to the experimental condition. Each group was evenly balanced between age, total time in service, active time in service, and time in current duty position. The two groups showed a similar profile of junior and senior enlisted and officer personnel.

The experimental and control groups, formed from available personnel, were closely matched in terms of age and various military experience measures. The combat and digital experience levels of the participating personnel was relevant and appropriate for the training received and mission elements that form the content of the practical exercises.

Team performance ratings were completed for each of the four workstations by four observer-evaluators (OE) who scored the teamwork behaviors for their respective workstations using the Team Performance Checklist. This level of rating was focused on *intrateam* teamwork. Interrater reliability was determined within the framework of generalizability theory (Brennan, 2001; Shavelson & Webb, 1991). In G study notation, the analysis was modeled as (r:w) x (s:ph) x TCO.

That is, raters were nested under workstation (one rater per workstation team) and scenarios were nested under phases (first and second scenario for the controls, pre-training and post-training scenarios for the experiments). The facets r, w, s, and ph were considered random facets and TCO as fixed. Because ratings are rendered on the basis of specific performance criteria, the reliability coefficient was computed based on absolute (criterion-referenced) criteria for item and random error variance estimation. The resulting reliability coefficient (the ratio of item to random variation) for the OEs was .572.

Subsequently, a panel of three expert raters who viewed videotapes of the teams rated overall team performance (i.e., *interteam* teamwork across all four workstations). Because each rater rated each scenario, the analysis model was r x (s:ph) x TCO. The resulting absolute reliability coefficient was .713.

The OEs also rated *interteam* teamwork performance. The correlation of mean teamwork ratings per scenario for the OEs with those of the expert raters was $r = .97$, $p = .034$.

Figure 2 shows the observer-evaluator overall mean teamwork ratings. These ratings were assigned after all events comprising a scenario had been observed. A three-way within subjects analysis of variance on the factors group (experimental vs. control), TCO, and phase (pre-training vs. post-training) revealed a statistically marginal effect for the experimental versus control comparison ($F(1,3) = 8.91$, $p = .058$) with the experimental group showing higher mean teamwork ratings. A marginal effect was found for the pre-training versus post-training comparison ($F(1,3) = 8.38$, $p = .063$) with post-training ratings higher.

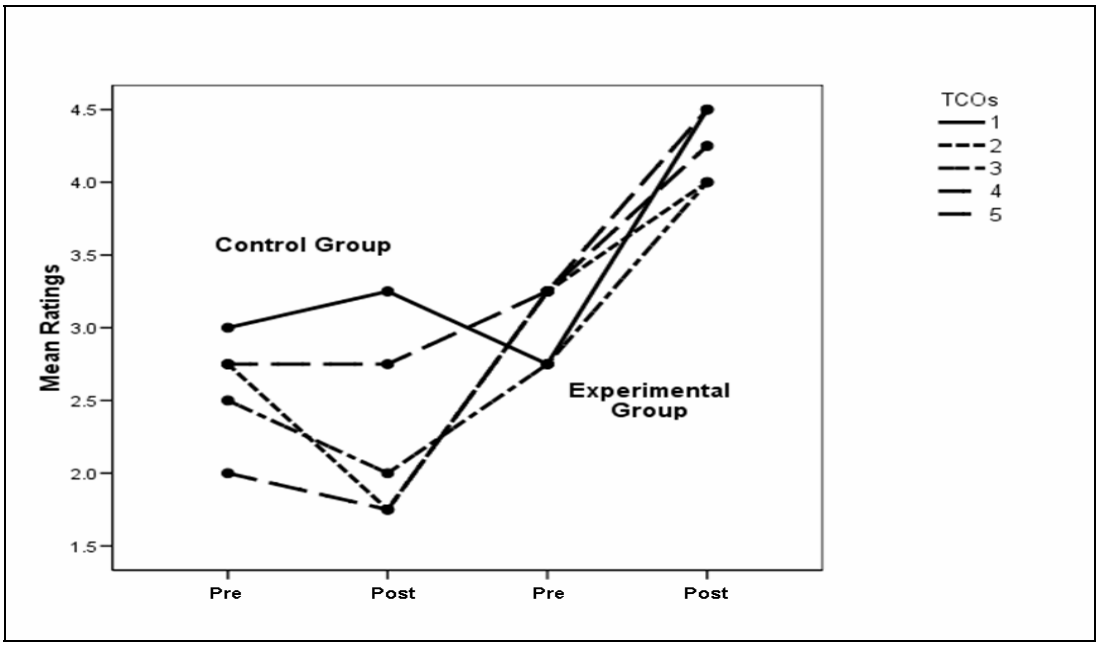

Figure 2. Team performance mean ratings for Fort Bragg experimental and control groups

The control group consisted of three officers and four NCOs. The first-day evaluations of their performance of the practical exercise reflected a below standards average rating of 2.6 on a scale of 1 to 7 in which a 1 rating represented below standards, 4 represented meets standards, and 7 represented above standards. The control group returned two days later to complete a second practical exercise which revealed a small decrease in teamwork performance with an average rating of 2.3, again below standards.

The experimental group consisted of two officers and five NCOs. End users that received the training increased their knowledge of battle staff coordination by 8 percent. As with the control group, the experimental group's pre-training performance revealed a below standards average rating of 3.1. Following the training, the experimental group's performance revealed an improvement to 4.3, a meets-standards rating.

After engaging as workstation teams in the emulated mission events of PE3, experimental group participants provided self-ratings of (a) the battle staff team meeting mission element-specific performance criteria rendered as Yes-No responses, in addition to written comments explaining the reasons for assigning the specific rating, and (b) self-ratings on the 4-point scale (not observed, jeopardized, contributed, enhanced) that summarized the overall level of team performance for an event. This team performance review was completed only on the post-training PE3 exercise. In contrast to the Ft. Lewis evaluation in which teams manning the FBCB2, AFATDS, ASAS, and MCS workstations individually rated battle staff team performance, the Battle Captain reported the consensus of the overall teamwork rating was more collaborative and promoted better teamwork.

The consensus self-ratings for meeting specific performance criteria are shown in Table 4. The teams reported meeting critical teamwork goals for Event 2, but not for one segment of Event 1 or any segments of Event 3.

The training resulted in improvements in teamwork performance as evidenced in higher teamwork ratings when the trained group performed as a battled staff in PE3. Prior to this opportunity to demonstrate teamwork performance, this group had shown a progressive improvement in understanding of the TCOs and CSs in PE2.

This evaluation provided the opportunity to compare OEs who provided intrateam ratings with expert raters who provided interteam ratings. The OEs showed a moderate level of interrater reliability in their value of .572. The expert raters revealed an interrater reliability index of .713. Compared to the intrateam reliability, the increase in interteam reliability was due to (a) three raters per team for the expert raters versus one rater per team for the on-site OEs and (b) reduction in intrateam workstation-to-workstation teamwork variability when rating interteam performance. Both sets of raters used a 7-point rating scale. The course critiques showed positive, and in some cases, near maximum ratings for the usability, realism, relevance, and effectiveness of the course as shown in Table 4.

Table 4. Mean response and count by scale value to realism, relevance, and effectiveness course critique items for Ft. Bragg respondents.

Survey Item	Response Counts by Scale Value			
	3	4	5	Mean
Realism				
TCO and CS	1	2	1	4.0
PE1 (Observe and Identify)	1	2	1	4.0
PE2 (Observe, Evaluate, and Discuss)		2	2	4.5
PE3 (Apply TCOs and CSs as Team)	1		3	4.5
Prototype Courseware - Overall	1	2	1	4.0
Relevance				
TCO and CS		4	1	4.2
PE1 (Observe and Identify)		2	3	4.6
PE2 (Observe, Evaluate, and Discuss)		1	4	4.8
PE3 (Apply TCOs and CSs as Team)		1	4	4.8
Course Summary		2	3	4.6
Prototype Courseware - Overall		2	3	4.6
Effectiveness				
TCO and CS		2	3	4.6
PE1 (Observe and Identify)		2	3	4.6
PE2 (Observe, Evaluate, and Discuss)		2	3	4.6
PE3 (Apply TCOs and CSs as Team)		1	4	4.8
Course Summary		3	1	4.3
Prototype Courseware - Overall		3	2	4.4

Note. Scale values: 0 = Not observed 1 = Low 5 = High
Practical Exercise (PE), Team Coordination Objectives (TCO), Coordination Skills (CS)

Participant Rating of Usefulness

End users that received the training in the summative evaluation favorably rated the final version of the TSP as realistic (3.4), relevant (4.7), and effective (4.5) on a scale of 1 to 5 in which a 5 rating represented strongly agree. Using the same rating scale, end users critiqued specific areas of the TSP and provided constructive comments:

1. The TSP increased my ability to function as a team member. (4.5)
2. The Practical Exercise mission scenarios were effective tools for encouraging management of information prioritization and exchange. (4.5)
3. The mission scenarios enabled me to practice decision making processes. (4.7)
4. The TSP courseware will have a positive effect on mission performance. (4.5)

DBCTT Advanced TSP

Based on the results from both formative and summative evaluation of the awareness TSP, the advanced TSP was developed and then evaluated at Fort Riley, KS. The formative evaluation of the advanced TSP included a Performance Evaluation System which uses a Behaviorally Anchored Rating System (BARS) that will offer users the ability to quantify the applications of team coordination skills during training. Preliminary results include the following critique ratings in Table 5.

Table 5. Mean Response of the Fort Riley respondents on formative evaluation of the Advanced Training Support Package (TSP)

Performance Evaluation System	
The Performance Evaluation System (PES) was easy to use.	4.3
The purpose for using the Performance Evaluation System was clear.	4.4
The 7-point rating scale concept was easy to understand.	4.6
The ratings from the Performance Evaluation System were an effective way to evaluate teamwork.	4.3
The Case Study was helpful to practice applying the PES.	4.4
Effectiveness	
The Training Support Package (TSP) helped me to understand how to apply Team Coordination Skills during mission performance.	4.1
The TSP courseware will have a positive effect on mission performance.	4.1
The Course Instructor was better able to facilitate the Team Performance Review (in this TSP) than the Battle Captain (in the prerequisite Awareness TSP).	4.0
Overall, this training was valuable.	4.9
Note. Scale values are from 1 to 5, with 1 being the lowest rating and 5 being the highest rating.	

Next Steps

During the summer of 2007, a Train-the-Trainer TSP will also be developed and evaluated in order to provide units the ability to develop in-house instructors that are qualified to administer team coordination training utilizing the DBCTT program.

During the next phase of the project the DBCTT program will continue to incorporate recommendations pertaining to the full range of cognitive and interpersonal skills, in particular, situational awareness.

DISCUSSION

TSP Development and Evaluation Process

The DBCTT Awareness TSP development used the modular design approach proven successful in delivering behavior-based team training principles to Army aviation aircrews and battle staff members serving as Battle Captain.

During TSP development, the DBCTT Advisory Group actively reviewed the training content for realism and relevance to meet the previously identified training needs. As detailed in the results section of this paper, the prototype DBCTT TSP was evaluated by operational unit participants at Fort Hood, TX; Fort Lewis, WA; and Fort Bragg, NC. Courseware improvements based on analysis of user feedback were incorporated after the first and second evaluations producing the summative evaluation version presented at Fort Bragg, NC. Profiles of participants' combat experience, rank, and experience with digital systems were similar across the evaluation groups. Soldiers in the first evaluation did not have the benefit of the PE3 team interaction lesson. For the summative evaluation at Fort Bragg, NC, there was a control group and experimental group of seven participants each. The difference between the two groups was that the control group did not receive the DBCTT application training. Lessons learned from this foundation supported development and formative evaluation of the Advanced TSP at Fort Riley, KS.

The Effect of Training

The final version of the DBCTT Awareness TSP presented for summative evaluation at Fort Bragg, NC provides both a quantitative and qualitative measure of training effectiveness. The experimental and control groups, formed from available personnel, were closely matched in terms of age and various military experience measures. The combat and digital experience levels of the participating personnel was relevant and appropriate for the training received and mission elements that form the content of the practical exercises.

The control group consisted of three officers and four NCOs. The first-day evaluations of their performance of a practical exercise reflected a below standards average rating. The control group returned two days later to complete a second practical exercise which revealed a small decrease in teamwork performance, again below standards.

The experimental group consisted of two officers and five NCOs. Battle staff Soldiers that received the training increased their knowledge of battle staff coordination by 8 percent. As with the control group, the experimental group's pre-training performance revealed a below standards average rating. Following the training, the experimental group's performance revealed an improvement to a meets-standards rating.

Two caveats to these conclusions must be pointed out. First, the inter rater reliability of the OEs ratings was relatively low. Second, the OE's of course knew who had the training and who did not. The OE's would, although not deliberately, tend to see trained participants as performing better than untrained participants.

SUMMARY

The training approach from the previously implemented ACTE and BCATT systems provided the basis for this prototype training support package. The final version of the DBCTT Awareness TSP has a number of design features that includes self-paced instruction, learner comprehension checks and feedback, team-based exercises, facilitated instruction, and team performance feedback. Emulation of currently fielded ABCS systems is a key platform capability that provided effective training realism and relevance.

Three formative evaluations demonstrated the utility of the training approach and provided the basis for content improvements. A summative evaluation that compared the experimental group's performance to a trained group versus and untrained group showed teamwork performance improvements. Following the training, the experimental group's performance revealed an improvement to a meets-standards rating, whereas the control group remained at the marginal performance level, a difference that was marginally statistically significant. Users consistently rated the training positively and provided constructive comments. Together, SMEs and instructional developers improved the product during the evaluation process and identified a number of lessons learned for application in advanced DBCTT research efforts.

Based on summative evaluation results, the Awareness TSP is a stand-along product ready to be incorporated into a final product. The Advanced DBCTT TSP has been developed and is undergoing formative and summative evaluation. During the first formative evaluation, users rated value of the training as 4.9 on a 5-point scale, with 5 as the highest rating.

Team coordination training promotes a set of team coordination skills that can increase mission effectiveness, while decreasing errors that can lead to mission failure. The goal of this research effort is to develop a prototype DBCTT program that will improve the coordination effectiveness of Army battle staff teams involved in risk analysis, dynamic mission planning and execution within the digital TOC. The prototype courseware has been demonstrated to meet the need for initial team coordination awareness training.

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