U.S. Army Research Institute
for the Behavioral and Social Sciences

Research Report 1788

Collective Staff Training in a Virtual Learning Environment

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U.S. Army Research Institute

March 2002

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20020416 210

REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy) March 2002	2. REPORT TYPE Final	3. DATES COVERED (from. . . to) May 2001 to August 2001
4. TITLE AND SUBTITLE Collective Staff Training in a Virtual Learning Environment		5a. CONTRACT OR GRANT NUMBER
		5b. PROGRAM ELEMENT NUMBER 0602785A
6. AUTHOR(S) William R. Sanders (U.S. Army Research Institute)		5c. PROJECT NUMBER A790
		5d. TASK NUMBER 211
		5e. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences ATTN: TAPC-ARI-IK 2423 Morande Street Fort Knox, KY 40121-5620		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences ATTN: TAPC-ARI-IK 5001 Eisenhower Avenue Alexandria, VA 22333-5600		10. MONITOR ACRONYM ARI
		11. MONITOR REPORT NUMBER Research Report 1788
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.		
13. SUPPLEMENTARY NOTES		

14. ABSTRACT *(Maximum 200 words)*:

As the Army transitions to modern digital command and control technology it faces a major challenge in designing web-delivered training to support the acquisition, retention, and transfer of collective staff skills required to apply these advanced technology capabilities to real-world tasks. This report identifies training program design features based on principles of cognitive psychology that can be incorporated into Virtual Learning Environment (VLE) collective training. A prototype Cognitive Training Techniques Checklist was developed and applied in a review of U.S. Army Armor School Virtual Tactical Operational Center (VTOC) collective training. From this review candidate training program design features were identified that can support VLE training requirements. The examination of VTOC training also provided insights for Train-the-Trainer products, and a description of potential future C2 system operational capabilities and challenges. The research represents a logical extension and continuation of previous U. S. Army Research Institute for the Behavioral and Social Sciences cognitive skills training, and distance learning research conducted to assist the U.S. Army Armor School in assessing the individual self-paced phase of training for a new Armor Captains Career Course – Distance Learning (AC3 DL) offered primarily as web-based instruction.

15. SUBJECT TERMS

Cognitive Training Techniques	Collective Training	C4I Training
Virtual Learning Environments	Distance Learning	Future Combat Systems

SECURITY CLASSIFICATION OF			19. LIMITATION OF ABSTRACT	20. NUMBER OF PAGES	21. RESPONSIBLE PERSON (Name and Telephone Number)
16. REPORT	17. ABSTRACT	18. THIS PAGE			
Unclassified	Unclassified	Unclassified	Unlimited	48	Dr. James W. Lussier DSN 464-3450

NSN 7540-01-280-5500

Standard Form 298

Research Report 1788

Collective Staff Training in a Virtual Learning Environment

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March 2002

Army Project Number
2O262785A790

Personnel Performance and
Training Technology

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FOREWORD

The Future Battlefield Conditions (FBC) Team of the Armored Forces Research Unit (AFRU), U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) has a work package (211) FUTURETRAIN: Techniques and Tools for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Training of Future Brigade Combat Team Commanders and Staffs. Recent work under this work package has involved research and development concerning collective training for digital staffs.

Rapid advances in computing power have resulted in an unprecedented capability to bring geographically dispersed students together in Virtual Learning Environments (VLEs). As the Army transitions to the new web-based training technologies, research is needed to ensure that VLE training program design features exploit the full capabilities of these training systems. The present research represents a logical extension and continuation of previous ARI distance learning research conducted in partnership with the U.S. Army Armor School (USAARMS). This research extends the application of cognitive principles to collective skills training design to fully realize the training potential of VLE training technologies.

The information provided in this report is valuable to the USAARMS and other organizations involved in developing VLE collective training for leaders and staffs. The cognitive psychology principles for collective VLE training in this report are applicable to a wide range of current and future systems. The results of this research were briefed to representatives of the USAARMS on October 31, 2001.

MICHAEL G. RUMSEY
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ACKNOWLEDGEMENTS

The author wishes to acknowledge the essential contributions made by personnel in the U.S. Army Armor School (USAARMS) who supported this research. Much of the value of the present research comes from documenting the detailed comments and recommendations provided by the Armor Captains' Career Course Distance Learning trainers and students. The present research required observations and data collection from Virtual Tactical Operation Center (VTOC) class exercises. Mr. Ron Offutt, Mr. Pete Borosky, and Mr. Jim Harrison of AB Technologies Incorporated provided essential information regarding the effectiveness of the VTOC training techniques, and the challenges facing the Army in developing the next generation of VTOC instructors. Dr. Connie Wardell served as the senior USAARMS representative for the present research, and provided valuable information regarding the issues underlying the development of distance learning programs.

COLLECTIVE STAFF TRAINING IN A VIRTUAL LEARNING ENVIRONMENT

EXECUTIVE SUMMARY

Research Requirement:

As the Army transitions to modern digital command and control (C2) technology it faces a major challenge in designing training for the collective staff skills required to apply these advanced technology capabilities to real-world tasks. Web-based Virtual Learning Environment (VLE) training technologies offer great promise as collective training tools. However, to fully exploit the potential of VLE collective training, research is needed to identify the principles of cognitive psychology that support collective skills, to identify how these cognitive principles can be incorporated as specific VLE collective training design features, and to identify potential Train-the-Trainer products. The investigation of VLE collective staff training should also provide early insights into future C2 system operational capabilities and challenges.

Procedure:

As a first step, cognitive psychology principles and training techniques identified in previous research were organized into a checklist tool to provide a framework for identifying specific techniques currently implemented in VLE training. Next, a representative VLE training system was selected where insights from instructors, students, and previous research could be gathered. Interviews with VLE instructors were conducted, and training sessions were observed. Particular attention was paid to identify training program requirements driven by the transition from classroom to VLE training. The review of current VLE training issues also identified potential operational capabilities and challenges for future distributed digital C2 systems.

Findings:

Several products were generated from the present research. A prototype Cognitive Training Techniques Checklist was developed and used to review a current VLE collective training program. From this review candidate Training Program Design Features were identified that can support VLE training requirements. The VLE training program review also provided insights for future Train-the-Trainer products, and a description of potential future C2 system operational capabilities and challenges.

Utilization of Findings:

The results of this research should support Army efforts to design VLE collective training for a broad range of current and future systems. The prototype Cognitive Training Techniques Checklist, and Candidate Training Program Design Features product demonstrate how the principles and techniques of cognitive psychology can be utilized in real world VLE training design. Insights gained into future C2 system operational capabilities and challenges should be of value to managers involved in future systems acquisition and development.

COLLECTIVE STAFF TRAINING IN A VIRTUAL LEARNING ENVIRONMENT

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COLLECTIVE STAFF TRAINING IN A VIRTUAL LEARNING ENVIRONMENT

Introduction

Requirement

It has been estimated that in the 21st century, half of all learning will be conducted on the Internet, and when online learning is combined with more interactive and facilitative in-person learning, it could easily outperform today's one-size-fits-all traditional lecture delivery system (Draves, 2000). With the rapid advance of computer hardware and software capabilities, a great deal of effort is being devoted to the development of web-based training to replace or supplement the traditional exposition-application classroom lecture education. Researchers caution us, however, that the training potential of emerging technologies stems not simply from technologically advanced capabilities, but from the ability to vary instructional methods and media systematically according to the cognitive demands of learning tasks (Hooper & Hannafin, 1991). Research is needed to ensure that the development of sound teaching techniques for employing web-based Distance Learning training technology does not lag far behind the pace of the development of the technology. For the present research, Distance Learning (DL) will be defined as "planned learning that normally occurs in a different place from teaching and as a result requires special techniques for course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements." (Moore & Kearsley, 1996, p. 2)

The Army has made the decision to employ the Internet as a central means of delivering training. Army training developers have stated that for learners who cannot attend full length resident training, a collective DL environment is needed for battle staff training to capture the peer interaction and the creative energy present in real small group interactions. These training developers view DL technology as offering unexpected capabilities, and actively support efforts to identify learning principles and training techniques that can be incorporated into current and future DL applications, stating that "At this point in DL development we need to set future targets, not current, for technology, to be a risk taker or you will never get beyond current capabilities" (C. Wardell, personal communication, March 28, 2001).

While advances in computer technology have led to the large scale introduction of web-based training applications, many opportunities exist to enhance this training. The Army has developed learning environments where individual web-based learning is combined with collective learning experiences that harness the power of performance modeling, peer tutoring, and peer motivation to achieve success in training collective battle staff skills. The present research seeks to identify principles of cognitive psychology that support DL collective skills training, to identify how these cognitive principles can be incorporated as specific DL collective training design features, and to identify potential Train-the-Trainer products. The investigation of DL collective staff training should also provide early insights into future digital command and control (C2) system operational capabilities and challenges.

Background

Overview. The present research represents an extension of previous individual staff skills work to address requirements for collective staff skills training in a Virtual Learning Environment (VLE). This research must first consider collective staff skill requirements, as effective training should derive from applying established cognitive principles to learning requirements, rather than from a focus on VLE technological solutions. In particular, the central role of the trainer in employing these cognitive approaches to staff skills training needs to be identified. Research on staff skills training must also be future oriented to ensure that training solutions will be available to meet the anticipated demands of a future digitally networked force.

Related staff skills research efforts. The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Armored Forces Research Unit (AFRU) at Fort Knox has recently conducted research to assist the U.S. Army Armor School in assessing the individual self-paced phase of training for a new Armor Captains' Career Course – Distance Learning (AC3 DL) offered primarily as web-based instruction (Sanders & Burnside, 2001; Sanders & Guyer, 2001). This research gathered information from AC3 DL instructors and students to identify strengths of the training program, and also areas of training that could be improved. In a related effort, research was conducted to identify opportunities to apply cognitive psychology principles to the development of training techniques for computer delivered individual training to enhance digital system skill acquisition, retention, and transfer (Sanders, 2001). The cognitive training techniques derived in this research were incorporated into the development of prototype individual procedural skills training modules (Deatz & Campbell, 2001).

Virtual learning environments. Early training applications on the Internet tended to divide the traditional method of teaching into two parts – cognitive learning, which could be accomplished with online learning; and affective learning, which could be accomplished better in a small group discussion setting (Draves, 2000). Here, cognitive learning includes facts, data, knowledge, and mental skills, while affective learning involves emotions and social skills essential in team building. Advances in technology have now permitted the development of VLEs where both cognitive and affective learning can take place. The VLEs have been described as learning management software systems that synthesize the functionality of computer-mediated communications software (e.g., shared text and graphics documents, e-mail, voice, bulletin boards, and information reference resources such as maps and manuals) and on-line methods of delivering course materials (e.g., the World Wide Web). The VLEs are intended not simply to reproduce the classroom environment "online," but to use the technology to provide learners with new tools to facilitate their learning. They aim to accommodate a wider range of learning styles and goals, and to encourage collaborative learning (Britain & Liber, 2000).

Cognitive principles for collective training. Cognitive psychology learning paradigms include learning theories (e.g., behaviorism, cognitivism, and constructivism), which consider the nature of individual learning as well as how knowledge is constructed in social situations. For behaviorism, learning reflects a new behavioral pattern being repeated until it becomes automatic, while cognitivism views learning in terms of the thought process behind the behavior. Constructivism is distinguished by its premise that learners construct their own perspective of the

world, based on individual experiences and schema (Wilhelmsen, Asmul, & Meistad, 1998). The constructivist theories of learning are particularly appropriate for collective skills training in VLEs as this learning approach leverages the power of performance modeling, peer tutoring, and peer motivation as tools to enhance learning. The review of theories of learning can provide the basis for identifying theory-driven technology-based approaches to meeting training requirements (Lajoie, 2000). The need exists to identify how cognitive principles and pedagogical design can be applied to meet battle staff collective training goals. Cognitive principles and techniques that would apply to VLE collective training have recently been documented by Sanders (2001) and Lussier, Ross, and Mayes (2000).

Train-the-Trainer. The "Train-the-Trainer" requirement associated with the introduction of the DL training approach needs to be identified and documented as an essential contributor to the success of the training system. An essential goal of any training system is that it be robust, and scalable as the demand for classes increases. A key concern that drives the "Train-the-Trainer" requirement is the potential for a shortage of instructors as DL courses proliferate and the instructor demand increases in turn. The development of instructor training, establishment of student performance standards, and development of reliable student performance assessment tools are essential to ensure consistent training across instructors for a robust training program. The introduction of advanced DL training technology, and the requirements for instructors to perform as role model and mentor, leveraging a growing set of VLE technology capabilities, can create a significant Train-the-Trainer requirement.

Future distributed digital C2. One unanticipated benefit of collective battlestaff VLE training is that it can provide an early look at the operational capabilities and challenges facing the Army as it moves to distributed battalion C2 digitized systems. The future of Army commander and staff mission planning and execution tasks bears a strong resemblance to the VLE training of today, where the geographically dispersed instructor (commander) and students (staff) work collectively to develop planning products. The Army is undergoing a transformation to a rapidly deployable yet fully capable force built around Future Combat Systems (FCS) internetted combined arms operations. It is anticipated that the FCS will offset platform limitations in the close fight with internetted combined arms with "point and shoot" fire support. While commanders and staff have traditionally been co-located for mission planning and execution, the transformation to FCS will likely require that geographically dispersed leaders and staff communicate and coordinate their collective actions rapidly across digital C2 links. This ability to plan and execute actions across digital C2 links will be essential to the successful employment of Networked Fires, Robotics, Organic Three-Dimensional Targeting and Mobile C2 enabling technologies (St. Onge, 2000).

Distributed training. It is likely that in the future training capabilities will be required to support Distributed Training (DT) requirements. For the present research, DT will be defined as training that can be delivered electronically across geographically dispersed leaders and subordinates to support unit skill sustainment training requirements. While DL and VLEs typically are an extension of the schoolhouse that supports initial skill acquisition, DT will leverage the capabilities of modern training technology to meet the requirement for leaders to conduct individual and collective sustainment training, whether in garrison or deployed. The investigation of collective battlestaff training in VLEs can provide insights into the training

requirements associated with future C2 systems, particularly with respect to the commander's role and support requirements as primary trainer for his battlestaff. One challenge will be to identify training system designs, to include trainer aids and automated performance assessment and feedback tools, that can support sustainment and proficiency training within and between digitally equipped forces in the future.

Research Approach

The research approach basically follows the sequence of topics identified in the Background Section. Cognitive psychology principles and training techniques identified in previous research were used as a framework to identify specific techniques that are currently implemented in VLE training, and opportunities to incorporate additional techniques into training. As a first step, training issues documented in previous research that specifically address VLE training issues were reviewed and summarized. Next, a representative DL VLE training system was selected where insights from instructors and students could be gathered. Interviews with VLE instructors were conducted, and training sessions were observed. Particular attention was paid to identify Train-the-Trainer requirements driven by the transition from classroom to VLE training. The review of current VLE training issues provided a valuable opportunity to identify potential operational capabilities and challenges for future distributed digital C2 systems. Definitions for the acronyms used in this report are provided in Appendix A.

Virtual Learning Environment Training Issues Identification

An Exemplar Virtual Learning Environment

The Virtual Tactical Operations Center (VTOC) located at the U. S. Army Armor School (USAARMS), Fort Knox, was selected as an exemplar VLE training system for the purpose of identifying and documenting cognitive training techniques applicable to a representative Army VLE. The VTOC is a virtual reality environment representing a battalion–level tactical operations (TOC) center, where geographically dispersed National Guard students and instructors participating in AC3 DL training come together over the Internet for real-time collective staff training. The VTOC allows for online collective task performance training through audio, text, and graphic overlay tools to accomplish battalion-level commander and staff tasks. Tasks include using the Military Decision Making Process, developing the Operations Order, preparing a Warning Order, and preparing a Mission Analysis Brief.

The VTOC training is presented in Phase 1 of the AC3 DL program. In Phase 1 students complete a year-long course of study based on individual (Asynchronous) Internet-based self-study modules addressing brigade (BDE) and battalion (BN) battle staff skills, and Company Team operations. Seven weekend VTOC collective (Synchronous) training sessions are distributed across the Phase 1 training program to provide students with an opportunity to practice applying this new knowledge. While the individual delivering VTOC instruction is formally referred to as the Small Group Instructor (SGI) he will be referred to here as a "trainer" to highlight the fact that he does not lecture or provide instruction in VTOC, instead acting as a mentor for the students. Students who successfully complete Phase 1 training complete the course with two weeks of Resident Training (Phase 2) at Fort Knox. The AC3 DL replaces the

previous Armor Officer Advanced Course – Reserve Component (AOAC RC) self-study book-based correspondence course. The AC3 DL program is the National Guard's alternative to the traditional 18 week Armor Captains' Career Course – (AC3) taught for Active Component (AC) officers as a resident course at Fort Knox.

Principles of cognitive psychology were incorporated into the pedagogical design of VTOC training delivery from the outset. The new VTOC course design incorporates elements of the constructivist approach to instruction, which places the learner in an active role in which knowledge is discovered in interaction with the environment (AB Technologies Inc., 1998, July). Using the constructivist model, the VTOC classroom environment should closely represent the conventional battalion TOC task environment. The students are actively involved in the learning process, constructing their own understanding of how knowledge can be used. The trainer intervenes only when the students are no longer able to make progress. The after action review (AAR) is a key component of this constructivist learning approach (Ross & Yoder, 1999).

Figure 1 presents the home page of the VTOC computer screen interface. The large window at the upper left side of the screen provides a virtual reality environment where students and instructors move about as avatars in a conventional battalion TOC, communicating via voice and text chat, accessing maps, manuals, orders, and preparing staff products by working individually or collectively on templated documents and graphic overlays. The large window at the upper right can display various data, to include templated documents for collective editing. Specific interface features available in VTOC have been identified by Offutt and Borosky (2000). A typical VTOC training session would involve a trainer and 8-12 students taking on the roles of a battalion task force commander and staff. Training is conducted one weekend each month for students, with each class participating in approximately seven training sessions. Additional information describing the AC3 DL VTOC is available at their web site (U.S. Army Armor School, 2001).

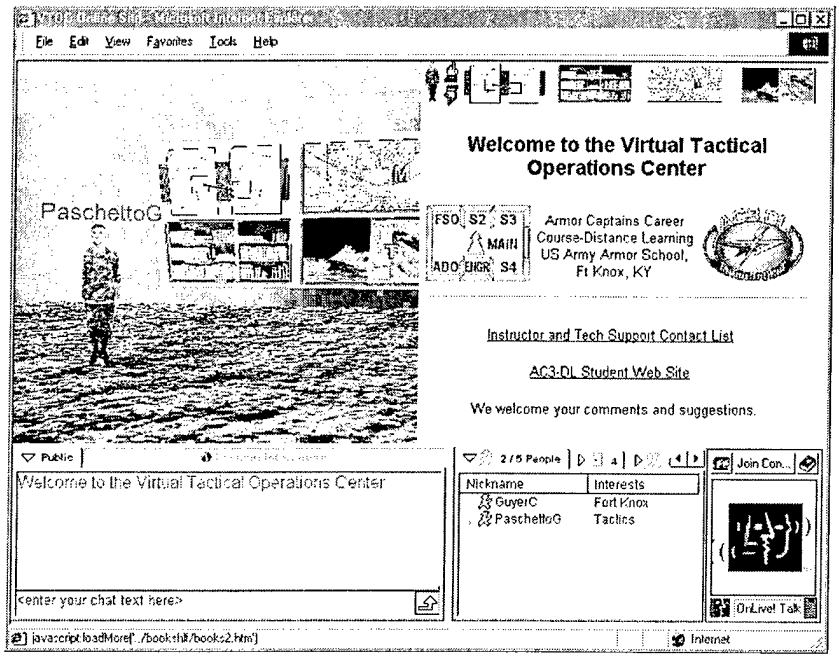

Figure 1. VTOC computer screen home page (source: U.S. Army Armor School, 2001).

Training Issues for Collective Staff Training

Issues for collective staff training were identified from several sources. These issues were used to identify features of the VTOC VLE training program design that might be incorporated to enhance VLE training in general. Interviews were conducted with VTOC trainers, VTOC training sessions were observed, and software was obtained to allow a hands-on exploration of the VTOC environment. Issues were also identified from a review of previous AC3 DL research which included data from structured interviews with AC3 DL students and trainers, and student surveys. A brief description of each data collection effort will be presented, annotated with a summary of training issues derived from each source. Based on this review of training issues, and the stated research goals, three categories were chosen for use in presenting and reviewing the training issues: "Training Program Design Features," "Train-the-Trainer Requirements," and "Implications for Future C2 Operations."

VTOC Trainer Interview

The ARI staff interviewed the senior VTOC trainer, also referred to as the senior SGI, primarily to investigate VTOC Train-the-Trainer requirements, using a structured interview guide. Previous research (Sanders, 2001) had noted that there might be a shortage of trainers available for current VTOC classes, while the demand for DL throughout the Army was expected to increase dramatically. Facing this increasing demand for DL trainers the issue was raised of how best to meet this need through a Train-the-Trainer program. Topics of discussion included the trainer role and activities in VTOC class sessions, availability of written materials such as a trainer's handbook, and recommendations for additional materials that could be developed that would help new trainers deliver VTOC training. A selection of issues identified from this interview are presented in Table 1. The full listing of issues identified in the interview is presented in Appendix B.

Table 1

VTOC Trainer Issues

Training Program Design Features:

- Performance Assessment: There is no formal recorded assessment of student leadership skills, or individual student performance during VTOC training.
- Structured Training: Group AAR is informal, conducted at the end of each weekend training session with teaching points taken from the SGI's notes.
- Performance Feedback: Students are not individually rated on their written VTOC products. Formal evaluation of important VTOC-trained competencies occurs later, in the two-week resident phase of instruction formal evaluation. Scores from this later evaluation do go into the student's record.

Table Continues

Table 1 (Continued)

Train-the-Trainer Requirements:

- Training Requirement: The senior VTOC trainer stated that trainers will need very little VTOC-specific training. The senior VTOC trainer stated that instructors selected as VTOC trainers will already know how to train battle staff competencies based on their previous Army training and leadership experience.
- Training Process: Instruction to convey subject matter knowledge is presented in the Asynchronous portion of the course. Using the VTOC, the trainer guides collective experiential learning by mentoring students and monitoring their progress.
- Instructor Support: There is no VTOC trainer handbook.

Implications for Future C2 Operations:

- Future Commander Training Skills: VTOC performance assessment and feedback tools are not available to serve as a basis for building training aids to assist a future commander who serves as primary trainer for his staff. The current VTOC approach is to hire retired officers as VTOC instructors, and not develop Train-the-Trainer programs.

VTOC Training Observations

ARI staff observed VTOC Class #3 weekend training sessions, primarily to investigate VTOC Train-the-Trainer requirements, using a structured data collection guide. A selection of issues identified during these observations are presented in Table 2. A full listing of issues identified during the training observation is provided in Appendix C.

Table 2

VTOC Training Observation Issues

Training Program Design Features:

- Skill Flexibility: New tasks are introduced during a VTOC session to require students to adapt to change quickly. Students were given additional tasks that were not expected (e.g., one-page additional commander's guidance posted on VTOC message board).
- Advance Organizer: The trainer described the link between past, present, and future work at the beginning of VTOC training: "Expand on what we did last time today, you will see this again in Resident phase training."
- Digital Media Skills: Some students had trouble remembering where text and graphic digital files from previous VTOC session were stored, and which files represented the most recently updated version.
- Skill Rehearsal: Student stated that trainees start sending email to each other a week before VTOC training to review what they did in the previous session.

Table Continues

Table 2 (Continued)

Train-the-Trainer Requirements:

- Training Goals: Consider formally crosswalking training design: course goals, training methods, performance assessment, and feedback.
- Performance Modeling: There were long pauses in discussion, and absent students during the Mission Brief to the commander. It was stated that students can hide in the VTOC training, compared to a real life briefing where the battlestaff is present in the briefing room. Consider presenting a video clip demonstration early in lesson to model the desired briefing format and protocol, establishing the collective performance standards.
- Performance Feedback: The VTOC trainer role plays the BDE and BN Commander (CDR), BN Executive Officer (XO) and Operations Officer (S3). The trainer stated that his instructor role combines art and science. The "Science" is the multi-page task checklist used to outline task requirements for the students. The "Art" is the instructor's ability to assess whether the student's plan is feasible. There are no set solutions, so the instructors must be prepared to assess a broad range of plan options.

Implications for Future C2 Operations:

- Degraded Communications: The class started staff tasks while some students were still not logged on, and some logged on but with degraded communications. Students were told to inform others when they came online. Unplanned loss and return of students occurred due to communications problems, but students quickly adjusted using alternative communication lines (email, cell phones, commercial text and graphics software).
- Commercial Product Preferences and Expectations: Students used a variety of available communication resources not provided in VTOC to accomplish tasks: Commercial text and graphics software, public email, cell phones. Students may expect high functionality from Army digital systems, at the same level as commercial hardware/software systems.
- Digital Media Design: Students cannot file all the information that they would like to file. "I wish I could store information like the previously developed Operations Order and refer back to it."
- Digital Media Risks: It appeared that sometimes student individual staff products were not collectively reviewed by all staff members before being briefed, raising concerns about internal coordination of collectively developed digital documents.

Assessment of Initial Delivery of the Armor Captains' Career Course (DL)

Data originally collected to assess the self-paced portion of a prototype training course were reviewed for the present research to identify issues related to the VTOC-delivered collective staff training portion of the course. In June 1999, the Director USAARMS requested the ARI AFRU provide assessment support to the USAARMS review of the AC3 DL. The ARI researchers worked with USAARMS to develop an interview protocol for both students and instructors, and a multiple-choice survey for students to identify training issues for the first AC3 DL class to complete training. A 12-item AC3 DL Resident Course Survey was developed to

identify how well elements of the program meet training needs. A 16-item AC3 DL Student Interview Guide was also prepared to identify Army policies and incentives that could impact RC officer participation in the AC3 DL training program. Both the survey and interview were administered to students during the 2-week resident portion of the AC3 DL program (Sanders & Burnside, 2001).

A selection of VTOC-related issues identified by students in the survey and questionnaire is presented in Table 3. One active duty SGI experienced as a VTOC trainer participated in the detailed interview addressing specific strengths and weaknesses of the AC3 DL course, to include issues associated with VTOC training. A selection of VTOC-related issues identified by the SGI is presented in Table 4. The full list of VTOC-related issues identified by students in the AC3 DL Resident Course Survey and Student Interview appears in Appendix D. The complete list of VTOC-related SGI Interview issues appears in Appendix E.

Table 3

AC3 DL Student Issues

Training Program Design Features:

- Peer Motivation and Tutoring: Students stated that AC3 DL is superior to AOAC RC as it includes peer motivation and peer tutoring as part of the learning process, and better prepares students for resident training.
- Part-task Training: Students stated that the Army can't have RC company commanders doing (weekend-long) Synchronous training instead of drill, that so many students dropped out that the class lost key positions.

Train-the-Trainer Requirements:

- Trainer Feedback: Need more one-on-one feedback from trainers on student progress.
- Performance Evaluation: Students stated that they need a detailed AAR at end of the VTOC training sessions.

Implications for Future C2 Operations:

- Centralized vs. Distributed C2: Students stated that it would be better if they could work together in co-located small groups for VTOC training. This suggests that face-to-face staff work may have performance advantages over distributed C2.

Table 4

AC3 DL Small Group Instructor Issues

Training Program Design Features:

- Decision Making: With VTOC experience students are more likely to make a decision.
- Communication Skills: Students have more confidence, experience speaking in front of peers, students know SGI better.
- Supervising Skills: Students play the role of XOs or S3 which involves supervising, controlling, and directing other students in subordinate staff roles. Students say they need to learn to lead, and to be a follower.
- Teaching/Counseling Skills: AC3 DL includes peer motivation, peer tutoring as part of the learning process.
- Team Development: Students teamed in VTOC portion of training arrive at the 2-week resident training phase ready to perform as a team.

Train-the-Trainer Requirements:

- Student Skills Assessment: VTOC Instructor must identify students with stronger leadership skills early in training, and put them in more demanding positions (e.g., S3) first, then rotate with other students. Assessment of student strength comes through Asynchronous Phase performance, and dialogue between SGI and student.
- Behavior Modeling: The SGI plays the role of the CDR and/or XO, and walks students through wargaming the Course Of Action analysis. First the SGI shows the students what to do, then appoints students to play the role of XO or S3 which does involve supervising, controlling, and directing students in subordinate staff roles.
- Performance Assessment: Individual student VTOC written products are not evaluated.

Implications for Future C2 Operations:

- Use of Available C2 Systems: Degraded communications training is essential for future digital C2 operations, particularly developing the staff mindset that workarounds can be found. The VTOC students demonstrated the ability to adapt "on the fly" to communications problems after having had lots of experience with degraded communications during their VTOC training.
- Flexible Staff Roles: Students learned to perform various staff roles during planned rotations through staff assignments. Students also got experience at having to quickly assume staff functions while filling in for staff members who were temporarily off-line.

Commander's Survey: Armor Captains' Career Course (DL)

Data originally collected to address AC3 DL course policy issues were reviewed for the present research to identify issues specifically related to the VTOC collective staff training. In June 2000, the Director USAARMS requested that the ARI AFRU provide assessment support to the USAARMS review of the AC3 DL course. The ARI researchers worked with training developers and instructors to construct a survey for both students and unit leaders involved with

AC3 DL. The survey requested demographic information, and presented 14 open-response questions regarding policy issues that might impact student participation in the training (Sanders & Guyer, 2001). In responding to the survey 45% of students and 32% of unit leaders indicated that AC3 DL is a good course, and described it as an improvement over the previous paper-based correspondence course. It was noted that the DL format does not lead to a reduction in the requirement for instructors, as instructors are essential to on-line training success for DL students. The full set of VTOC-related issues identified by students and unit leaders are presented in Table 5.

Table 5

VTOC Issues: Commanders' AC3 DL Survey

Training Program Design Features:

- Peer Tutoring: Need more real-time interactions with others.
- Digital Skills Mental Model: Students reported that learning to use unfamiliar VTOC-specific C2 interface software wasted a lot of training time.

Train-the-Trainer Requirements:

- Trainer Role: The DL format does not lead to a reduction in the requirement for instructors, as instructors are essential to on-line training success for DL students.
- Trainer Target Audience Skills: Consider integrating Active Component and Active Guard Reserve instructors to counter shortage in authorized instructor personnel.

Implications for Future C2 Operations:

- C2 Interface: Future staff members will expect that the C2 interface will operate with the same functionality and reliability as commercial products.

Suggested VLE Research Directions

The issues identified from ARI's AC3 DL training program research were presented to the ARI Director (Chief Psychologist of the Army), on August 8, 2001 at ARI Fort Knox to gather guidance and suggestions for VLE research. The briefings noted that as the Army transitions to new digital communications technologies, it faces a major challenge in developing integrated training programs that support the collective leader and staff planning and decision making skills required to exploit the capabilities of these systems. It was noted that previous research by Abell (2000) has identified the importance of including both whole-task, and part-task presentations in training. The ARI Director suggested that research could be conducted to investigate several cognitive training techniques to address the identified VLE training issues. The suggested research directions are summarized in Table 6.

Table 6

Suggested Research Directions

- Training Design Checklist: Translate the cognitive principles and methods for training into a checklist, using clear behavioral terms, and use this to systematically review a representative VLE training program.
- Part-task Training: An additional useful cognitive technique is the use of a part-task approach to focus training emphasis on difficult and problematic tasks. It was noted that VTOC training takes an analogue training approach, where each element of a conventional task is played out sequentially in real time.
- Performance Standards: Clear behavioral standards for performance should be presented early in collective DL exercises.
- Performance Demonstrations: The VLE AAR needs to include teaching points to make it a learning event. It was noted that Reserve Component students will not have the experience and background that their AC instructors do. Trainers might demonstrate performance standards with tools such as realistic video demonstrations.

Summary of VTOC Related Training Issues

Issues for VTOC collective staff training were identified from interviews with VTOC instructors, and the observation of VTOC training sessions. Previous AC3 DL research which included VTOC-related data from structured interviews with AC3 DL students and SGIs, and student surveys was also reviewed for training issues identification. The review suggests that a number of constructivist training techniques are currently employed in VTOC training. Staff officer subject matter knowledge training is delivered in the self-paced Asynchronous portion of the AC3 DL course. In VTOC training the trainer does not lecture, but instead monitors, mentors, and provides guidance to students, and thus needs the skills to perform in this role. VTOC training might benefit from incorporating additional cognitive techniques supporting performance assessment and feedback, and the introduction of part-task training exercises as an alternative to the current single vignette per weekend approach.

With regard to Train-the-Trainer requirements, VTOC training delivery currently relies heavily on recruiting retired military officers with the requisite skills, rather than implementing a training program to develop these required skills in future instructors. The concern exists that as VTOC-type VLE training increases there will be a greater need to develop instructor skills through training. The review of VTOC training revealed the fortuitous situation where technical problems in VTOC communications led the students to become proficient at finding workarounds to continue their staff tasks. It appears that there is great benefit in having staff members develop a flexible mindset for dealing with degraded communications. This experience with degraded modes of communications might be an essential, but overlooked, element of digital staff training for future distributed digital C2 systems.

Cognitive Principles and Training Techniques

Cognitive Theory Support for Training

Constructivist psychology principles can address many of the training design needs for VLEs. For the present research a checklist was developed to demonstrate how training programs can be reviewed to identify principles of cognitive psychology and related training techniques that have been incorporated into the design of training. The checklist was based on previous ARI research which identified a number of constructivist psychology principles that can be applied to VLE staff training to enhance skill retention (Sanders, 2001).

Constructivist theory proposes that knowledge is individually constructed and socially co-constructed by learners based on their interpretations of experiences in the world. Following this principle, training should consist of experiences in realistic task environments that facilitate knowledge construction (Jonassen, 1999). Constructivist theory lends itself to ill-defined tasks, and seeks to address higher level cognitive tasks, particularly those involving collective task performance. Constructivist theory suggests that VLEs should provide an environment for social interaction, social negotiation, and collaboration, important skills for collective commander and battle staff planning and decision making tasks. Thus it might have great utility in providing a training approach for battalion staff collective C2 tasks in an environment that contains a fluctuating mixture of both digital and conventional message traffic. For one example of battle staff training, Lussier, et al. (2000) have developed training to facilitate "adaptive thinking" in response to unanticipated circumstances; this training combines the constructivist principles of coaching and scaffolding with the behaviorist technique of deliberate practice.

For the present research it was important to consider the role of the trainer in employing constructivist training techniques. Employing the "cognitive apprenticeship" instructional approach, students will model skills demonstrated by an expert trainer in a realistic setting. The sequence of feedback in coaching would start with a high degree of external support or "scaffolding" for beginning learners and move to a gradual reduction of support as learning progresses, an instructional technique referred to as "fading" (Samarapungavan, Beishuizen, Brazier & Sanders, 1993).

Cognitive Training Techniques Checklist

The interviews and surveys conducted with students and VTOC trainers served to identify the strengths of VTOC training particularly in leveraging the powerful training potential of peer motivation and peer tutoring. These data gathering efforts also identified issues regarding the absence of systematic individual and collective performance assessment, and the reliance on a single training approach involving a 2-day real-time staff planning task. The framework for constructivist principles previously presented in Sanders (2001), was revised into checklist format using descriptive behavioral terms, and used to review VTOC training features. This example serves to illustrate how constructivist principles are currently implemented in VTOC training, and identifies further opportunities to leverage constructivist training techniques. A sample of a prototype constructivist principles checklist is provided as Table 7. The full prototype checklist, annotated with VTOC training observations, appears in Appendix F.

Table 7

Cognitive Training Techniques Checklist

SYSTEM	DATE			RATER
Cognitive Principle	Integrated in Training?			Rater Comments/Suggestions
	Yes	No	NA	
1. Use context-based training to build situated cognition of tasks.				
1a. Knowledge to be trained should be presented in a realistic context.				
1b. The training problem should be ill-defined, ill-structured, to stimulate original thinking.				
2. Training should emphasize learner control and the ability to manipulate information in the task environment.				
2a. Learner should have multiple ways (interface options) to access information.				
2b. Learner should be able to access manipulate multiple types of information (e.g., text, voice, graphics).				
3. Training should provide multiple modes and perspectives for representing instructional content.				
3a. Training should provide learner selectable interface media, individualizable to meet learner preferences.				
3b. Team training should provide for cross-training of team member roles.				

Candidate Training Program Design Features

Many of the cognitive training techniques identified in the Cognitive Training Techniques Checklist require that training program design features be in place to ensure their success. For example, scaffolding techniques require that trainers are able to make reliable assessments of relevant aspects of individual students performance over a period of time, using these performance assessments to either sustain, or fade the amounts of trainer assistance to each individual student. The incorporation of cognitive techniques is also facilitated where training programs have established clear training goals with desired performance identified in behavioral terms that will allow program developers to assess whether program goals are being met, or not. Table 8 presents a number of training design features that could be introduced into VTOC training to support the incorporation of cognitive training techniques, and enhance training effectiveness.

Table 8

Candidate Training Program Design Features

Training Needs and Issue Source	Training Design Features
1. The VTOC training developers need to crosswalk stated training goals to training methods, and student performance assessment. Issue Source: Table 4	Build a training goals and techniques matrix. Establish performance criteria for training program effectiveness assessment. Collect empirical student performance data to support training techniques effectiveness assessment.
2. The VTOC should provide a broader range of experience for learners, greater staff role rotation. Focus practice on difficult tasks. Issue Source: Table 7, and Abell (2000)	Develop a variety of part-task vignettes as an alternative to the current weekend-long training scenario. Use video teamwork examples to make up for lack of visual examples of teamwork in VTOC.
3. Provide "Train-the-Trainer" experience in student performance assessment and feedback to enhance performance assessment consistency across trainers. Issue Source: Table 2	Develop digital video VTOC screen capture examples of student performance that new trainers can practice evaluating. Establish observable student performance criteria that can be reliably scored across trainers.
4. Formal documentation of student strengths is needed in the event that substitute trainer must take over the class. The student record is needed to make student staff role assignments. Issue Source: Table 2	Make a record of student progress that can be accessed by a substitute teacher. Employ a structured rating sheet similar to the "cut-sheet" used by some instructors in Resident phase training, and update student assessments to support student staff role assignments.

Table Continues

Table 8 (Continued)

5. The VTOC training developers need to clearly identify the leadership behaviors to be trained. Develop methods to demonstrate the desired behaviors. Issue Source: Table 2.	Identify key leadership behavior training goals. Develop methods to demonstrate desired behaviors (e.g., decision making, information organization, task allocation) such as digital video files, graphic or text descriptions.
6. The VTOC training needs to include a means of demonstrating the execution of the staff plan. Issue Source: Future VTOC capability.	Incorporate a tactical simulation game in VTOC for plan execution and assessment. Identify evaluation criteria and opportunities for automated performance assessment.
7. The VTOC training needs a structured AAR, with a record of student performance across VTOC training weekends to support training program effectiveness assessment. Issue Source: Table 7.	Structured AAR product should leverage available VTOC multimedia to identify what to sustain, and what to improve. Record AAR issues for review at next VTOC lesson.

Training the Trainer

Train-the-Trainer Issues

The establishment of Train-the-Trainer requirements is an essential component of large scale training system design. Train-the-Trainer issues identified from AC3 DL VTOC training will be very valuable in identifying a training approach to ensure consistency in training delivery, and which will allow for training program assessment. The assessment of AC3 DL Phase 1 Asynchronous training was conducted with an empirical comparison of AC3 DL versus AOAC RC test scores (Sanders & Burnside, 2001). A similar evaluation of the effectiveness of VTOC training, quite useful in justifying funding requests, would first require the development of standardized and validated performance assessment tools.

The Train-the-Trainer requirement associated with the introduction of the VLE training approach needs to be identified and documented as an essential contributor to the success of the training system. The introduction of advanced VTOC training technology, and the requirements for instructors to perform as role model, mentor, and trainer, can create a significant training burden. Train-the-Trainer issues identified from AC3 DL VTOC training will be very valuable in identifying a training approach to ensure consistency in training delivery. As noted previously, a key concern that drives the Train-the-Trainer requirement is the potential for a shortage of instructors as VLE courses proliferate and the instructor demand increases in turn. Even with the small scale VTOC training program, a shortage of instructors has resulted in the decision to employ retired officers as instructors, and to consider using Reserve Component officers as instructors.

An essential goal of any training system is that it be robust, and scalable as the demand for classes increases. The training system must be able to adapt on occasions when an individual instructor is not available to teach. It is hazardous to follow a practice where essential student

performance information for an entire class resides only in one instructor's memory. Formal student performance assessment, establishment of student performance standards, and development of instructor training are essential to ensure consistent performance standards and assessment across instructors for a robust training program. If instructors from different backgrounds hold students to different standards then training will also be inconsistent. It will not be known if instructors, or instructors-in-training, use the same reliable standards unless this is checked through estimates of inter-rater reliability against a common class session, or against repeatable examples of student performance such as video or audio recordings. Students have noted frustration and difficulty when encountering different performance standards as they progress from AC3 DL VTOC civilian (retired military) to AC3 DL Resident Phase AC instructors. While the perceived change in performance standards could reflect a Crawl-Walk-Run progression, the different standards might also reflect the personal decisions of the individual instructors. Experienced instructors have learned how to gather student performance insights from the limited (audio, text) information available in VTOC. These insights should be validated, so that they can be shared with other instructors, and integrated into Train-the-Trainer lessons.

Skill Requirements for VTOC Trainers

The role of the VTOC trainer is evolving. At first the VTOC trainer provided instruction, lecturing and demonstrating how products were produced. Now instructors monitor, mentor, and provide guidance, letting the students produce the staff planning products. It is assumed that the students get the subject matter knowledge instruction they need from the Asynchronous self-study portion of the course. The AC3 DL Course Design Document identifies a number of student competencies as training goals for the total course which suggest areas where instructors will need training skills: 1) Decision Making, 2) Planning, 3) Communicating, 4) Technical and tactical proficiency, 5) Use of available systems, 6) Supervising, 7) Teaching/counseling, modeling behaviors, and 8) Soldier team development (AB Technologies Inc., 1988, July). While these student competencies are developed in VTOC training, no student performance record is kept. Formal evaluation of VTOC trained competencies occurs in follow-on Asynchronous training individual projects, and in the Resident phase formal evaluation which does go into the student's record.

The role of VTOC trainer is tied in with that of the Resident phase SGI. The current VTOC trainers are retired military, and they benefit from the Active Duty Captain resident phase instructors' current knowledge of doctrine and detailed knowledge of company team operations. VTOC trainers will typically manage 60-80 students progressing through the Asynchronous self-study material, and two VTOC classes with 8-12 students in each. The VTOC classes are conducted on weekends (all day Saturday, half-day Sunday) so that a VTOC trainer will devote two weekends each month to VTOC training, and devote weekdays to managing Asynchronous training.

In structured interviews VTOC trainers were asked to describe the training that new instructors should receive to prepare for VTOC. The VTOC trainers stated that they have been doing collective leader training for years as active duty military to develop these competencies in students and subordinates, and that they do not need additional training to perform this role for

the VTOC. They stated that the AC3 DL Asynchronous and VTOC phase trainer needs to be an Army Lieutenant Colonel (LTC) retiree, with experience as a BN XO or S3, have completed Command and General Staff College (CGSC) training, and be Armor branch qualified. It was stated that the candidate trainer must have the personal disposition needed for VTOC interactions with students, and must present the proper image of a leader. Most of the individuals in this selection group have been Army instructors. Potential VTOC trainers must first complete the AC3 DL Asynchronous course before serving as a trainer. The current VTOC trainers are retired LTCs, have experience as BN XOs, have completed CGSC, are Armor branch qualified, have passed the interview for proper image, and are experienced Fort Knox Armor Captain Course instructors.

Currently there is not a VTOC Trainer Handbook, but in the VTOC there is an instructional guide for students that new trainers can use for orientation. The VTOC trainers first attend a 1-week Instructor Training Course, then the standard Army 2-week SGI course. Normally the new VTOC trainer will attend two VTOC training sessions getting guidance from the trainer before teaching a class on their own. One VTOC SGI interviewed had assisted an instructor in three VTOC sessions before serving as the primary trainer, and stated that new trainers really need this, to assist and not just watch or "right seat" the VTOC course. The new VTOC trainers also go through the Asynchronous phase of the AC3 DL course as additional training. No formal practice is conducted for new trainers to observe and evaluate individual student performance in the VTOC environment, or rate student performance against a standard to ensure reliability across trainers.

Train-the-Trainer Products

New trainer preparation is essential, but time consuming, typically requiring that the individual attend a VTOC course to learn the trainers role through first hand observation. While in the course the new trainer has an opportunity to gain experience, witnessing examples of effective and ineffective performance on the part of both the experienced trainer, and the students. However, this experience would typically be limited to those situations that occur within one iteration of the VTOC course. Given this limitation the opportunity exists to enhance new trainer preparation through the introduction of VTOC-specific Train-the-Trainer products.

The review of survey, interview, and previous AC3 DL research issues suggests several candidate Train-the-Trainer products that could be developed through follow-on research. As an example, Train-the-Trainer products might support the skills necessary for a VTOC trainer to play the role of a more senior officer for a limited set of structured staff planning vignettes. Alternatively, Train-the-Trainer products could provide up-to-date subject matter knowledge on lower echelon doctrine for retired senior officers serving as VTOC trainers.

As mentioned previously in Table 8, some of the goals of having the new trainer attend a VTOC class might be achieved efficiently by presenting multimedia examples of both desirable and undesirable trainer and student performance. This is particularly true for VTOC, where the trainer and students normally interact via electronic media, rather than face-to-face. Vignette examples of trainer performance could also provide the new trainer with real world examples of how cognitive principles such as scaffolding can be employed in the VTOC environment.

Vignette examples could provide the less experienced trainer with detailed examples of the BDE commander role, or coaching techniques, that are appropriate for the training goals of specific VTOC vignettes. A combination of written guidelines and digital video clip VTOC screen captures examples of performance might also be used to provide VTOC trainers with a common set of standards for student performance. By having new trainers rate the digital video clip student performance examples training managers could ensure that consistent standards are being applied to students by trainers who might come from different backgrounds, whether active duty, reserve component, or retired.

Future Distributed Digital C2 Operational Capabilities

Future Operational Capabilities

The examination of VTOC training can provide valuable insights to powerful future FCS C2 operational capabilities. Currently the VTOC training system seeks to replicate a conventional TOC environment where staff meet face-to-face for collective planning and decision making. However, in the VTOC all trainer and student (commander and staff) interactions are computer mediated, presenting a task environment that possesses key characteristics of proposed future fully digital distributed C2. Information gained from VTOC trainer and student interviews and surveys were reviewed to gain insights into possible future C2 system operational capabilities, training support requirements, and training design issues.

Future FCS C2 operational capabilities could include the ability for deployed units to "Reach Back" to leadership experience available online, to access staff manpower located in "Sanctuary" off-battlefield sites, and to achieve greater lethality through digitally networked coordination across on-battlefield units. Projecting the future operational and threat environment of 2015, the U.S. Army Training and Doctrine Command (TRADOC) has predicted that the new C2 communication systems and information technology have the potential to provide tactical experience, accelerate planning, and foster innovation (TRADOC, 2000). The TRADOC predicts that leaders and units within an area of conflict will be able to link electronically to allies, external organizations, or individuals outside the area of responsibility to obtain ideas, plans, or guidance for dealing with tactical problems. Advanced communications capabilities will allow "virtual leaders" and operational planners to add professional qualities to forces with limited experience, training, and skill. "The experience, advice and assistance received could make all the difference in future close combat operations" (TRADOC, 2000, p. 16).

Leadership Expertise Reach Back

The development of a future FCS C2 "Reach Back" where commanders and staff are geographically dispersed, but linked digitally, may actually serve to increase the tactical leader experience available to assist in decision making. Rather than being limited to the personnel on hand, future C2 cells linked in a virtual TOC could share information and request guidance from experienced leaders around the world. Face-to-face video discussions could be held with experienced allied personnel who have fought the same opponent, or fought in the same tactical environment. Access to tactical experience could also be achieved via links to reach back to

web-based information sources, such as bulletin boards of tactical lessons learned from sources such as the Center for Army Lessons Learned (CALL).

Potential disadvantages of having an on-line mentor available can also be identified. Observations of VTOC training suggested that the ease of access to the subject matter expert trainer might lead students to rely on this leader excessively for guidance, or to defer to commander/instructor solutions, rather than making a decision on their own. In the VTOC Mission Planning briefings it was observed that student staff members continued to request information and guidance from the trainer role-playing the battalion commander even during their Mission Planning briefing. Here, the lack of face-to-face contact between the staff and commander, and the ability to constantly update digital documents, may have contributed to a tendency for staff members to put off making their own decisions in hopes of gaining more information for last minute integration into plans. This would be a dangerous trend if continued into future digital C2 operations.

Sanctuary Off-Battlefield Manpower Sites

Future FCS C2 operational capabilities could include the ability for deployed units to access additional staff manpower located in "Sanctuary" off-battlefield sites. Using a VTOC-type distributed digital C2 interface virtual staff members located far from the battlefield in Sanctuary sites could provide professional manpower to assist on-battlefield units, accelerating the planning process. Much as the remotely located VTOC instructor reviews student staff planning products, experienced virtual staff members at Sanctuary sites could participate in the preparation of mission planning products. In the past the staff would have to monitor unit activities, sending information requests and consolidating information for purposes of planning. With digital communications links across personnel, vehicles, and commands, unit status reports could be automatically generated, posted to a common data base, updated, and accessed as needed by staff at a Sanctuary location to meet planning information requirements. The VTOC observations suggest that new methods for allocating tasks across digitally-linked staff may be needed, as it was observed that some misunderstandings persisted as to the specific staff roles and responsibilities in collectively developed planning products.

Synchronization of Assets Across Digitally Networked Units

Future FCS C2 operational capabilities could include the ability of deployed units to achieve greater lethality through digitally networked synchronization across on-battlefield units. One potential advantage of being able to bring geographically dispersed leaders into the planning process via digital C2 is that this can support improved allocation of assets across traditional unit boundaries, in contrast to traditional stove-piped unit support. This will be an increasingly important capability as the Army seeks to direct resources to specific units that need them, rather than dispersing limited resources into individual unit stockpiles. The enhanced coordination achieved through digital C2 might allow greater support between units, where (for example) one unit might contribute fires across unit boundaries to support another unit's mission.

Fostering Innovation

The new C2 communication systems and information technology have the potential to foster innovation. Observations of VTOC training sessions revealed that students were using available media in novel ways, and that the students could identify desired changes in design features to facilitate task accomplishment. One VTOC instructor stated that most students had purchased an additional home phone line, or kept a cell phone available, so that they would have an additional voice channel to use to coordinate their efforts. It was observed that students used their personal commercial text and graphics software and email in innovative ways to create and share information, as the commercial tools were considered more user-friendly for some tasks than those developed specifically for VTOC. The flexible commercial text-editing software, graphics, and email tools were familiar to students, demanded few attention resources, and can be leveraged in novel ways to accomplish C2 planning goals. One example of innovation emerging from VTOC training would be the development of standardized digital templates for planning documents which speeds up student preparation of products, as it would for future fielded digital C2 systems.

The VTOC lessons learned provide innovative ideas and prototype products that could support the introduction of future C2 systems. As an example, one VTOC instructor encouraged students to develop a Battle Book of commonly needed products that can be modified to meet new requirements. The instructor stated that the Battle Book would be useful for students throughout AC3 training, and also when assigned to a unit. Research could be conducted to document VTOC student and instructor innovative digital command post Battle Book features that would apply to future distributed C2 systems. The VTOC Battle Book could contain digital files of worked document examples, document templates, and commonly used graphics. By systematically identifying staff information needs for a digital TOC a VTOC Battle Book could be developed with input from training developers, instructors, and students to identify information and tools that could be incorporated into future C2 systems as performance aids to enhance their operational capabilities.

VTOC research could be valuable in identifying desired capabilities of future distributed digital C2 systems interface. Students mentioned that problems occurred when trying to keep track of changes and updates made to collective documents. The students were able to identify changes to VTOC digital file structures that might help to keep track of document changes, and the desire for digital work areas to develop products, which might prove to be innovative lessons learned for future C2 system design efforts. In the face of system problems students learned innovative ways to circumvent temporary communications problems. In this case the unintentional introduction of problems into tasks resulted in students learning to be flexible and find workarounds, a valuable skill that should be incorporated in training for staffs using future digital C2 systems.

Distributed Training

The commander will likely serve as the primary trainer in future C2 cells, and will need automated training support systems to facilitate this training. The operational capabilities of forces commanded by FCS C2 cells will likely not have 2-day planning tasks like current

conventional battalion forces, and will not do VTOC-style two-day planning (or 2-day long training sessions for this). It is more likely that future units will face short planning timelines, and will need to be proficient at dynamic replanning in response to changing events during mission execution. These new short suspense planning requirements will need to be reflected in both initial and sustainment staff training. Particularly for sustainment training there should be a requirement for short training vignettes and part-task training that deployed units can more easily accommodate in the regular duty schedule, rather than a continued focus on weekend-long planning sessions. Training developers could support the transition to future digital C2 leader conducted training in the unit by initiating the development of structured vignettes, automated performance assessment and feedback, and integrated wargaming simulation capabilities to playout mission plans, and courses of action.

Multifunctional Staff

Future C2 systems can support multifunctional leaders capable of performing multiple staff roles. This would allow C2 staffs to be quickly assembled and task organized to meet the demands of a specific mission. In AC3 VTOC and Resident phase training, students rotate staff roles, gaining experience in the full range of staff tasks. The SGIs stated that they identify stronger students and put them in more demanding positions (e.g., S3) first, then rotate the staff roles with other students. This technique of rotating staff assignments during training supports the development of multifunctional leaders, and would need to be continued during sustainment training to meet the demands of future C2 systems. Current VTOC training sessions last one and a half days, with students maintaining the same role throughout the session. Future C2 staff sustainment training will require shorter training sessions. The use of a part-task training approach could be implemented to repeatedly practice the more difficult to train aspects of staff tasks, rather than simply performing all the detailed aspects of staff planning in analogue real-time fashion, and would allow for greater rotation of staff assignments. The development of automated evaluation and feedback tools to support staff training should greatly facilitate sustainment training in garrison or in the field.

Training for Degraded Communications

While future C2 systems will rely heavily on an established network of digital communications links, leaders will need to be prepared to operate in an environment of degraded and changing communications capabilities. This requirement calls for the development of collective training vignettes that require leaders to utilize available communications media, and conventional backup capabilities. The VTOC training hardware and software tools necessary to link the 8-10 students and instructor and perform collective tasks across the Internet are still evolving. From observations of VTOC training it was noted that a number of technical problems occurred during training which temporarily dropped the instructor and students off the VTOC net, degrading or eliminating modes of communication such as voice communications or text chat messages. One unanticipated benefit resulting from this random occurrence of problems was that students learned to adapt to the changing environment very well, becoming adept at recovering from system crashes, continuing to perform collaborative tasks with partial or changing communications links, and optimizing available capabilities in realtime. Students learned to begin staff tasks without all participants online, and learned to "cover" responsibilities

and otherwise take care of those staff members temporarily off-line or operating with limited capabilities. It was observed that students would use email as an alternative to voice communication, commercial graphics software as an alternative to the VTOC map editing program, and personal cell phones to bypass computer modem telephone line constraints.

Digital Media Induced Performance Problems

The move from the conventional face-to-face TOC environment to the computer-mediated distributed VTOC may require changes in the way that C2 is conducted, and a need for new leader support tools. Observations of VTOC training sessions raised the issue of whether a new structure for briefings presented by distributed leaders and staff is needed, and whether the conventional TOC metaphor should be the basis for designing future C2 communications. In VTOC virtual reality where the commander could not see the staff face-to-face it appeared that the formality of conventional staff briefings was lost. As one example, the Executive Officer once told the Battalion Commander to "Wait-One" in response to a question from the Battalion Commander, and left the virtual TOC for several minutes to review digital files in search of his response. Research should be conducted to explore whether the conventional TOC briefing format of verbal discussion and graphics will remain valid for the future digital C2 environment, or whether a new digital TOC briefing format optimized for digital capabilities and constraints needs to be developed.

Summary and Discussion

Training Program Design Features for VLE Training

The present research identified VLE training program design features based on principles of cognitive psychology that can support collective staff training. The program design features documented in this research should be generalizable to a broad range of web-based VLE training applications. A Cognitive Training Techniques Checklist was developed to provide a systematic and comprehensive approach for reviewing VLE training program features based on trainer and student surveys, interviews, and first-hand observations of training. The checklist review of the VTOC training program suggested candidate training program design features that could be incorporated in the training. For the VTOC VLE training system additional features could be developed to support individual and group performance scoring, development of short vignettes for part-task training, incorporation of access-on-demand video demonstrations of individual and collective performance, and development of structured AARs that are archived for later review. Future ARI supported training development should investigate the planned incorporation of Battle Games into VTOC training, first identifying the training goal, and then considering performance assessment and feedback techniques that will be required of instructors to gain the full benefit from this training.

Train-the-Trainer Issues

The rapid move to adopt VTOC-type training will create a parallel demand for qualified VLE trainers possessing collective training, performance assessment, and feedback skills that match the capabilities and constraints of the VLE training environment. The present research

suggests that the role played by the trainer is essential to the success of VLE training, however, in the case of VTOC the required trainer skills are selected for during hiring rather than being developed through a formal training program. Future research should identify methods of instructor training required to develop the skills associated with the cognitive training techniques, such as practice in role playing, coaching, and student performance assessment.

Future Digital C2 Systems Operational Capabilities and Challenges

VTOC training can provide insights to powerful future FCS C2 operational capabilities. Currently the VTOC training system seeks to replicate a conventional TOC environment where staff would meet face-to-face for collective planning and decision making. However, in the VTOC all instructor and student (commander and staff) interactions are computer mediated, presenting a task environment that possesses key characteristics of proposed future fully digital distributed C2. The present research suggests that distributed digital C2 systems can serve to expand the tactical experience base available to decision makers, allowing for accelerated planning, and innovation. Observations from VTOC training suggest that training can be designed to prepare multifunctional officers capable of assuming a variety of staff roles. One unexpected benefit of VTOC training observations has been the identification of training conditions that foster skills in handling degraded communications. Some students reported that the available VTOC file structures did not exactly fit their needs as they would tend to lose track of shared digital text files containing individual and collective product updates, which are key features of future C2 staff work. This may represent a digital text media problem area, and may reflect a broad real-world problem encountered when staffs perform collaborative writing and distributed-decision making tasks.

Future research should investigate a number of potential operational capabilities that distributed digital C2 may afford. Research should investigate whether there are any geographical limits to the distances that might exist between distributed staff members. Currently the VTOC battalion level commander and staff are dispersed across several states while they collaborate on plans, and make decisions. If geographical dispersion does not introduce performance problems, then experienced subject matter experts might be able to assist in staff planning for forward deployed units, increasing the speed and quality of planning and decision making. While VTOC training appears to be effective in establishing some sense of teamwork between students and instructor it may not provide essential interpersonal aspects provided in traditional face to face small group training situations. The one student co-located with the VTOC instructor enthusiastically stated that the co-location arrangement provided him with much greater access to the instructor, and with a greater opportunity to pass on information gained from the instructor to the other students. Future research needs to identify the psychological teamwork issues as well as the communications technology aspects of distributed command and control.

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Appendix A

List of Acronyms

AAR	After Action Review
AC	Active Component
AC3	Armor Captains' Career Course
AC3-DL	Armor Captains' Career Course – Distance Learning
AFRU	Armored Forces Research Unit
ARI	U.S. Army Research Institute for the Behavioral and Social Sciences
AOAC-RC	Armor Officer Advanced Course – Reserve Component
BDE	Brigade
BN	Battalion
C2	Command and Control
C4I	Command, Control, Communications, Computers, and Intelligence
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CALL	Center for Army Lessons Learned
CDR	Commander
CGSC	Command and General Staff College
DL	Distance Learning
DT	Distributed Training
FBC	Future Battlefield Conditions
FBCB2	Force XXI Battle Command Brigade and Below
FCS	Future Combat Systems
FUTURETRAIN	Techniques and Tools for C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) Training of Future Brigade Combat Team Commanders and Staffs
LTC	Lieutenant Colonel
S3	Operations Officer
SGI	Small Group Instructor
TOC	Tactical Operations Center
TRADOC	U.S. Army Training and Doctrine Command
USAARMS	U.S. Army Armor School
VLE	Virtual Learning Environment
VTOC	Virtual Tactical Operations Center
XO	Executive Officer

Appendix B

Issues From VTOC Small Group Instructor Interview

The ARI staff interviewed one VTOC Small Group Instructor (SGI) on August 2, 2001, primarily to investigate VTOC "Train the Trainer" requirements. A structured interview guide was used. Issues identified from this interview follow:

- Individual student performance is not formally evaluated during VTOC training. A group AAR is conducted at the end of each weekend training session with teaching points taken from the SGI's informal/unstructured notes.
- VTOC SGI stated that instructors do not need VTOC-specific training to conduct training in the VTOC environment. The SGI stated that instructors selected as VTOC trainers already know how to train battle staff competencies in VTOC based on their previous experience as trainers and leaders.
- Instructors need some familiarization with VTOC to learn the interface.
- VTOC Program logic:
    1. Identified leadership (not just doctrinal knowledge) competencies to train in the DL course design plan (ex. Decision Making, Communicating, ... Teamwork).
    2. Assign standard BN Command Group task to students.
    3. SGI believes (through observation) that all students become proficient in leadership competencies/skills.
    4. No assessment of leadership skills.
    5. Assess individual doctrinal/subject matter competency when student prepares the whole Operations Order by himself in follow-on Asynchronous lesson.
- No direct crosswalk from VTOC leadership competency goals to 1) competency evaluation and feedback, 2) required trainer skills, 3) required Train the Trainer support. There are no data to indicate that VTOC works for general or specific competencies for group or individuals in the group.
- VTOC training places a heavy demand on instructors to role play commander and battle staff competencies, mentor students, and evaluate and shape individual learning exercises (staff positions) for each student based on an assessment of the students strengths and weaknesses.
- Performance assessment: Formal student competency ratings and feedback. Students are not individually rated on their written VTOC products. Cut sheets are used in the two-week Resident Training phase of the course, typically not in VTOC.
- Instructors have been training all the (VTOC related) leadership skills for years.
- What student performance scores/comments are formally recorded in the course data base?
    1. No student performance record kept for VTOC. Formal evaluation of important VTOC trained competencies occurs in Resident phase formal evaluation, this goes into the record.
    2. VTOC assessment is to group from notes, not formalized. No formal written evaluation in VTOC. In VTOC the S3, S2, and XO are working the hardest. VTOC final product is OPORD. The SGI stated that Asynchronous teaches bits and pieces, that students practice in VTOC, evaluate individual mastery of

knowledge in follow-on Asynch class where final product is an individually prepared OPORD.

- Does VTOC present unique demands on the instructor?
  - Role-Playing (Avatars): The avatar has an important useful purpose; it shows that there is another person working – instructor and other students can see him checking a file or map.
  - Coaching: This occurs through text and audio. The absence of face-to-face is not a problem.
  - Social interaction, collaboration between students: Students feel that they are part of a group, they learn more than they thought they would.
- The SGI monitors, mentors, provides guidance to students. Instructional content comes from Asynchronous portion of the course.
- The VTOC role plays BN CDR, other staff positions, provides performance assessment and feedback. Instructor needs to be Army LTC (Retired). No "Train-the-Trainer" program can prepare a person to serve as VTOC trainer. The VTOC SGIs are selected for necessary skills, not trained. Current LTC (Retired) SGIs have been doing the training tasks required in VTOC throughout their Army career.
- The SGIs all take 1 week Instructor Training Course, then 2-week SGI course. Normally new instructor will right-seat a course, and will complete Asynchronous.
- Resident Course instructor needs to be "Fast Track" top 10% Active Component Captain.
- There is no VTOC instructor handbook.

Appendix C

Issues From Observation of VTOC Training

First Observation of VTOC Training

The ARI staff observed VTOC Class #3 training on August 3, 2001, primarily to investigate VTOC "Train-the-Trainer" requirements. A structured data collection guide was developed and used. Issues identified from observations follow:

- The VTOC doesn't incorporate as much multi-media as it could – video role playing both individual and collective, examples of good and bad performance, briefings, products, and time allocation graphics.
- Code Red virus forced Army to restrict network access, students could not access Asynchronous training, could access VTOC training.
- On-site student claimed value in being able to get insights directly from the trainer, pass on to other students. Implies that face to face has advantages over digital. Students given highly structured five page Mission Analysis Briefing Checklist describing in detail the products they will need to produce (ex. Situation Template Overlay). The trainer clearly states product and time requirements: The learning point here is....Your task is to....Time due .... Who provides product. (Task, conditions, standard). However students misunderstood, used all the time available on the stated task, did not allocate time correctly to this task, and then began work on follow-on tasks. Students "Got Lost In The Woods" the details of follow-on activities, spent too much time on immediate task.
- Class starts tasks while some students are still not logged on, some logged on but degraded communications. Students told to inform others when they come online.
- Student staff roles are rotated across the seven sessions. Unplanned loss and return of students occurs due to common problems, but students quickly adjust using alternative communication lines (email, cell phones, MS Word, MS PowerPoint).
- New tasks introduced during VTOC session to require students to adapt to change quickly. The trainer dropped off the VTOC net frequently, had to reboot computer.
- The trainer claims there should be a one-to-one correspondence between Asynchronous lessons, and the seven VTOC practice exercises. Currently not an exact match.
- The trainer said it would be smart to crosswalk course goals, training methods, assessment, and feedback.
- Student briefing was late, appears that students did not allocate time to review the product (Warning Order) prior to briefing it.
- Lots of dead air, missing students during brief. Students can hide, compared to real life with all battlestaff present in briefing room.
- Instructors carry a lot of student performance assessment information in their head, not systematic performance evaluation records. What if one gets sick?

Second Observation of VTOC Training

The ARI staff observed VTOC Class #3 training on September 1, 2001 to gain additional insights on DL VLE training. Issues identified from observations follow:

- Student asks if anyone is in the main tent. Can't they see each other as avatars? Do the students use avatars?
- Instructor calls students by phone to see if they are going to come online. Is a more structured approach needed?
- The VTOC Instructor and student log-on takes a long time, start logging on at 0830 for 0900 training.
- Students were given additional tasks not expected (one page additional CDR guidance posted on VTOC message board).
- The trainer describes link between past, present, and future work. "Expand on what we did last time today, you will see again in resident phase training." When you find information save it as a Battle Book/Smart Book for resident phase and when you go to a command.
- The trainer has student by staff position matrix for the seven VTOC training sessions.
- The trainer claims that not seeing each other is no problem. "They almost do see each other – working the documents and verbally."
- The trainer stated "Almost all S's have gotten an additional line for email/cell phone so they can use these additional common links to perform VTOC tasks." Maps: MapEdit topographical digital map has battlefield symbology that does not scale down. Vehicle icons that are too large to place on map (ex. tank icon takes up almost a full grid square, icon is 700 meters long, 400 meters wide. Students use generic graphics tool to display simple battlefield geometry for planning. The detailed digital topographical map tool provided with VTOC is too detailed, icons not scalable, takes too long to put graphics on map. Students get a 1:50K paper map to use in lesson projects.
- Students use MS PowerPoint as an alternative for MapEdit in sharing map graphics
- Students get threat information from web sites instead of available VTOC FMs. Miss an opportunity to become familiar with validated doctrinal materials. Students use a variety of available communication resources not provided in VTOC to accomplish tasks: Microsoft Word and PowerPoint, public email, cell phones.
- The trainer stated that it might be good to develop a more formalized (not just verbal) AAR – provide digital text/paper the student could keep as a reference.
- One student stated that students lose files from previous month's training that they need for today's tasks.
- Students can't remember where files are from previous VTOC session, which files were updated. "I don't remember what change we made last time – it was a month ago." In this collective document editing task the students don't know which files are most up to date, what material or changes other students might have added as updates.
- Students start sending email to each other a week before VTOC training to review what they did in the previous session.
- Students can't file some of the information that they would like to file. "I wish I could store information like previously developed Operations Order and refer back to it.

- The trainer role plays the BDE and BN CDR, BN XO and S3. The trainer role combines art and science. Science is the task checklist. Art is the ability to assess whether the student's plan is feasible, no set solutions, requires coaching a broad range of subject matter.
- Current verbal AAR has trainer asking questions and getting student answers, a learning event. High structure prepared ARR might have less student involvement, lose a training opportunity.
- One student stated that "Files get confusing – month later lose track of changes made to pieces, what is most up-to-date."
- One student stated that "In VTOC the S3 position is the most important, others just pitch in." Do we get diffusion of staff responsibility/ lose responsibility for specific staff duties, to the point where they don't get done?
- The trainer stated request for an "update" was misinterpreted by students. Is there a human bias toward presenting detailed digital products, briefings, instead of focusing on information content? Do students need clear example of expected product, could be a video demonstration, digital file example, previous student work.
- Students prefer to use alternative phone and email common lines not provided in VTOC to share files. Student roles evolve, one appeared to have the role of "PowerPoint" guy.
- Digital products not reviewed before presentation, concerns about internal consistency. Each student confirms he has the latest update of text and graphics prior to brief, an important concern with digital C2.

Appendix D

Issues From Initial Delivery of AC3 DL Course Student Interview and Survey

AC3 DL Student Interview Issues:

- People in command positions can't miss a drill.
- Problem: when writing an OPORD you would normally have a battle staff to support you. Provide a Battle Book - Battle Book helped tremendously - Map Edit only allows 6" view of map, and it crashed a lot.
- Progression - should we start w/ TF, CO, BN? Start big and work down, or start at the bottom and work up? Trying to write CO/TM orders - student says they are "swinging in the dark."
- The VTOC is good - everybody worked from home. It would be much better if students worked in teams because it is too easy to "hide" at home.
- So many students dropped that you lost key positions.
- Command and control through a port hole.
- Can't have commanders' company/team doing Synchronous training instead of drill.
- If you could get small groups together for VTOC - real world together - then do it.
- If you have the chance to work face-to-face do it. Like S3 and S2 tasks, will need to get chain of command to support it.
- There is not an understanding of the time requirements associated with the course. The chain of command does not realize the time demands.
- Problem if you don't have weekends off, or rotate days off.
- The VTOC facilitates later resident training.
- The VTOC group training is a problem when one member can't participate.

AC3 DL Student Written Survey Issues:

- Seventy three percent of students rate the quality of AC3 DL VTOC training as Very High, or High.
- Students and the SGI stated that AC3 DL is superior to AOAC RC as it includes peer motivation and peer tutoring as part of the learning process, and better prepares students for resident training.
- Do not do VTOC every month for several months in a row (miss drill and have more conflicts with civilian job).
- Need more one-on-one feedback from SGIs on student progress.
- Enforce standards (e.g., suspense dates for work completion).
- Compress the timeline. Run Phase I in tandem with Phase II (VTOC).
- A lot of straight OPORDs and tactics. However, as an armor CO CDR I spend more time with training issues and plans, soldier issues, recruiting, armory activities, and paperwork than I do with OPORDs. Need to focus on other aspects of command also.
- Need detailed AAR to follow course.
- Work the software conflicts with VTOC, Map Edit etc., so they are not training distracters.
- Big blocks of instruction are a problem. Start late and see a nine-hour block of VTOC and sign off – can't do big blocks.

Appendix E

Issues From Initial Delivery of AC3 DL Course SGI Interview

The SGI was asked to give his overall assessment of the AC3 DL course and offered the following comments related to VTOC training:

- The VTOC training is valuable because it provides repetition in Orders Preparation, and provides additional experience for students in briefing planning products.
- The VTOC trainer must decide the division of labor between students, identifying the stronger students who can take on more demanding positions (ex. S3) first. The trainer makes his preliminary assessment of student skills through a review of their performance in aysnchronous training, and from discussions with each student.
- Student load: Instructor can handle two VTOC classes at the same time, equal to two weekends each month.
- Shortcoming: VTOC does not provide opportunity to practice tactical operations prior to Resident Training.

The SGI was asked to describe how VTOC provides training for nine specific student competencies, and to describe the training needed for SGIs to support this training. The following comments were provided:

- Decision Making: Students more likely to make a decision.
- Planning: More planning experience through VTOC.
- Communicating: More confidence, experience speaking in front of peers, students know SGI better. Individual student VTOC written products not evaluated.
- Technical and tactical proficiency: Students have better knowledge of the job and tactical doctrine (compared to old AOAC RC Correspondence Course).
- Use of available systems: Students get more experience with computer usage (future C2 flexibility, degraded modes of operation).
- Supervising: Synchronous VTOC training first addresses Military Decision Making Process, the SGI plays the role of the XO and/or CDR, and walks students through wargaming the Course Of Action analysis. First the SGI shows the students what to do, then appoints students to play the role of XO or S3 which does involve supervising, controlling, and directing students in subordinate staff roles. The previous AOAC RC course did not train staff processes, course content was all Company Offense (for commanders), then Company Team Defense, Operations Order, written exam.
- Professional ethics: Not specifically addressed in VTOC.
- Teaching/counseling: AC3 DL includes peer motivation, peer tutoring as part of the learning process. Students say they need to learn to lead, and to be a follower.
- Soldier team development: In Asynchronous identify Team Leaders. Students teamed in VTOC portion of training. The bond between students was there when they showed up (for 2-week Resident phase of training).

Appendix F

Cognitive Training Techniques Checklist

SYSTEM *VTOC*	DATE *X OCT 2001*			RATER *SANDERS*
Cognitive Principle	Integrated in Training?			Rater Comments/Suggestions
	Yes	No	NA	
1. Use context-based training to build situated cognition of tasks.				The VTOC tasks are performed collectively by groups of students in virtual battalion TOC with avatars to represent battlestaff (students).
1a. Knowledge to be trained should be presented in a realistic context.		√		The VTOC tasks are performed with digital communication links vs. conventional. Better reflects the future digital C2 interface context.
1b. The training problem should be ill-defined, ill-structured, to stimulate original thinking.		√		Problem is highly defined and structured, using a 5-page Mission Analysis Briefing Checklist.
2. Training should emphasis learner control and the ability to manipulate information in the task environment.				The VTOC students role-play staff positions and use generic map and text tools to exchange information.
2a. Learner should have multiple ways (interface options) to access information.	√			The VTOC interface provides multiple text and graphics tools: bookshelf metaphor, maps, chat line, and email.
2b. Learner should be able to access and manipulate different types of information (e.g., text, voice, graphics).	√			Learner can access and share information using personal computer files, telephone, non-VTOC text and graphics software applications.
3. Training should provide multiple modes and perspectives for representing instructional content.				The VTOC does provide the student with multiple methods for examining material.
3a. Training should provide learner selectable interface media, individualizable to meet learner preferences.	√			The VTOC provides voice traffic, digital text messages, simulated faxes, information from maps, doctrinal documents, and plans.
3b. Team training should provide for cross-training of team member roles.	√			The VTOC students rotate assigned staff roles, cover for off-line staff, learn how to lead and how to follow.

SYSTEM *VTOC*	DATE *X OCT 2001*			RATER *SANDERS*
Cognitive Training Techniques	Integrated in Training?			Rater Comments/Suggestions
	Yes	No	NA	
4. Promote case based reasoning (CBR). Provide related cases or worked examples to enable CBR and cognitive flexibility.				The VTOC training incorporates realistic vignettes that require unique solutions. Vignettes build on Phase 1 self-study tutorial themes.
4a. Provide multiple short vignettes. A broad range of training examples can promote greater flexibility and reinforce the learning points.		√		The VTOC presents one vignette per weekend. Recommend incorporating Part-task training of short vignettes, or selected portions of staff process, to increase the breadth of examples.
4b. Present brief case studies and worked examples of staff process and products.		√		Recommend adding multimedia examples (video, illustrations) of effective and ineffective staff collaboration.
5. Assessment focused on transfer of knowledge and skills to similar but different tasks.				The VTOC training does involve transfer of Phase 1 self-study tutorial course knowledge to practical exercises.
5a. Include novel vignettes to assess transfer of skills to similar but not identical situations.	√			Trainers present learners with unanticipated changes during the planning process. However, VTOC tasks and learner roles are limited by weekend-long single vignette format.
5b. Performance assessment should measure information synthesis and integration skills, and not just recall of facts.	√			The VTOC trainers stress that planning products require information synthesis and integration, and not just digital file cut-and-paste.
6. Coaching develops learner expertise through performance assessment, feedback and goals tailored to the individual students needs (Scaffolding).				The VTOC training does not include formal individual performance standards, or student performance record keeping.
6a. Coaching requires assessment of individual learner skills.		√		The VTOC relies on informal learner performance assessment for coaching, without standardized performance criteria.
6b. Standardization of assessment and performance documentation allows for coaching by multiple instructors.		√		There is currently no check of performance assessment consistency across trainers.

SYSTEM *VTOC*	DATE *X OCT 2001*			RATER *SANDERS*
Cognitive Principle	Integrated in Training?			Rater Comments/Suggestions
	Yes	No	NA	
7. Use conflicting perspectives, and cognitive dissonance, to force students to rethink their assumptions.				The VTOC training presents changing requirements to force students to rethink assumptions.
7a. Put student in an immersive problem-solving context from the beginning of training.	√			The VTOC immerses student in a virtual representation of the task environment and problem context.
7b. Learning environment should promote rethinking of assumptions, and restructuring of decision making knowledge.	√			Trainers introduce changes (e.g., add or delete battalion assets) to force students to rethink and adjust their plans.
8. Learning requires social interaction and collaboration between learners, testing their own understanding against that of others.				The VTOC training includes collective scenario-based tasks which leverage peer assessment and peer tutoring to promote learning.
8a. Facilitate social interaction through face to face, voice, and text chat communications channels.	√			The VTOC provides virtual battlestaff avatars on-screen to enhance voice and text social interaction.
8b. Collaborative tasks provide a venue for students to share ideas and understanding.	√			The VTOC provides planning document preparation tasks that require collaborative team work.
9. Have students model skills demonstrated by an expert tutor or coach (Cognitive Apprenticeship).				The VTOC trainers role play the brigade commander, and serve as subject matter experts.
9a. Key skills should be modeled by the trainer.		√		VTOC trainer play the role of Commander. Trainer does not demonstrate examples of staff officer task performance.
9b. Incorporate an expert tutor to demonstrate skills.		√		Might add multi-media video clips to demonstrate examples of effective, and ineffective staff collective performance.

SYSTEM *VTOC*	DATE *X OCT 2001*			RATER *SANDERS*
Cognitive Principle	Integrated in Training?			Rater Comments/Suggestions
	Yes	No	NA	
10. Training should provide a high degree of external support and coaching that links new skills to previous training and information (Scaffolding) which gradually fades.				The VTOC virtual learning environment provides problem representation, knowledge-modeling, performance-support, and information-gathering tools.
10a. Trainer must assess each learner's strengths and weaknesses to scaffold new skills on previously mastered knowledge.	√			The VTOC trainers make a subjective assessment of the strengths of each learner. Trainers provide guidance and assigns battle staff roles to learners when they feel the learner is sufficiently prepared.
10b. Trainer support of learners should gradually fade as learning progresses.	√			The VTOC trainers are careful to volunteer less guidance to learners as they progress through the VTOC training sessions.