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

Research Report 1893

Training Digital Skills In Distributed Classroom Environments: A Blended Learning Approach

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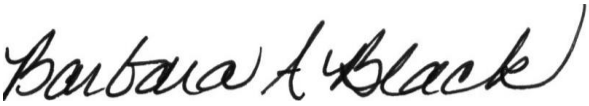

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Specific goals of the present research were to 1) report lessons learned from instructors in a distributed blended learning environment; 2) report student reactions to this type of learning environment; and 3) compare the training approaches with those reported for traditional classroom environments. Both the dL instructors and students acknowledged substantial value in the blended approach (video teletraining with computer software) for training digital skills remotely. The students offered some good suggestions for improving the training in distributed environments such as having hands-on training with tactical equipment and additional training aids (acronym list, commander's guide, train-the-trainer materials, etc.). Overall, the findings indicate that the dL instructors were able to adapt to using the technology to teach FBCB2 operations, resulting in training that is very comparable to the traditional courses. The positive student comments and similar training approaches and topical coverage support these findings. Additionally, major advantages and disadvantages of the dL method of instruction are noted. Several specific recommendations for dL instructors were made in the areas of (a) leveraging student strengths, (b) emphasizing problem-centered instruction, and (c) leveraging training aids. The findings contribute to the Army's efforts to enhance blended learning solutions to meet critical training needs.

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TRAINING DIGITAL SKILLS IN DISTRIBUTED CLASSROOM ENVIRONMENTS: A BLENDED LEARNING APPROACH

EXECUTIVE SUMMARY

Research Requirement:

The present research was conducted as part of the U.S. Army Research Institute's (ARI) internal workprogram that is focused on science of learning objectives. As the U.S. Army Training and Doctrine Command (TRADOC) faces resource challenges in developing and sustaining both effective and efficient institutional training, it has sponsored ARI to investigate different blended learning approaches for training within the Schoolhouse. As there is a need to determine effective methods for using distributed learning (dL) to train different echelons and skills, we investigated the blended learning approaches used to train digital skills in distributed classroom environments and the students' reactions to this type of instruction. Specific goals of the present research were to 1) report lessons learned from instructors in a distributed blended learning environment; 2) report student reactions to this type of learning environment; and 3) compare the training approaches with those reported for traditional classroom environments.

Procedure:

To accomplish the goals of the research, we collected observational and interview/survey data from two instructors of a dL Force XXI Battle Command Brigade and Below (FBCB2) course at the Battle Command Training Center (BCTC), Camp Dodge, IA and from the students of these classes at remote locations. Observers used a structured protocol to collect data on the training environment, instructional activities, and training techniques that were used. A portion of these data were used to compare blended learning instructional approaches with traditional classroom training.

Findings:

Both the dL instructors and students acknowledged substantial value in the blended approach (video teletraining with computer software) for training digital skills. The students offered some good suggestions for improving the training in distributed environments such as having hands-on training with tactical equipment and having additional training aides (acronym list, commander's guide, train-the-trainer materials, etc.). Additionally, major advantages and disadvantages of the dL method of instruction are noted in the report.

Overall, the findings indicate that the dL instructors were able to adapt to using the technology to teach FBCB2 operations, resulting in training that is very comparable to the traditional courses. The positive student comments and similar training approaches and topical coverage support these findings.

The dL instructors applied a variety of techniques to convey course content, maintain the students' motivation, and respond to students' problems and concerns. Several techniques and

training aids were identified as particularly effective for distributed classroom environments, including selecting one of the more capable students to serve as a demonstrator, encouraging peer coaching, taking control of a student's mouse to ensure proper execution of procedural steps, and conducting "mini-exercises" to reinforce key skills or tasks and enable the instructors to perform structured learning checks.

Although the overall patterns of dL activities and techniques were similar to those found in traditional classrooms, specific adaptations occurred to accommodate the dL environment. Overall, the dL instructors spent more time covering selected topics than the instructors in the traditional classes. The absence of face-to-face interaction may have led the instructors to conduct more learning checks to generate feedback on student progress, which may account for some of the additional time. The checks on learning, review of material, and testing are all effective ways to ensure that students understand the material and are learning the skills and should be sustained. Although some differences were noted between the dL and traditional classes, these may have been due to other factors besides the training medium (e.g., background of students in the class, etc.).

The findings suggest that the right mix of training techniques depends on the skill level of the students, which varies from class to class. A good approach is to train instructors to be knowledgeable about the different training techniques and when to use them. With this in mind, several specific recommendations for dL instructors were made in the areas of (a) leveraging student strengths, (b) emphasizing problem-centered instruction, and (c) leveraging training aids.

Utilization and Dissemination of Findings:

While the sampling approach was limited, the results provide insights and lessons for ensuring effective courses for FBCB2 operators. The findings contribute to the Army's efforts to enhance blended learning solutions to meet critical training needs. Many of the recommendations are applicable to both distributed blended learning environments and traditional classroom settings, and we encourage instructors to use these ideas to make small changes to their training that may result in big differences in their students' proficiency levels. Major findings were briefed to the Project Officer and digital instructors of the BCTC at Camp Dodge, IA.

TRAINING DIGITAL SKILLS IN DISTRIBUTED CLASSROOM ENVIRONMENTS: A BLENDED LEARNING APPROACH

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INTRODUCTION AND BACKGROUND

The present research was conducted as part of the U.S. Army Research Institute's (ARI) internal workprogram that is focused on science of learning objectives. As the U.S. Army Training and Doctrine Command (TRADOC) faces resource challenges in developing and sustaining both effective and efficient institutional training, it has sponsored ARI to investigate different blended learning approaches for training within the Schoolhouse. To identify learning science findings and technologies for training Soldiers, ARI conducted a Science of Learning Workshop in 2006 that brought together experts from industry, academia, and other military services (see Quinkert, Morrison, Fletcher, Moses, & Roberts, 2007). From this workshop, the ARI-Fort Benning unit developed a workprogram to conduct blended learning research and leverage lessons learned from science and technology work to the Schoolhouse. The present research addresses several of the objectives of this workprogram:

- Examine effective methods for using distributed learning (dL) in Army institutional training and successful ways to incorporate other emerging training technologies.
- Investigate exemplar blended learning solutions for technical training and leader training.
- Identify and leverage best dL practices from Army schools, other services, and industry.

Current Institutional Training Environment

At the Science of Learning Workshop, General William S. Wallace, Commanding General, TRADOC, discussed a transformation that is occurring between the Institutional and Operating forces (see Quinkert et al., 2007; Wallace, 2006).[1] Traditionally, there has been a linear flow of forces and doctrine from the Institutional to the Operational Army. However, this model does not allow for feedback in the opposite direction such as improving training and doctrine by applying lessons learned. Thus, a dynamic model has evolved such that TRADOC, as the Generating Force, is fully integrated with the Operational Force and is responsible for training leaders and Soldiers to perform in the current environment as well as identifying the training gaps to respond effectively to future threats.

Two major factors have put pressure on TRADOC to produce more trained leaders and Soldiers – the Nation at War and the Army Force Generation Model (ARFORGEN).[2] In addition to responding to increasing output requirements, TRADOC is facing significant budgetary and personnel reductions. To meet the training needs within these resource constraints, TRADOC has changed the way they implement mobile training teams (MTTs) and blended distance learning and traditional classroom instruction. Although TRADOC has supported the use of blended learning approaches in Army institutional training, there is a need to determine effective

[1]The information contained in this paragraph and the following paragraph is summarized from the Quinkert et al. (2006) and Wallace (2006) reports.

[2] "ARFORGEN is the structured progression of increased unit readiness over time that results in recurring periods of availability of trained, ready, and cohesive units prepared for operational deployment in support of civil authorities and combatant commanders" (Department of the Army, 2005, as cited in Wallace, 2006).

methods for using dL to train different echelons and skills. Thus, the purpose of this report is to provide information on the blended learning approaches used to train digital skills in distributed classroom environments and on the students' reactions to this type of instruction.

Blended Learning Approaches

Blended learning instructional approaches are defined as those which combine different training media (technologies, activities, types of events) to create an optimum training program for a specific audience (Bersin, 2004). Typically, the term blended learning is used to describe instruction that combines face-to-face (F2F) instruction with computer-mediated instruction (Bonk & Graham, 2006). The widespread adoption and availability of digital learning technologies have made synchronous, or high-fidelity, interactions in a distributed environment possible (Bonk & Graham, 2006). Thus, human interactions that once only occurred in F2F environments are now facilitated in real time via computer-supported collaboration, virtual communities, instant messaging, live-virtual-constructive exercises, etc.

Instructors, trainers, and learners may choose blended learning approaches for at least three overlapping reasons: improved pedagogy, increased access and flexibility, and increased cost effectiveness (Bersin, 2004; Bonk & Graham, 2006). Specifically, blended learning approaches may increase the level of active learning strategies or experiential learning, leading to greater mastery of skills (proficiency + retention), productivity, and retention. Some research supports this idea that there is increased learning and retention compared to traditional lecture or completely distributed formats (Bersin, 2004; Bonk & Graham, 2006). Additional empirical investigations are needed to determine the generalizability of these positive effects across job tasks and organizational contexts as well as provide results from cost/benefit comparisons of different instructional media. However, if training developers align their program with strategic objectives and posit blended learning as a solution to close long-term skill gaps, then they may be justified in building a more expensive program. There is some evidence to suggest that developers who have taken this approach have achieved positive individual and organizational outcomes such as effective transformation of processes and rollouts of new products, increased productivity and job satisfaction and reduced turnover (Bersin, 2004; Bonk & Graham, 2006). It is important to note that while one goal of blended learning training programs is to reach a wider audience at a lower cost, "the business impact of reducing the cost of training is virtually zero" (Bersin, 2004, p. 20). In other words, rather than only examining the cost effects of blended training programs, these programs should be evaluated according to whether they solved high-impact problems. Bersin (2004) suggests that a 1% increase in productivity has more than 10 times the financial impact as a 1% decrease in training costs.

The typical approach to developing a blended learning course reflects a *program flow model* in which some of the F2F interactions in an instructor-led training program are replaced with self-study or e-learning activities (Bersin, 2004). Thus, different media are integrated into a step-by-step series of events which are usually delivered in cycles of self-study, live events, check-in processes with the instructor, and assessments. Bersin (2004) reported that many different organizations have adopted this approach and suggested that training programs should be designed such that one or two hours of self-study are followed by a live check-in process so that instructors can better track progress. This model fits into the normal flow of classroom

training that most employees expect and reflects most instructional-design paradigms of learn/try/assess as well as the Army Learning Model (ALM; e.g., TRADOC Analysis Center, 2007). For example, the ALM involves three phases: 1) Individual Learning Preparation consisting of dL which could be required before, during, or after F2F instruction, 2) Collective Learning Synergy consisting of guided experiential learning approaches [blended training (F2F, dL, simulations) reflecting a process of instructor-led demonstrations, practice sessions, and feedback], and 3) Learning Reinforcement consisting of reinforcement training at the unit supported by dL and job aids.

In the military, blended learning approaches have been mostly used in *specialized skill training* that "provides personnel with initial job qualification skills and new or higher levels of skill in military specialties to meet specific job requirements" (Wisher, 2006, p. 522). An example of an Army course that uses a blend of instructional techniques is the Maneuver Captains Career Course for Army National Guard or Army Reserve Soldiers (MC3-RC). Although the design of the course has changed somewhat since Wisher's (2006) description, it still consists of asynchronous, synchronous, and face-to-face instruction. The asynchronous instruction provides the Captains with doctrinal knowledge delivered over the Internet while the synchronous instruction allows the Captains to interact with each other from remote locations in a virtual tactical operations center. The Captains use collaboration tools such as chat rooms, a whiteboard, a book shelf, shared-text application, and three-dimensional terrain tools to solve problems collectively and develop mission planning products.

Of importance to the present research is an Army National Guard course that has blended instructional approaches to train operator skills for a digital command and control system, Force XXI Battle Command Brigade and Below (FBCB2), which is a component of the Army Battle Command System (ABCS). The course is designed for distributed instruction such that the Soldiers are in computerized classrooms in their home states, remote from the instructor, who is located at the Battle Command Training Center (BCTC), Camp Dodge, IA.

Factors Affecting Blended Learning Outcomes

Individual characteristics. The experience level of an individual student significantly influences the effectiveness of particular blended learning approaches. For example, instructional approaches appropriate for novices differ from those appropriate for more experienced learners (Clark & Wittrock, 2000). When the learners' background knowledge is extensive, the use of guided-discovery approaches in the beginning of the instruction where learners participate in a problem-solving exercise and then receive feedback and resources to improve the learners' outcomes may be more effective than directive techniques known as *learning by telling*. Experienced learners benefit more in terms of comprehension (understanding) and generation (creation of meaning) when they solve real-world problems by using their prior knowledge and experience to make sense of new information and develop new skills (Clark & Wittrock, 2000). Some evidence supports this idea- initial entry Soldiers (Privates) preferred and performed best in an instructor-centered learning context (lessons followed by exercises or exploration activities) compared to Infantry officers who, with more education, computer skill, and Army experience and knowledge, preferred to select their own learning strategy (Dyer, Singh, & Clark, 2005). Dyer et al. explained that the initial entry

Soldiers lacked the requisite metacognitive skills to take advantage of the self-select method. That is, the Soldiers did not know what types of training worked best for them, thus, they were unable to identify these methods during the training process. On the other hand, the officers were more consistent in their training strategy selections, showing more self-regulatory skills by staying with the training modes that worked best for them.

Media selection & sequencing of instruction. In addition to the effects of individual characteristics, instructional media indirectly influence learning outcomes by affecting the cognitive processes responsible for comprehension, generation, and transfer of training. That is, media support the cognitive processes reflecting the interpretation of the performance goal, the retrieval of task-relevant knowledge, the execution of new procedural knowledge, performance monitoring, and the diagnosis and correction of sources of error in performance (Sugrue & Clark, 2000). Thus, media should be selected to compensate for weaknesses in trainees' abilities to perform such processes by elaborating on task goals, providing task-related information and opportunities for practice, monitoring performance, and diagnosing and correcting errors (Sugrue & Clark, 2000).

There is a debate among academics regarding the points in the curriculum at which different media should be used to provide students with relevant information about the course topics. As such, the sequencing of learning events, including the use of media for "telling" instruction such as presentations and lectures, demonstrations, and experiential activities as well as how much information is given to students, also is a source of contention (cf., Hmelo-Silver, Duncan, & Chinn, 2007; Kirshner, Sweller, & Clark, 2006; Mayer, 2004; Schwartz & Bransford, 1998; Sugrue & Clark, 2000). The choice of such sequencing may depend in part on both the individual characteristics of the students as well as the type of skills developed by the course. For example, as described above, novices may learn best if they are first shown a complete worked example of the content or provided with a lecture while more experienced students may learn best if they can shape their own learning experiences (Dyer et al., 2005). However, the amount and timing of information required by both novices and experts will likely depend on the number of errors they make during task performance and by the trainees' own interests and perceived needs (Sugrue & Clark, 2000).

Further, the sequencing of instruction may depend in part on the types of skills developed by the course. For instance, to develop procedural skills such as assembling and disassembling a weapon, it may be more effective to first provide a demonstration of the correct or incorrect procedures rather than asking students to figure out how to do this on their own. On the other hand, to develop cognitive, decision-making, problem-solving skills, it may be more effective for students to first work independently to try to solve a relevant problem prior to receiving an instructor-led demonstration or presentation (cf., Hmelo-Silver et al., 2007; Schwartz & Bransford, 1998). Depending on how different military systems are used as well as the design and complexity of the system, digital skills likely fall somewhere between purely cognitive, decision-making skills and procedural, motor-centric skills. For example, when commanders use Army systems for planning purposes they may use more cognitive than procedural skills because they are using the system as a tool to wargame different courses of action and to understand second-order effects of their decisions (cf., James, Dyer, & Wampler, 2008). Thus, they will use system functions in different ways to achieve their learning goals. On the other hand, operators

of systems on different platforms, such as FBCB2, may use more procedural than cognitive skills as they repeatedly use the same system functions to perform routine tasks, such as map, message, and administrative functions (cf., Bink, Wampler, Goodwin, & Dyer, 2008). These differences affect the type (e.g., complexity, level of student engagement, feedback), authenticity (i.e., realism), amount (more practice is needed to transfer to novel and variable job contexts), and sequencing of practice sessions embedded in training contexts (cf., Sugrue & Clark, 2000). To understand the instructional approaches employed when training digital skills, some researchers have suggested conceptual links to psychological learning theories as described below.

Digital Skills Training

Digital skills are those that are needed to effectively use computer software involving data entry and the execution of commands through a graphical user interface (Goodwin, 2006). Digital skills are discrete, multi-step procedures as operators navigate through a series of menus and submenus to set parameters and execute commands (Goodwin, 2006). These skills are becoming increasingly important as the Army is migrating toward total force fielding of the ABCS (for a review of the components of this system see Leibrecht, Goodwin, Wampler, & Dyer, 2007).

In a review of training principles for digital training, Goodwin (2006) provided the following three conclusions from prior research. First, completely unguided instruction in which no training materials or exercises are provided to the participants except for a user manual is the least effective means for training digital skills. Second, computerized tutorials are not as good as live or videotaped instructor demonstrations; however, Goodwin noted that this conclusion which was based on research conducted in the 1980s may no longer be valid as technology has greatly advanced this type of instruction. Further, some variation of guided exploration, a technique in which students are given minimal instruction as they work through a series of exercises, is better than other training conditions such as unguided exploration, behavioral modeling, computerized tutorial, and classroom instruction alone. In addition, Dyer and Salter (2001) conducted an experiment to assess Soldiers' performance using a digital map interface and found that Soldiers, who were given a large amount of information before they could apply it, obtained low scores on the assessment exercises. To be more effective, the training needed to present information in smaller amounts prior to the application of the material.

Sanders (2001) and Leibrecht et al. (2007) investigated Army digital training practices and reported the techniques currently used to train digital skills and identified the learning theories best represented by those techniques (i.e., behaviorist, cognitive, and constructivist). Specifically, a sample of the training from four different ABCS courses was observed. For the operator courses, training techniques reflecting the behaviorist and cognitive theories were observed more frequently than the constructivist theory. That is, instructors pointed out screen cues and prompts (behaviorist) and conducted guided demonstration (cognitive) at much greater rates than encouraging active learning (constructivist). Leibrecht et al. pointed out that these findings were expected because the courses sampled were designed for novice audiences. Although this general pattern was consistent, each course included a somewhat unique mix of training techniques, and, in addition to the more traditional training approaches (e.g., lecture, video, and practical exercises), some instructors employed innovative techniques such as using

experienced students as demonstrators, distributing information to students through digital media, and conducting exercises reflecting real world missions. Leibrecht et al. recommended that current ABCS courses can be improved by incorporating a greater use of constructivist techniques such as conducting exercises which require students to apply what they have learned to novel problems without first being shown a step-by-step demonstration. Further, by relating new material to general knowledge (cognitive approach), instructors could further Soldiers' understanding of the new procedures by relating the material to well-known Windows or Microsoft applications.

Present Research

As there is a need to determine effective methods for using dL to train different echelons and skills, we investigated the blended learning approaches used to train digital skills in distributed classroom environments and the students' reactions to this type of instruction. Specific goals of the present research were to 1) report lessons learned from instructors in a distributed blended learning environment; 2) report student reactions to this type of learning environment; and 3) compare the training approaches with those reported by Leibrecht et al. (2007) for traditional classroom environments.

The BCTC at Camp Dodge, IA provides a unique opportunity in which to address the goals of the present research. As the students receive the digital skills training remotely via video-teletraining (VTT) and with sophisticated computer software that emulates the FBCB2 system, the course blends VTT with dL instruction. As such, the instructors must employ a variety of techniques to cover the content, maintain the students' motivation, and sufficiently address students' problems and concerns. To accomplish the goals of the research, we collected observational and interview/survey data from instructors and students of two blended/distributed FBCB2 classes.

Specific to the goal of comparing blended learning instructional approaches with traditional classroom training, we first studied the approaches used to train residential ABCS courses reported by Leibrecht et al. (2007). We then developed observation forms based on those used by Leibrecht et al. to record both instructor and student behaviors. Since we expected that a significant number of the training approaches employed by the instructors would reflect multiple learning theories, we used the Leibrecht et al. forms as a guide. However, we did not structure our results according to the specific learning theories described above.

METHOD

Participants

Instructors. Given that all of the instructors at the BCTC follow the same POI, we felt that interviewing and observing two instructors would be sufficient. We felt that this would enable us to determine if there were any major differences in the execution of the POI within the practical constraints of conducting the research (i.e., time, available funds). Table 1 summarizes the experience and training of the two instructors. Both had substantial experience as FBCB2 instructors, especially for the residential course. However, neither instructor had any operational experience with FBCB2 nor did they have experience teaching other ABCS courses. Perhaps most notably, neither instructor had any specific training in distributed instruction techniques.

Table 1
Four Dimensions of Instructor Experience and Training

Instructor	Operational Experience	FBCB2 Courses Taught		Other ABCS Courses Taught	dL Instructor Training
		Residential	Distributed		
1	None	6	3	None	None
2	None	15	2	None	None

Students. Sixteen Soldiers from two National Guard units (Engineer Battalion, $n = 10$, and Infantry Division, $n = 6$) attended the FBCB2 course at two different locations. The majority of Soldiers had recent deployment experience (Engineer unit: average months = 12 for Operation Iraqi Freedom and 12 for Operation Enduring Freedom; Infantry Division: average months = 14 for Operation Iraqi Freedom only). However, only three Soldiers had experience using ABCS systems either in deployment operations or during field training exercises: one Soldier used FBCB2 plus one other ABCS system in deployment operations for 12 months; a second Soldier used another ABCS system both in deployment operations for 96 hours a week for 9 months and during field training exercises for two weeks; a third Soldier used a subordinate ABCS system in field training exercises for a total of 36 hours.

Other biographical information for the Soldiers is shown in Table 2. Of particular importance to the present research is that the majority of the Soldiers had moderate to much computer experience and felt moderately to very comfortable using computers.

Finally, the majority of the Soldiers from the FBCB2-1 class (Engineer unit) reported that they were attending the course to prepare for deployment while the Soldiers from the FBCB2-2 class (Infantry Division) reported that they were attending the course either as refresher or annual training or to learn the system so that they could train their Soldiers.

Table 2
Student Biographical Information

Biographical Information				
Variable	**FBCB2-1** (n = 10)		**FBCB2-2** (n = 6)	
Rank/Grade	1LT	10%	MAJ	16.7%
	2LT	10%	CPT	33.3%
	1SG	10%	SSG	16.7%
	SFC	20%	SGT	16.7%
	SSG	30%	PV2	16.7%
	SGT	10%		
	SPC	10%		
Average Time in Service	15.0 years		15.9 years	
Current Duty Position*	Platoon Leader	10%	Deputy G6	16.7%
	Executive Officer	10%	Operations Officer	16.7%
	First Sergeant	10%	Provost Marshall	16.7%
	Platoon Sergeant	10%	Communications Sergeant	16.7%
	Operations NCO	10%	Imagery Analyst	16.7%
	Squad Leader	20%	Aviation Operations Specialist	16.7%
	Section Sergeant	10%		
	Communications Specialist	10%		
NCOES	1SG Course	10%	1SG Course	0%
	ANCOC	20%	ANCOC	0%
	BNCOC	60%	BNCOC	33.3%
	PLDC/WLC	60%	PLDC/WLC	33.3%
	Other	10%	Other	0%
OES				
	OAC/CCC	0%	OAC/CCC	50%
	OBC/BOLC III	20%	OBC/BOLC III	33.3%
	OCS/ROTC	10%	OCS/ROTC	50%
	Other	10%	Other	16.7%
Comfortable Using a Computer	Not At All	10%	Not At All	0%
	Slightly	10%	Slightly	0%
	Moderately	30%	Moderately	50%
	Very	50%	Very	50%
Computer Experience	None	0%	None	0%
	Little	30%	Little	0%
	Moderate	30%	Moderate	33.3%
	Much	40%	Much	66.7%

Note. ANCOC = Advanced Noncommissioned Officer Course; BNCOC = Basic Noncommissioned Officer Course; PLDC = Primary Leadership Development Course; WLC = Warrior Leader Course; OAC = Officer Advanced Course; CCC = Captains Career Course; OBC = Officer Basic Course; BOLC = Basic Officer Leader Course; OCS = Officer Candidate School; ROTC = Reserve Officer Training Corps.
***** Does not equal 100% due to missing data.

Materials

Instructor observation packet. We used the instructor observation forms developed by Leibrecht et al. (2007) to conduct the instructor observations (Appendix A).[3] The observation packet consisted of three forms: 1) Part I: basic classroom details (e.g., number of students, general description of the training site); 2) Part IIA: a chronology of instructor activities and training techniques, Part IIB: a sheet to record practical exercise information; and 3) Part III: prerequisite training and course objective questions and end-of-course assessment questions.

As shown in Table 3, eight activities were selected to record on the observation form in Part IIA of the packet based on prior observation of contemporary ABCS training; the form did *not* include the full list of training methods described in TRADOC Regulation 350-70 (U.S. Army Training and Doctrine Command, 1999). Further, as shown in Table 3, this form also included 10 specific instructional techniques to observe based on prior research (Dyer et al., 2005; Sanders, 2001) and on the belief that these behaviors could be recorded in real-time with a high degree of reliability; the observers also could record additional behaviors not included on the list. For the present research project, specific dL techniques were added to the observation form.

Table 3
Classroom Activities and Training Techniques Selected for Observation Purposes

Activity	**Description**
Lecture	Oral presentation of information, typically accompanied by slides
Video	Film-based presentation of real-world scenes and/or animation
Demonstration	Illustration of steps/actions by demonstrator (students observe only)
Guided Demonstration	Performance of steps/actions by demonstrator (students replicate)
Practical Exercise	Scenario-based event requiring application of skills and knowledge
Review	Retrospective summary or recapitulation of key learning points
Test	Formal measurement of learning by means of quizzes, exams, etc.
Break	Temporary suspension of formal learning activities
Technique	**Description**
Emphasize practice	Provide repeated opportunities to perform tasks and correct errors
Check learning progress	Assess learning via questions, feedback, and performance monitoring
Point to screen prompts	Point out elements in slides or ABCS screen displays to guide learning
Use memory aids	Provide memory prompts and mnemonics to facilitate recall
Provide purpose and path	Specify course benchmarks or topics, and maintain path awareness
Relate to military operations	Put system functions in context of military knowledge or operations
Relate to general knowledge	Link system functions to general knowledge of computer capabilities
Relate to previous content	Build on knowledge and/or skills covered earlier in the course
Respond to learners	Provide information to satisfy student questions or requests
Encourage active learning	Promote student involvement by means of instructor's challenges

[3] The observation form was revised twice based on the results of pilot tests conducted at Ft. Hood and Ft. Benning.

Use specific dL techniques	Uses instructional techniques specific to dL environments

Observers recorded the activities and behaviors in five-minute blocks so that the observation form provided a chronology of the training activities. Codes were used by the observers so that the activities and behaviors could be recorded quickly (Table 4). In addition to the codes, the observers provided descriptions of the activities and behaviors. A sample of a completed form appears in Table 5. This example also was used during the training that was provided to the observers prior to the data collection to ensure consistency in the coding process which is further described in the *Procedure* section.

Table 4
Codes Used to Record Instructor Activities and Behaviors

ACTIVITY CODE	**VID** – video	**DEM** – demonstration
G/D – guided demo	**PE** – practical exercise	**REV** – review
BRK – break	**TEST** – quiz, exam, etc	**LEC** – lecture
LEARNING PRINCIPLES	**MA** – uses **M**emory **A**ids	**RM** – **R**elates to **M**ilitary operation
EA – **E**ncourages **A**ctive learning	**PP** – **P**urpose and **P**ath	**RP** – **R**elates to **P**revious content
EP – **E**mphasizes **P**ractice	**RG** – **R**elates to **G**eneral knowledge	**SP**– points out unique **S**creen **P**rompts or cues
LC – **L**earning **C**heck	**RL** – **R**esponds to **L**earners	**dL –** Uses techniques specific to **dL**

Table 5
Sample of Completed Part IIA of the Instructor Observation Form

Num	Activity Code	Time	Description of topics covered and instructor/student behaviors	Training Technique
1	LEC	0815	Reviewed what they would cover for the day and reminded them of upcoming PE	PP
			Told students to power up systems, answered questions from students	RL
2	G/D	0820	Instructor provided steps to build 3D maps. Two students asked clarifying questions.	SP, RL
		0825	Cont G/D to 3D maps. Stopped multiple times to answer student questions.	SP, RL
			Appears to be a problem with workstations. No AI is present so instructor is troubleshooting.	RL
3	DEM	0830	Nobody can build 3D map so instructor just demonstrated. Explained operational uses.	SP, RM
4	G/D		Began a G/D to locate and select a map. Instructor had to help some students properly configure their machines.	SP, RL
		0835	Continued G/D on selecting a map	SP

Note. Reproduced from Leibrecht et al. (2007).

Following Leibrecht et al.'s (2007) procedure, the observers also were required to describe the practical exercises that were coded on the chronology form. As shown in Appendix A, the observers recorded the type of exercise, the exercise context, how the instructor monitored progress, whether peer coaching was observed, the number of repetitions of the same exercise, and additional explanatory comments. The codes for the type of exercises reflected the extent to which the practical exercises challenged the students. For example, a less challenging activity would be one in which the instructor leads the students through the procedures while a more challenging activity would be one in which the students were required to apply knowledge or skills learned at earlier points in the course. The codes for the type of exercise context reflected whether the activities/tasks were conducted within a simulated military operation, whether they were job relevant but not necessarily operational, or whether they were performed independent of a specific context (e.g., send a free text message). Finally, the codes for how the instructor monitored student progress included whether the instructor obtained student feedback and observed student performance.

Instructor interview protocol. Interview questions were developed to determine the specific instructional design and learning principles that the instructors considered when preparing to teach/present the distributed FBCB2 course (Appendix B). The interview protocol also included questions aimed at determining effective techniques for facilitating learning, keeping the students' on the same pace, and answering students' questions in a distributed classroom environment. Finally, several questions tapped the instructors' opinions of the advantages and disadvantages of teaching digital skills in a distributed environment, problems they typically encounter teaching the course, their likes and dislikes in teaching the course in a distributed format, and suggestions for course improvements.

Student observation form. We modeled the student observation forms after the instructor observation packet (Appendix C). Specifically, the observation packet consisted of three forms: 1) Part I: basic classroom details (e.g., number of students, general description of the training site); 2) Part II: a chronology of instructor activities and student behaviors; and 3) Part III: summary questions concerning the nature of the skills covered during that observation period, technical problems experienced during that observation period, and innovative teaching techniques that were noted.

Similar to the instructor observation form, Part II used the same activity codes to more accurately link the student behaviors to specific instructional events and, as shown in Table 6, included codes for the specific student behaviors that occurred during the course. The codes reflected the range of possible behaviors that could occur within the distributed classroom environment and, as with the instructor codes, were based on the belief that these behaviors could be recorded in real-time with a high degree of reliability.

Similar to the instructor observation form, the observers recorded the student behaviors in five-minute blocks to provide a chronology of behavior. In addition to the codes, the observers provided descriptions of the behaviors. A sample of a completed form appears in Table 7. This example also was used during the training that was provided to the observers prior to the data collection to ensure consistency in the coding process which is further described in the *Procedure* section.

Table 6
Codes Used to Record Student Behaviors

Student Behaviors	**OB – O**ther student **B**ehaviors are observed	**SM -** Instructor takes over **S**tudent's **M**ouse
AR - Asks instructor to **R**epeat step	**NP –** Does **N**ot **P**ay attention to the lecture/demonstration	**UO - U**ses **O**ther functions than those for current task
AQ - Asks instructor a **Question**	**PA –** Pays attention to lecture/PowerPoint presentation/demonstration	**WF – W**aits for others to **F**inish task/PE
GS - Works in **G**roups to **S**olve individual tasks	**PC - P**eer **C**oaching (seeks/gives help)	**WA - W**orks **A**head of instruction but on same task
IS - Works **I**ndependently to **S**olve problems	**RQ – R**esponds to instructor **Questions**	
LB - Lags **B**ehind instruction	**SC - S**ide **C**onversations during instruction	

Table 7
Sample of Completed Part II of the Student Observation Form

Num	**Activity Code**	**Time**	**Description of topics covered and instructor/student behaviors**	**Student Behaviors**
2	DEM	0820	Steps to build 3D maps. Two students asked clarifying questions.	AQ
		0825	Con't Demo 3D maps. Student works ahead of instructor and builds his own 3D map.	WA
3	G/D	0830	G/D 3D maps. Several students cannot keep up with the instructor.	LB
		0835	Con't G/D 3D maps. Instructor takes over mouse of one student to show him the steps of building a 3D map.	SM

Student survey. A survey was developed to determine the students' perceptions of the effects of the distributed classroom environment on both their motivation and ability to learn digital skills (Appendix D). The students also were asked to provide the extent to which they sought assistance from their peers, their reactions to the pace of instruction, any problems they encountered, their likes and dislikes about the course, and recommendations for improvements. The survey also included demographic questions to determine the students' experience with digital systems and computers.

Procedure

Two subject matter experts (SMEs) collected the data. To facilitate consistency, one SME observed instructors and the other SME observed students for both courses. Both of the observers were retired Army personnel with extensive experience using ABCS systems, training digital skills, and observing classroom training in Army schools and/or training centers. Further, both had also conducted observations for the residential research project, Leibrecht et al. (2007). For the present research, the observers observed 100% of both the instructor and student class time.

Prior to the first data collection, the observers participated in training sessions to increase the reliability and validity of the data. The observers were provided with instructions that explained the procedures for recording the activities and behaviors (see Appendix E for instructions for both the instructor and student observations). Then, a senior investigator led the observers through the observation process, discussing procedural consistency, and clarifying issues raised by the observers.

A standard procedure was used for observing the instructors and student classes. Well before each course, each observer coordinated by e-mail and/or phone with the respective instructor or the training site point of contact. In each case, this coordination included an explanation of the purpose and role of the observation and gathering course information aimed at improving the observation while minimizing the impact on the instructor and students. On the first class day, observers arrived early at their respective sites to make any final coordination and for face-to-face introductions. In the case of the student observer, this was to the unit chain of command and included an explanation of the purpose and role of the observation and discussion of any concerns they may have had regarding the data collection.

The observers captured the data directly on the observation forms, recording all of the data and notes by hand. As can be seen in Tables 5 and 7, the observers numbered each activity (i.e., lecture, guided demonstration, practical exercise, etc.) sequentially. Using a time-sampling procedure, the observers entered the code for each activity observed during a 5-min block. Then, they described the content that was covered during that time block, along with noteworthy student or instructor behaviors. Finally, they entered the code for the specific training technique or student behavior that was observed in the final column of the chronology form. It is important to note that every activity, training technique, and behavior that occurred within a 5-min block was only counted once; additional occurrences in the same block were ignored. The instructor observer was collocated with the instructor in the "Broadcast Booth" (see description below) and took precautions to avoid interfering with the instruction. The student observer was located inconspicuously in the classroom as to not affect the students' behavior.

The instructor observer conducted individual interviews with the instructors at a time near the end of the course, as previously coordinated with the instructors. In each case, the instructor interview protocol was followed, Appendix B. Where appropriate, the follow-on questions and prompts included in the primary questions were used to elicit more detailed information. The interviews varied in length but were less than an hour in duration and were tape recorded to allow for augmentation of the observer's interview notes.

With prior coordination by the observer with the instructor and the students, the student surveys, Appendix D, were administered to the students after their completion of the course final exam. Since test completion times varied widely, students completed the survey individually with the observer present to resolve any questions. All responses were anonymous; the biographical responses did not include any identifying information.

RESULTS

Instructor Workstation

As a goal of the course is to provide distributed FBCB2 instruction, the instructors were remotely located from the students and interacted with them by means of networked video and audio capabilities. The course uses a software program that emulates the FBCB2 system, and the BCTC has over 900 supportable server connections. The instructors conducted the dL FBCB2 training from "Broadcast Booths" located at Camp Dodge, IA. These "Booths" were small rooms (approximately 8 by 10 feet) that contained the instructors' stations with controls which allowed all instruction to be conducted remotely. The instructors sat in front of a bank of computer screens which displayed each student's desktop (up to 32 screens at one time). There were cameras mounted on top of the suite of monitors which displayed the instructor to the students and there was a microphone so the instructor could speak with the students. Thus, the instructors had the capability of presenting PowerPoint slides to their students as well as communicating to individual students or to the entire class (see below for specific details).

One important feature of the Booths was the instructor's ability to directly monitor and control the FBCB2 system of each student individually. This enabled the instructor to view students' input or omissions as they operated their systems. As necessary, the instructor could take control of a student's mouse and directly manipulate the input to his system as a means of providing individual assistance. Interconnectivity between the instructor and student workstations is described below, see Instructor-Student dL Networking.

Student Classroom Environment

The students occupied three separate classrooms during the two courses. In most respects each student classroom resembled a resident classroom. In fact, all were dual-purpose, designed for residential training (or office space) and later equipped for dL instruction. Each classroom contained rows of student workstations with each student assigned to a workstation (terminal) that connected to a tactical FBCB2 system as described below.

The student classrooms contained capabilities that were unique to the dL method of instruction. To enable the students to interact with the remote instructor, the classrooms contained VTT equipment. The VTT components included:

- Wheeled cart for the VTT equipment.
- Large screen on which the students viewed the instructor, the PowerPoint slides, or the FBCB2 display being used for demonstration (instructor's or student's). The instructor controlled the view.
- Camera via which the instructor observed the class as a whole. The camera afforded no capability to view a single student, although the instructor could view each student's FBCB2 display on a separate bank of monitors.
- Push-to-talk microphones enabled voice communication between the classroom and instructor. Although numbers varied by classroom, there were sufficient microphones for all students.

- At least two speakers (more in the larger classrooms) facilitated at-large broadcasting of voice communications from both the instructor and students.

During one course, the students were divided between two classrooms. A camera in each classroom enabled the instructor to view the students in either room, one classroom at a time. The instructor's monitor displayed the classroom view linked to the most recent push-to-talk activity. If a student in the classroom containing the "inactive" camera activated a push-to-talk button, the camera view switched to that classroom. If the instructor wanted to switch the view from the current classroom to the other, he asked for someone in the other classroom to activate a push-to-talk button. Each classroom could not view the other classroom. Thus, there was no direct interaction between the two classrooms, but all students could listen to the voice communications.

Instructor-Student dL Networking

Interaction between the classroom(s) and the instructor's station was accomplished by using two separate network systems.

- The VTT connection was implemented over an Army National Guard Bureau wide area network dedicated to Guard VTT use and not part of the commercial Internet system.
- The Battle Command Training and Distributed System (BCT&DS) supported FBCB2 connectivity. The BCT&DS allows student-Soldiers to remotely control software that emulates a FBCB2 system housed within a data center at BCTC-Dodge. Soldiers use input devices (keyboard, mouse) and video access via a secure tunnel over the commercial Internet to control the remote systems. The FBCB2 systems operate on a closed local area network within the BCT&DS, with inter-system connectivity.

When the bandwidth of either network system became overtaxed due to shared use, some latency was experienced. Bandwidth limitations typically delayed transmissions between FBCB2 systems (inter-site) and occasionally degraded the video/audio environment. In addition, the failures of the Internet connection or the VTT equipment sometimes caused interruptions in the instruction. When failures occurred, technicians on both ends worked to restore connectivity. During these interruptions the students typically took a break.

Instructor-to-Student Ratio

In both courses, one instructor taught each class from start to finish (Table 8). No assistant instructors (AIs) or proctors participated in either course. In both classes, the senior ranking individual performed minimal administrative duties on an informal basis.

As Table 8 shows, the instructor-to-student ratios for the dL courses were 1:11 and 1:8, with the determining factor being the number of students enrolled. It is not known if there was a limit on the class size, but the student classrooms contained no more than 17 workstations. The instructor-to-student ratios in the distributed courses were similar to those reported by Leibrecht et al. (2007) for traditional courses, as shown in Table 8.

Table 8
Ratio of Instructors to Students in FBCB2 Courses Observed

Course	# Instructors	# Students	Instructor-to-Student Ratio
Distributed Courses			
FBCB2-1	1	11[a]	1:11
FBCB2-2	1	8[b]	1:8
Traditional Courses (from Leibrecht et al., 2007)			
FBCB2-1	2	19	1:9.5
FBCB2-2	2	19	1:9.5

[a] One student dropped out after Day 3 due to illness.
[b] Two students were eventually dropped due to absences.

Course Objectives and Characteristics

The BCTC courses were designed to take National Guard Soldiers with basic computer knowledge and experience to the point where they knew how to perform the basic functions of an FBCB2 workstation. Thus, the lessons were organized around the functional features of the system (preparation for combat, messaging, navigation, orders, overlays, data transfer, and system security). Both courses observed were five days in duration (Monday – Friday). This included class start-up, primary instruction, testing, and course wrap-up. The student observer estimated that both courses focused 100% on operating the user interface ("knobology") during the instructional phase (Days 1-4), and 100% on applying the system capabilities ("employment") during the final exam (Day 5).

The sequence of instruction followed a general-to-specific approach. Instruction began with a system overview of the FBCB2 platform. System description and initialization came next, followed by readying the system for operations. An orientation to the system's main screen was typically followed by a series of learning activities organized around the layout and structure of system features and functions. This led to a drill-down cascade as the instructor followed menu options to deeper levels of functioning, then returned to a higher level to move to the next major function or feature. The instructor used performance challenges and practical exercises to integrate and consolidate knowledge and skills across major functions. Each course ended with a capstone (final) exam, preceded by a review of cumulative topics.

Instructional Activities for dL Classes

This subsection presents the results regarding the instructor's teaching process (basic activities, techniques employed, etc.). The following topics organize the presentation:

- Basic Activities
- Training Techniques
- Training Aids
- Practical Exercises
- Testing

Basic activities. As explained in the Method section, the set of eight instructional activities included conventional methods ranging from lecturing by the instructor to demonstration (with and without student participation) to testing by means of quizzes and examinations. These activities formed the categories used to classify instructor behaviors, and this subsection describes their frequency of occurrence.

The methodology called for the observer to record every activity that occurred at least once in a 5-min block, using the pre-defined codes. In the vast majority of cases the observer recorded a single activity code per time block. Occasionally he recorded two or even three codes in a 5-min block.

Table 9 summarizes key parameters for both courses. The second column of the table gives the total number of 5-min blocks observed during each day, excluding breaks. Within each main cell appear the number of blocks in which an activity was recorded and the same value (in parentheses) expressed as a proportion of the total blocks observed for the day. Because a single block could contribute multiple counts (one for each type of activity observed), the proportions in Table 9 (counts per block) typically sum greater than 1.0 across a row.

The relative frequencies of the various activities were highly consistent across both courses. By a substantial margin, the most frequent activity was guided demonstration. This activity took place in 44% or more of the blocks during 7 of the 10 days observed. Test activities were the next most frequent, occurring in nearly one-fourth of the blocks overall (but heavily concentrated in the last day of the course). Lecture was frequent during the first day of each course (occurring in 35-44% of the blocks), but it dropped off sharply in subsequent days. Practical exercises accounted for 20-40% of the blocks during 5 of the 10 days observed. In three of the days, practical exercises did not occur. Review of previous materials took place in 14% of the blocks overall, and was rare (10% or less) or absent in 5 of the 10 days observed.

Two activities were notable because of their overall absence during the observed classes. A demonstration without students participating was observed in only two days (nine blocks of time) of one course. A video presentation occurred in only one course, appearing merely once and involving only three blocks. The video illustrated FBCB2 capabilities employed in combat.

The last row of Table 9 sums the data across both courses to shed light on overall trends. In descending order from most frequent to least, the summed data show the following hierarchy of instructional activities: guided demonstration, testing, practical exercise, review, and lecture, with instructor-only demonstrations and videos nearly absent.

Table 9
Frequency of Instructional Activities

Day	Total Blocks	Lecture	Video	Demo	Guided Demo	Practical Exercise	Review	Test
FBCB2 Distributed Course #1								
1	68	24 (.35)	0	0	30 (.44)	13 (.19)	5 (.07)	0
2	67	1 (.01)	3 (.04)	0	42 (.63)	0	7 (.10)	17 (.25)
3	74	0	0	3 (.04)	44 (.59)	25 (.34)	16 (.22)	0
4	64	2 (.03)	0	6 (.09)	32 (.50)	25 (.39)	5 (.08)	0
5	67	0	0	0	0	0	10 (.15)	57 (.85)
1-5	340	27 (.08)	3 (.01)	9 (.03)	148 (.44)	63 (.18)	43 (.12)	74 (.22)
FBCB2 Distributed Course #2								
1	36	16 (.44)	0	0	17 (.47)	5 (.14)	0	0
2	71	2 (.03)	0	0	42 (.59)	10 (.14)	26 (.37)	0
3	80	0	0	0	24 (.30)	27 (.34)	11 (.14)	18 (.24)
4	60	3 (.05)	0	0	29 (.48)	11 (.18)	9 (.15)	14 (.23)
5	36	0	0	0	0	0	0	36 (1.0)
1-5	283	21 (.07)	0	0	112 (.40)	53 (.19)	46 (.16)	68 (.24)
All Courses/Days (Summed)								
All	623	48 (.08)	3 (.005)	9 (.01)	260 (.42)	116 (.19)	89 (.14)	142 (.23)

Training techniques and training aids. As described in the *Method* section, eleven training techniques provided the framework for characterizing the nature of the classroom teaching methods. The techniques were intended to reveal how the instructor applied various learning principles. Guided by the observation form, the observer recorded codes for the techniques that occurred in each 5-min block (one code for each technique observed one or more times). The tally process excluded breaks. This subsection presents both quantitative and qualitative data for the training techniques.

The training technique tallies for both courses (day by day) appear in Table 11. Each of the table's data cells gives a frequency count and rate (count per block). The rate of occurrence was computed by dividing the frequency count by the number of valid 5-min blocks for the day. The valid blocks excluded breaks and cases of missing data. Because single blocks often contributed multiple counts (one for each different technique observed), the proportions in Table 10 (counts per block) sum greater than 1.0 across a row.

In both courses overall, the most common training techniques were using dL-specific techniques and checking the progress of student learning, occurring in about half the total blocks. They were followed closely by relating materials to general knowledge, observed in almost half the blocks. Day by day these three techniques accounted for 30-92% of the total blocks, excluding the final exam (Day 5). Predictably, learning checks (testing) accounted for 85-100% of the total blocks on the day of the final exam. Relating the instruction to military operations and previous content occurred with low frequency (in 12% and 8% of the blocks, respectively), as did responding to learners (in 8% of the blocks). Pointing to prompts or cues on a publicly viewed display and encouraging active learning were observed very infrequently, accounting for only 2% of the blocks.

In each course, three training techniques appeared rarely (once per 100 blocks or less, on the average), emphasizing practice and giving purpose and path, or never, using memory aids. When the instructors stated the purpose and path for a particular FBCB2 function, they generally provided the purpose (why and when to use the function in combat) before covering the path (i.e., actual operating procedures). For example, the instructor might explain that pre-setting the Quick Send button for a frequent report, such as a Spot Report, will save critical time in the heat of battle. He would then lead the students through the steps for assigning a report to the Quick Send button.

The training technique labeled "Use dL techniques" was actually an umbrella category for instructor actions specific to the dL environment. The following examples illustrate the instructor actions that fell in this category:

- Monitor students' FBCB2 inputs via a bank of displays.
- Query a specific student via microphone to determine if he needed help.
- Verbally coach a student via at-large speaker.
- Take control of a student's mouse to demonstrate or rectify process steps.
- Send administrative announcements via FBCB2.
- Switch the instructor's classroom view (by asking a student to key his microphone).
- Monitor the health of the Internet connectivity.
- Adjust to a degraded video or audio stream.

Table 10
Frequency of Observed Training Techniques

	Training Techniques										
Day	**Point to Screen Prompts**	**Emphasize Practice**	**Use Memory Aids**	**Check Learning Progress**	**Give Purpose & Path**	**Relate to Military Ops**	**Relate to General Knowledge**	**Relate to Previous Content**	**Respond to Learners**	**Encourage Active Learning**	**Use dL Techniques**
FBCB2 Distributed Course #1											
1	5 (.07)	0	0	21 (.31)	1 (.01)	12 (.18)	44 (.66)	5 (.07)	2 (.03)	1 (.01)	30 (.45)
2	0	0	0	26 (.40)	1 (.02)	12 (.18)	37 (.57)	3 (.05)	2 (.03)	0	44 (.68)
3	0	1 (.01)	0	25 (.37)	0	20 (.30)	33 (.49)	5 (.07)	20 (.30)	9 (.13)	53 (.79)
4	5 (.08)	0	0	29 (.45)	0	12 (.19)	32 (.50)	6 (.09)	0	5 (.08)	40 (.62)
5	0	0	0	56 (.85)	0	0	0	10 (.15)	0	0	0
1-5	10 (.03)	1 (.003)	0	157 (.48)	2 (.006)	56 (.17)	146 (.44)	29 (.09)	24 (.07)	15 (.05)	167 (.51)
FBCB2 Distributed Course #2											
1	0	0	0	11 (.30)	3 (.08)	2 (.05)	34 (.92)	0	1 (.03)	0	34 (.92)
2	0	1 (.01)	0	35 (.49)	0	15 (.21)	41 (.58)	0	5 (.07)	0	42 (.59)
3	0	3 (.04)	0	35 (.44)	0	3 (.04)	24 (.30)	18 (.22)	4 (.05)	0	26 (.32)
4	0	0	0	25 (.42)	0	0	29 (.48)	0	17 (.28)	0	30 (.50)
5	0	0	0	36 (1.0)	0	0	0	0	1 (.03)	0	1 (.03)
1-5	0	4 (.01)	0	142 (.50)	3 (.01)	20 (.07)	128 (.45)	18 (.06)	28 (.10)	0	133 (.47)
All Courses/Days (Summed)											
All	10 (.02)	5 (.008)	0	299 (.49)	5 (.008)	76 (.12)	274 (.45)	47 (.08)	52 (.08)	15 (.02)	300 (.49)

Training aids. The instructors used a variety of training aids as they executed the instructional activities. These training aids included traditional materials as well as hardware and software unique to the dL environment.

Based on traditional classroom methods, a package of instructional slides was a key part of the program of instruction (POI). Conveying both text and imagery, the slides were projected on a large screen for the entire class to view simultaneously. Various static images of the user interface (screen captures) were displayed frequently in the slides. Video materials (e.g., scenes from tactical operations) were displayed on only one occasion.

Spiral bound Student Handouts were shipped by the schoolhouse to the classroom site and issued to the students at the start of the course by a member of the local staff administering the dL classroom. Serving as a guide and repository of essential information, the handout contained:

- Training schedule,
- PowerPoint slides printed two per page (297 used during the course),
- Tactical materials (task organization and maps for scenarios),
- Practical exercises (all nine used during the course),
- Final examination (hardcopy form),
- FBCB2 references (techniques and procedures handbook, operator's pocket guide), and
- FBCB2 sustainment training package on compact disc.

The handout was used by the instructor and students throughout the course as a reference and source of course materials. However, it was difficult to use because (a) some out-of-date procedures did not match the current FBCB2 software and (b) lack of continuous page numbers made it hard to locate materials referenced by the instructor.

The instructors could display an active FBCB2 user interface on a large screen display. The system thus displayed belonged to either the instructor or a "student driver." The instructors used the "live screen" view in performing guided demonstrations of the user interface features, operating procedures, or desired system end-states and outcomes.

Because the instructor's actions on his FBCB2 experienced transmission delays before arriving in the classroom ("lag time"), a "student driver" was often used for demonstrations. The student driver was an instructor-selected student with competent computer skills and good knowledge of FBCB2 (or a quick learner in the absence of prior experience). The student driver's screen was displayed on the large screen for the other students to see.

The bank of monitors displaying the FBCB2 screens of individual students in the Booth provided essential information for monitoring the progress of learning. This capability was especially valuable for identifying when a student was struggling with a task or skill.

Finally, through a specialized software tool, the instructors were able to take control of a student's mouse. This was typically employed when a student was having considerable difficulty which might slow the entire class or affect the individual student's learning process.

Summary of innovative training techniques and training aids. The observer noted that the following examples of the techniques and aids described above were particularly effective for distributed classroom environments.

- In both courses the instructors selected one of the more capable students to serve as a demonstrator ("student driver"), partly to avoid long-haul transmission lag.
- Peer coaching occurred extensively, with encouragement from the instructors to help offset their physical separation and lack of an AI.
- A routine dL mechanism involved the instructor taking control of a student's mouse to ensure proper execution of procedural steps.
- "Mini-exercises" (performance challenges) were employed to reinforce key skills or tasks and enable the instructors to perform structured learning checks.
- At the end of one practical exercise, the instructor asked a student to walk him through a specific set of steps.
- The student handout included a sustainment training package on compact disc that Soldiers could use to practice on their own.

Practical Exercises

Summary data for the practical exercises observed in both courses appear in Table 11. Integration of prior tasks was the predominant type of exercise (13 of 14 cases). Guided exercise accounted for the remaining case. Repeating a demonstration and utilizing a new situation did not occur. This pattern is different from that seen previously in traditional courses, where 60% of the definitive cases involved integration of prior tasks and repeating a demonstration was the only type not observed (Leibrecht et al., 2007).

Table 11
Practical Exercises Observed in Distributed and Traditional Courses

	Course	Total # PEs	Number of PEs per Type				
			Guided Exercise	Repeat Demo	New Situation	Integration of Prior Tasks	Not Recorded[a]
Distributed Courses	FBCB2-1	9	1	0	0	8	--
	FBCB2-2	5	0	0	0	5	--
	Total	14	1	0	0	13	--
Traditional Courses[b]	FBCB2-1	4	1	0	1	2	--
	FBCB2-2	3	0	0	0	1	2
	Total	7	1	0	1	3	2

[a] Type was not recorded by the observer.
[b] Data for traditional courses are taken from Leibrecht et al. (2007).

Practical exercises in the distributed courses were set in a job-relevant context (57% of the cases) or military operations setting (43% of the cases). An arbitrary context (e.g., send a free text message) was not used during practical exercises. In contrast, all of the definitive cases in the traditional courses involved a job-relevant context (Leibrecht et al., 2007).

In the distributed courses, the instructor nearly always monitored student progress and problems by directly observing them at work (93% of the cases). Querying students to obtain feedback occurred in only one exercise (7% of the cases). Peer coaching was very common, occurring in 86% of the cases. This pattern is quite similar to what was seen in the previous research project, where monitoring of students always entailed observing them and peer coaching took place in 60% of the definitive cases (Leibrecht et al., 2007).

Aided by their VTT capabilities, the instructors sometimes assisted students having difficulties during practical exercises. Instructor assistance occurred in at least 4 of the 14 exercises. More common was the peer coaching mentioned in the preceding paragraph.

A practical exercise consumed from 2 to 21 5-min blocks. An exercise usually involved 4 or more 5-min blocks—about 20 min or more (86% of the cases). In 57% of the cases, the duration exceeded 6 blocks (about 30 min), surpassing 100 min in one case. In the traditional courses (Leibrecht et al., 2007), the range of exercise durations was similar but the number of blocks exceeded 6 in only one case (14% of the exercises).

In both dL courses, the faster students frequently finished the practical exercises early and were allowed to take a break. The early finishers sometimes opted to assist fellow students. Both of these conditions also occurred in the traditional courses (Leibrecht et al., 2007).

Testing

Quizzes or tests took place occasionally in both courses. On Day 2 of FBCB2-1, six tests involved 1-4 time blocks. In FBCB2-2, one test occurred on Day 3 (lasting for 18 blocks) and three tests (3-6 blocks in duration) happened on Day 4. The tests were labeled scenario exercises or reinforcement exercises, with scenario-based test materials displayed in PowerPoint slides on the screen and/or (in FBCB2-2) placed in the Student Handout. Coaching by the instructor and peers was noted on occasion during tests. In no case was post-test review or feedback recorded by the observer. However, the instructors worked with the students, as necessary, until everyone successfully completed a given test.

Both distributed courses included a final exam as a capstone event (Table 12). Organized as a practical exercise, the final exam strongly emphasized hands-on tasks and included minimal fill-in items. In both courses the final exam allowed students to work with all materials in the Student Handout and their class notes. Completion time was targeted for three hours, but actual completion took four to five hours. Grading of the exams relied on Go/No Go scoring.

Table 12
Summary of Final Exams Used in Distributed and Traditional Courses

Courses	**Written Component**	**Hands-on Component**	**Estimated Time**
Distributed	2 fill-in (recall) questions scored Go/No Go	30 discrete tasks organized in three phases (outcomes scored Go/No Go)	3 hrs
Traditional[a]	6 fill-in (recall) questions scored Go/No Go	34 discrete tasks with outcomes scored Go/No Go	3 hrs

[a] Data for traditional courses are taken from Leibrecht et al. (2007).

The instructor's view. The instructors used a Guided Experiential Learning-like method to deliver step-wise instruction - demonstration, practice, evaluation. During interviews both instructors stated that, based on their experience with dL instruction, a blend of techniques is essential. The techniques they believe are most effective in the distributed environment, and a description of their practice in the course, are summarized in Table 13.

Table 13
Effective dL Instruction Techniques (Instructor View)

Technique	Description
Leveraging Experience	Instructor relates topics to students' previous experiences if they've used the system before.
Guided Demonstration	Instructor performs the steps of a skill while students observe and mimic, each using his assigned FBCB2 workstation.
Hands-on Practice	Guided demonstration is followed promptly by individual practice until students are familiar with the skill's steps. Students who are having difficulty learning the steps receive extra scenarios.
Consistent Scenarios	Linked scenarios are used throughout the course to help students understand operating procedures and their application to tactical operations.
Student Monitoring	Instructor observes progress of each student by monitoring actions via continuous view of each student's workstation. Directs questions to students who are not paying attention.
Learning Checks	"Mini-PEs" are used to assess student understanding of a limited aspect of the current topic.
Student Driver	A knowledgeable student serves as a surrogate demonstrator to overcome transmission lag of the instructor's FBCB2.

The instructors explained that their fundamental approach was to "walk them through the steps" (guided demonstration) and then have students practice the procedure on their assigned workstations, usually reinforced with a PE. The ability to use the individual FBCB2 monitors to observe specific actions on each student's interface allowed the instructors to closely monitor each student's progress during the hands-on practice and PEs. This enabled one-on-one coaching as well as adjustment of the pace of instruction based on the students' performance.

Comparison to Traditional Instruction

Due to slight differences in the POIs for the traditional and dL courses as well as differences in the observation procedures used in the predecessor research project, we compared the instructional activities and training techniques for specific topics.[4] Specifically, we examined the activities and techniques for messages and creating and sending orders and overlays. These topics were chosen because a significant amount of instructional time was spent on them. Tables 14 and 15 break out the data for instructional activities and training techniques, respectively. The topics are presented both separately and combined. It is important to note that only one traditional class was observed for each topic – so these percentages are based on lower numbers compared to the dL courses.

As shown in Table 14, the dL instructors were consistent in the types of instructional activities they used for both topics, using mainly guided demonstration and then practical exercises, review and testing. However, for the traditional classes, one instructor team (the traditional classes had AIs whereas the dL classes did not) predominately used guided demonstration for messages while the other instructor team used a mix of techniques similar to the dL classes.

When combined across topics, Table 14 shows strong similarities between the dL and traditional classes. Overall, the dL instructors spent much more time (judging from the total number of blocks) covering both of the selected topics than the traditional instructors. The greater time spent reviewing and testing students accounts for some of the additional time in the dL courses.

[4] The traditional classes followed a 6-day POI which included 1 day of training in a special classroom containing the actual tactical equipment.

Leibrecht et al. sampled the traditional instruction; only three out of the six days were observed for each of the operator classes.

Table 14
Comparison of Instructional Activities by Course and Topic

Course	Total[a] Blocks	Lecture	Video	Demo	Guided Demo	Practical Exercise	Review	Test[b]
Messages								
dL 1	84	0	0	3 (.04)	41 (.49)	14 (.17)	9 (.11)	17 (.20)
dL 2[c]	84	1 (.01)	0	0	35 (.42)	20 (.24)	28 (.33)	0
dL 1+2	168	1 (.01)	0	3 (.02)	76 (.45)	34 (.20)	37 (.22)	17 (.10)
Traditional 1[d]	43	2 (.05)	0	0	39 (.91)	0	2 (.05)	0
Overlays/Orders								
dL 1	92	0	0	6 (.07)	48 (.52)	25 (.27)	13 (.14)	0
dL 2	74	0	0	0	30 (.41)	11 (.15)	1 (.01)	32 (.43)
dL 1+2	166	0	0	6 (.04)	78 (.47)	36 (.22)	14 (.08)	32 (.19)
Traditional 2[d]	61	5 (.08)	0	0	23 (.38)	25 (.41)	8 (.13)	0
Messages and Overlays/Orders								
dL 1	176	0	0	9 (.05)	89 (.51)	39 (.22)	22 (.13)	17 (.10)
dL 2	158	1 (.01)	0	0	65 (.41)	31 (.20)	29 (.18)	32 (.20)
dL 1+2	334	1 (.003)	0	9 (.03)	154 (.46)	70 (.21)	51 (.15)	49 (.15)
Traditional 1+2[d]	104	7 (.07)	0	0	62 (.60)	25 (.24)	10 (.10)	0

[a]Total blocks = the number of blocks that were dedicated to the selected topics. Does not include delays due to technical issues. Does not include breaks.
[b]Test = evaluation conducted as part of the instruction for that topic – not the end-of-course evaluation.
[c]FBCB2-2 had technical issues during the first day of training which may have affected the results.
[d]These results are based on the observations from one FBCB2 Operator course; the results for messages and overlays/orders came from two different classes.

As shown in Table 15, the frequency patterns of training techniques demonstrate similarities in the orders/overlays instruction between the two types of courses – although the dL instructors also employed other types of techniques specific to the distributed environment (e.g., taking over a student's mouse). However, the time spent providing operational examples in the dL classes varied by instructor. Additionally, the dL instructors provided general computer examples (general knowledge) and related new information to previous course content much more often than the traditional instructors.

Conducting checks on student learning occurred approximately five times as often in the dL courses compared to the traditional courses during the messages instruction. This suggests that the absence of face-to-face feedback led the dL instructors to rely more on learning checks to generate feedback on student progress for this topic. However, for the orders and overlays topic, the frequencies for this technique were similar across the courses. It is not clear why the learning check difference between dL and traditional courses was topic-specific.

After checking the raw data, the large differences between the dL and traditional classes for giving purpose and path are most likely due to coding issues and not instructional differences.

Finally, some techniques were rarely used in both types of classes: encouraging active learning, pointing to screen prompts, emphasizing practice, and using memory aids. Although both dL instructors invited the students to arrive early or remain after the scheduled end of class so they could practice and ask questions, only one student stayed to work with the instructor for about 45 minutes. No other cases of extra student practice were recorded. The students did not create their own practice sessions by arriving early or working during breaks, as happened in the research reported by Leibrecht et al. (2007).

Table 15
Comparison of Training Techniques by Course and Topic

	Training Techniques										
Course	**Point to Screen Prompts**	**Emphasize Practice**	**Use Memory Aids**	**Check Learning Progress**	**Give Purpose & Path**	**Relate to Military Ops**	**Relate to General Knowledge**	**Relate to Previous Content**	**Respond to Learners**	**Encourage Active Learning**	**Use dL Techniques**
Messages											
dL 1	2 (.02)	1 (.01)	0	38 (.45)	0	11 (.13)	39 (.46)	5 (.06)	3 (.04)	0	49 (.58)
dL 2	0	3 (.04)	0	46 (.55)	0	18 (.21)	35 (.42)	1 (.01)	5 (.06)	0	36 (.43)
dL 1+2	2 (.01)	4 (.02)	0	84 (.50)	0	29 (.17)	74 (.44)	6 (.04)	8 (.05)	0	85 (.51)
Trad 1	0	0	0	4 (.09)	38 (.88)	12 (.28)	0	0	0	0	NA
Orders and Overlays											
dL 1	0	0	0	27 (.29)	0	21 (.23)	44 (.48)	5 (.05)	19 (.21)	9 (.10)	55 (.60)
dL 2	0	0	0	25 (.34)	0	0	30 (.41)	18 (.24)	13 (.18)	0	31 (.42)
dL 1+2	0	0	0	52 (.31)	0	21 (.13)	74 (.45)	23 (.14)	32 (.19)	9 (.05)	86 (.52)
Trad 2	0	0	1 (.02)	18 (.30)	19 (.31)	11 (.18)	1 (.02)	5 (.08)	9 (.15)	0	NA
Messages, Orders and Overlays											
dL 1	0	1 (.01)	0	65 (.37)	0	32 (.18)	83 (.47)	10 (.06)	22 (.13)	9 (.05)	104 (.59)
dL 2	0	3 (.02)	0	71 (.45)	0	18 (.11)	65 (.41)	19 (.12)	18 (.11)	0	67 (.42)
dL 1+2	0	4 (.01)	0	136 (.41)	0	50 (.15)	148 (.44)	29 (.09)	40 (.12)	9 (.03)	171 (.51)
Trad 1+2	0	0	1 (.01)	22 (.21)	57 (.55)	23 (.22)	1 (.01)	5 (.05)	9 (.09)	0	NA

Student Behaviors

The set of fifteen student behaviors ranged from simple actions—such as asking a question and waiting for others— to working in groups and coaching others (see the *Method* section for a complete description). These behaviors formed the categories used to classify student actions in the classroom. This section describes the student behaviors. It also presents the student opinion data obtained by administering the feedback questionnaire.

The methodology called for an observer to record every behavior that occurred at least once in a 5-min block, using pre-defined codes. In the majority of cases the observer recorded two or even three codes in a 5-min block.

Table 16 summarizes the frequency data for the various student behaviors. The most frequent behaviors overall were working alone (52% of the blocks) and paying attention to the instructor (50% of the blocks). Next most frequent was coaching peers (40% of the blocks), followed by asking questions (21% of the blocks). For the rest of the behaviors the frequencies fell substantially, to once in 17 blocks or less.

With three exceptions, the relative frequencies of student behaviors were very similar for the two courses (separated by 10 percentage points or less). In FBCB2-1, paying attention to the instructor occurred more frequently (in 57% of the blocks) than in FBCB2-2 (42% of the blocks). Conversely, two behaviors occurred more frequently in FBCB2-2—asking questions (33% vs. 10% of the blocks, respectively) and working alone (61% vs. 45% of the blocks). The reasons for these differences are unclear, but various student factors (and perhaps student-instructor interactions) probably played a role. Variations in student behaviors are to be expected.

Close inspection of Table 16 reveals a few trends across days (excluding the exam-focused Day 5). Paying attention to the instructor declined modestly across days in both courses. On the other hand, working alone increased noticeably across days in both courses, as did coaching peers. These trends may be the result of student confidence increasing as the course progressed. Further, asking questions increased across days in FBCB2-2 but not FBCB2-1. For both classes, responding to questions occurred much less frequently than asking questions.

The summed data in the last row of Table 16 provide a basis for charting general trends in the student behaviors. In descending order from most frequent to least, the following rank order of student behaviors emerged: working alone, paying attention to the instructor, coaching peers, asking questions, waiting for other students, engaging in side conversations, working in groups, and responding to questions. The latter four behaviors were observed infrequently (in 4-6% of the blocks). The rest of the behaviors occurred rarely (in 1% of the blocks or less).

Table 16
Frequency of Observed Student Behaviors

Day	Pay Attn to Instructor	Ignore Instructor	Ask Question	Respond to Question	Ask to Repeat Step	Release Mouse Control	Lag Behind Instructor	Work Ahead of Instructor	Work Alone	Work in Groups	Converse Aside	Coach Peers	Use Other Functions	Wait for Others	Other Behaviors
FBCB2 Distributed Course #1															
1	49 (.71)	0	6 (.09)	11 (.16)	0	1 (.01)	1 (.01)	0	16 (.23)	3 (.04)	1 (.01)	13 (.19)	1 (.01)	4 (.06)	1 (.01)
2	49 (.74)	1 (.02)	12 (.18)	0	1 (.02)	0	1 (.02)	0	23 (.35)	0	4 (.06)	25 (.39)	0	0	3 (.05)
3	43 (.62)	0	4 (.06)	0	0	3 (.04)	1 (.01)	4 (.06)	26 (.38)	2 (.03)	6 (.09)	43 (.62)	4 (.06)	1 (.01)	1 (.01)
4	40 (.59)	0	9 (.13)	0	0	3 (.04)	1 (.01)	1 (.01)	29 (.43)	8 (.12)	0	26 (.38)	0	0	1 (.01)
5	11 (.16)	3 (.04)	4 (.06)	0	0	0	0	0	57 (.85)	0	0	21 (.31)	0	0	0
1-5	192 (.57)	4 (.01)	35 (.10)	11 (.03)	1 (.003)	7 (.02)	4 (.01)	5 (.01)	151 (.45)	13 (.04)	11 (.03)	128 (.38)	5 (.01)	5 (.01)	6 (.02)
FBCB2 Distributed Course #2															
1	30 (.86)	0	9 (.26)	0	0	1 (.03)	2 (.06)	1 (.03)	5 (.14)	13 (.37)	6 (.17)	6 (.17)	0	2 (.06)	0
2	34 (.45)	0	23 (.30)	0	0	2 (.03)	0	0	43 (.55)	0	9 (.12)	38 (.50)	0	16 (.21)	0
3	33 (.42)	0	24 (.30)	1 (.01)	0	2 (.03)	0	0	53 (.67)	0	0	68 (.86)	0	8 (.10)	1 (.01)
4	31 (.54)	0	37 (.65)	3 (.05)	0	2 (.03)	1 (.02)	0	28 (.49)	0	4 (.07)	18 (.32)	0	8 (.14)	0
5	0	0	9 (.16)	10 (.17)	0	0	0	0	58 (1.0)	0	2 (.03)	0	0	0	0
1-5	128 (.42)	0	102 (.33)	14 (.05)	0	7 (.02)	3 (.01)	1 (.003)	187 (.61)	13 (.04)	21 (.07)	130 (.43)	0	34 (.11)	1 (.003)
All Courses/Days (Summed)															
All	320 (.50)	4 (.006)	137 (.21)	25 (.04)	1 (.002)	14 (.02)	7 (.01)	6 (.009)	338 (.52)	26 (.04)	32 (.05)	258 (.40)	5 (.008)	39 (.06)	7 (.01)

Student Survey Results

This subsection summarizes the data obtained in the survey questionnaires completed by students (Appendix D) at the end of each course. Data tables are presented in Appendix F.

For both dL classes, the results of the student survey indicated similar responses regarding the following aspects of the course (see Appendix F, Table F1 for complete results):

- Pace of instruction was appropriate (50% each),
- Did not work ahead of instruction or only during certain topics (~80% each),
- Sought assistance from/provided assistance to fellow students (83-100%),
- Instructors answered all of their questions (83-90%), and
- Engaged and motivated to learn throughout the course (68-80%).

However, the students differed across the two dL classes regarding the extent to which they felt that they learned the system (40% vs. 83.3%) and the extent to which they felt that the dL format facilitated learning (10% vs. 50%; see Appendix F, Table F1). The following are student comments for how the dL format *helped* learning:

- Better than a regular classroom environment because the instructor can monitor all of the computer screens and directly access student data.
- The instructor was able to answer all questions effectively.

On the other hand, the students noted that technical difficulties and the lack of F2F interaction were some of the factors that *hindered* learning in the dL classroom environments. The following are student comments regarding these issues:

- Technical difficulties.
  - Lag time / system malfunctions slowed learning.
  - Noise interference; difficult to hear instructions at times.
  - Computer problems made it difficult to keep pace with instructor.
  - Many people talking at the same time; no way to see who is speaking.
  - Screen image very blurry on instructor end.
- Lack of F2F interaction slowed progress when technical problems occurred.

Additionally, the students were asked to indicate whether specific FBCB2 procedures were easy or difficult to learn (see Appendix F, Table F2). *Preparation for combat procedures* and *creating/sending messages* were easy to learn for one class; the other class was neutral. The students indicated that it was easy to learn FBCB2 functions because of the instructional methods (e.g., good instructor, repetition), the system design (e.g., information was well organized and the system was easy to use), and prior experience using ABCS systems.

The results indicated that *developing/sending orders* and *overlays* tended to be more difficult to learn for one class; the other class was relatively neutral (see Appendix F, Table F2). Some students indicated that it was difficult to learn specific FBCB2 functions because of a lack of prerequisite knowledge, especially computer experience or familiarity with operational or battlefield terminology. The comments also suggested that technical terms were used instead of common terms and recommended that the instructors relate the technical terms to the course.

The students also felt that additional training aids would have increased overall learning/understanding, such as a student manual with complete instructions for beginners and access to real systems with some vehicle time as part of the training. Finally, the students commented that the amount of information, especially in regards to menus, submenus, and overlays, posed challenges to learning. However, some students felt that, overall, with all the reinforcement tools, it was a great course.

The survey results also indicated that the majority of the students felt that *demonstration with student participation*, *practical exercises*, *review of material*, and *testing* were effective techniques. A few of the recommended instructional approaches for the dL environment included practice with an actual FBCB2 system on site, more challenging PEs, and additional quizzes. On the other hand, some individuals felt that the instructor successfully guided them through all of the instruction.

General comments concerning what the students liked most about the course included the following:

- *Convenience* - not having to travel.
- *Unit organization* - being able to stand up a class just for our unit.
- *Peers* - work with others; help from classmates.
- *Instructional approaches / material* - well organized; good pace, the material being taught, the hands-on instruction, and the ability of instructor to walk me though something on my own computer.
- *That we were able to get the instruction at all.*
- *Enjoyed the course / Very good class and instructor.*

Recommendations for course improvements included the following:

- *Fix Technical Difficulties.*
  - Connectivity / Upgrade internet service.
  - System slowdowns and lock ups. Lag in the systems. Time delays.
  - Communication issues – audio/visual problems.
  - Improve the computer software.
- *Hands On Experience*.
  - Really need hands on - how do you turn this thing on?
  - Have the real gear onsite. Having the system here itself to observe.
  - Hands on field training.
- *Better Training* Aids.
  - Better course book/workup that doubles as a commander's guidebook and is useful to train our Soldiers; better train the trainer focus.
  - More training aids.
- *No changes - I wouldn't change a thing.*

Finally, the students reported mixed results when comparing the dL FBCB2 class to traditional ABCS classes. That is, some students felt that there were no differences between the two types of classes while other students felt that it was more effective or would be more effective than the traditional training if the communication issues were resolved. On the other hand, some students felt that the dL classes were less effective than the traditional training and

needed additional training aids. In particular, one student commented that although the instructor can take control of the students' systems when they need help, it is not as effective as letting the students do it on their own with the instructors guiding. Finally, another student emphasized the need for training on FBCB2 components in a tactical military vehicle and that residential training provides this type of training.

Additional Instructor Responses Regarding dL Classroom Environments

During one-on-one interviews, the instructors indicated that the virtual classroom as equipped is effective in supporting student learning. However, they felt that the most limiting factors of the dL environment were the insufficient bandwidth and the unreliability of Internet connectivity. Both factors result in significant distractions for the instructor and students. The insufficient bandwidth typically produces a lag in FBCB2 interaction during the normal conduct of classes, while the unreliable Internet connectivity produces unplanned interruptions of varying duration. When asked what could be done to improve the capabilities, both instructors stated that greater bandwidth and highly reliable connectivity were essential.

One instructor stated that, if the bandwidth and Internet reliability issues were corrected, dL classes "definitely would be the way to go." Both instructors cited advantages to using the dL method (see Table 17). These advantages may promote effective instruction, at least in the initial stages of a course.

Table 17
Instructor View of Distributed Learning Advantages

Advantage	Explanation
Improved monitoring of student learning	With the ability to observe each student's screen, the instructor can determine when to give individual attention or adjust the pace to accommodate student progress.
Reduced overhead	The elimination of instructor travel yields significant savings of time and costs. Similarly, the instructor is not required to spend time setting up a classroom and preparing for a new setting.
Instructor "comfort zone"	The instructor is able to teach in a familiar environment without adjusting to a new setting. Also, the instructor can resort to notes without the students being aware he is doing so.
Multimedia integration	The VTT equipment provides a single platform for all multimedia materials, eliminating the need for other equipment such as an electronic projector.
Greater student capacity	Because classes are not limited to a specific location, more students can be taught in different classes across the US or outside of the US. (The multiple Instructor Booths can provide instruction simultaneously with less logistical issues than having instructors travel to multiple locations).

The instructors also discussed some of the difficulties associated with the lack of F2F interaction. For example, assisting students who need additional help, especially those without sufficient digital skills, can be a challenge. Although this occurs in traditional courses as well, the instructor stated that the situation was more difficult to overcome since he could not provide F2F assistance to the students. In the absence of an AI in the classroom, as occurred in both courses observed, students with better computer skills assisted other students. A related issue is the difficulty of accomplishing robust instructor-student interaction, as compared to the residential classroom, which helps to keep students focused.

To improve the course, the instructors indicated that the class could be shortened by cutting out less important topics or by breaking the class down into phases to reduce the timeline for training. Other ideas mentioned were to tailor the class to the students' basic needs and/or teach only core system functions. One instructor also suggested introducing more plug and play sustainment or refresher training where the students can log into the system on their own.

DISCUSSION

The current research investigated the blended learning approaches used to train digital skills in dL classroom environments. The specific goals were to 1) report lessons learned from instructors in a distributed blended learning environment; 2) report student reactions to this type of learning environment; and 3) compare the training approaches with those reported for traditional classroom environments.

Effective Techniques for dL Classroom Environments

The results of this research extend the knowledge base on instructional practices and training techniques used in courses that build digital operator skills. The dL instructors applied a variety of techniques to convey course content, maintain the students' motivation, and respond to students' problems and concerns. In particular, the following techniques were especially effective for the dL environment.

First, the instructors used particular students, who had mastered certain procedures, to demonstrate the procedures to other students. This proved to be an effective technique in the absence of an on-site AI and was valuable when the bandwidth was limited. If possible, the instructors could identify these individuals prior to the start of the class, so that immediate assistance could be provided. Ideally, an AI or experienced FBCB2 operator from the students' unit could attend the class and offer assistance and share experiences of how they used certain features while deployed. This would be of great value to the dL instructors as the lack of F2F interaction makes it difficult for the instructors to keep the students engaged, motivated, and focused, especially when there are technical problems.

Second, we observed peer coaching during many of the course topics. The instructors mentioned that they encourage peer coaching. To structure these interactions so that they do not interfere with learning, the instructors could ask the students to work on a problem for a specified period of time before asking their fellow classmates for help. After receiving assistance, the students should be given the opportunity to practice the procedures on their own so that they will be better able to retain the information.

Third, the instructors employed a few techniques to more effectively monitor the students' performance. A bank of monitors showed each student's computer screen, and allowed the instructors to view the progress of each student as they worked through the FBCB2 procedures. They also used computer software that allowed them to take over the mouse of a student who was having difficulty with the procedures. This way, the student received individualized instruction as the instructor walked through the correct steps of the procedure from where the student had left off. However, we note that this technique had differential effects on student learning. Some students felt that this technique helped them to learn the difficult procedures while other students felt that this approach was not as effective as when they were encouraged to perform the steps on their own with instructor guidance. We provide some recommendations below regarding these issues.

Comparison to Traditional Classes

Overall, the findings indicate that the dL instructors were able to adapt to using the technology to teach FBCB2 operations, resulting in training that is very comparable to the traditional courses. The positive student comments and similar training approaches and topical coverage support these findings. Thus, training developers and instructors in need of alternative ways to provide training on ABCS components could successfully employ the dL method.

Although the overall patterns of dL activities and techniques were similar to those found in traditional classrooms, specific adaptations occurred to accommodate the dL environment. Overall, the dL instructors spent much more time covering the topics of messages and orders/overlays than the instructors in the traditional classes. The absence of F2F interaction may have led the instructors to conduct more learning checks to generate feedback on student progress, which may account for some of the additional time. The checks on learning, review of material, and testing are all effective ways to ensure that students understand the material and are learning the skills, and they should be sustained.

The dL instructors also provided many more general computer examples and related the information to previous course content much more often than the residential instructors. Providing general computer examples definitely makes it easier for the students to understand the functions. On the other hand, the dL instructors differed in the extent to which they used operational examples throughout the course; a recommendation for utilizing this technique more when teaching digital skills is discussed in more detail below.

It is important to note that although some differences were found between the dL and traditional classes, these may have been due to other factors besides the training medium (e.g., background of students in the class, etc.). Specifically, although the POIs for the dL and traditional courses are basically the same, the instructors may modify/adopt a different emphasis based on student differences. Thus, the differences we found between the two courses may be due to the way in which the instructors adapted to the needs of a particular class. Additionally, as only one traditional class was observed per topic, the number of observations was lower for the traditional courses compared to the dL courses in which two classes were observed per topic. These differences in the frequencies of the observations could have affected the results. In summary, we present the comparison findings as a case study of the possible differences across these different training environments and note that additional research is needed that controls for some of these factors to draw strong conclusions from the results.

Major Advantages and Disadvantages of the dL Approach

The dL instructors reported noteworthy advantages to providing FBCB2 operator training using the distributed method. In particular, they felt that the reduced cost, especially in terms of travel, and the ability to deliver the training to multiple classes simultaneously throughout the nation is a large benefit of the approach. The student survey results supported these comments

as some students appreciated the opportunity to receive the remote training because they may not have received the training otherwise.

Although the findings suggest that the instructors were able to overcome the technological difficulties, one disadvantage of the dL approach concerns the issues with the insufficient bandwidth and the unreliability of Internet connectivity. Both factors resulted in significant distractions for the instructor and students. To effectively use the class time when these technological issues occur, the instructors could have alternative exercises or course material available. For example, although not ideal, the instructors could walk the students through a demonstration of the FBCB2 steps via screen shots embedded in PowerPoint slides. Most screen shots are already provided to the students at the start of the class as part of the reference packet. The instructors also could conduct PEs either through verbal discussions or paper-pencil materials, focusing on when certain procedures would be used while deployed.

Further, research suggests that individuals who provide summaries of what they have learned show 10% gains over those individuals who did not summarize (for a review see Abell, 2000). Instructors could use the down-time to ask students to summarize certain procedures. If actual systems were available, this would be a good time for the students to familiarize themselves with the equipment. Perhaps videos could be used that describe the actual equipment or provide instances of how different FBCB2 features were used on deployments. In summary, the lack of F2F interaction poses additional challenges for the instructors when technological problems result in long lags and down-time, and they may be better able to keep the students engaged by having alternative materials available.

Student Results

The survey results indicated large differences across the classes reflecting the extent to which the students felt that they learned the system and the extent to which the dL format affected their learning. These differences seem to be the result of one class experiencing significantly more technical problems than the other class such as audio/visual problems, connectivity issues, lag time, noise interference, etc. These results highlight our note above that one disadvantage to the dL method is the effect of the technological issues on learning. However, in the present research, the trends for working alone, helping peers, and paying less attention to instructors may reflect increasing student confidence as the course progressed.

Another trend we noted for both classes was that responding to questions asked by the instructor occurred much less frequently than asking questions. That is, the students asked many more questions than they answered. Some research suggests that questioning by the instructor is the single most influential teaching behavior that affects learning and is key to fostering student-instructor interactions (Abell, 2000). Thus, dL instructors could actively engage the students throughout the course by asking them specific questions about certain steps of FBCB2 procedures and how they would apply the procedures. As indicated previously, the students may better retain the information by summarizing the procedures in their own words. These techniques could be especially useful for increasing student-teacher interactions in the dL environment, especially when the system is experiencing technical problems.

Additionally, some students reported having difficulty understanding the acronyms used in the class. The observer indicated that he did not think that any one area of terminology/ acronyms was more problematic. The survey responses regarding difficulty with acronyms came from the FBCB2-1 class, and our survey results indicated that this class consisted of junior officers and NCOs and that only 50% were very comfortable using a computer. Thus, the students may have had difficulty with both operational and general computer terminology. The need for additional training aids such as remedial materials for beginners is discussed in more detail below.

The Soldiers did not create their own practice sessions by arriving early or working during breaks, as happened in the traditional classes. This occurred even though the dL instructors offered these options to the students. Thus, the instructors may need to make time available in class for the students to practice complex procedures. Some of the FBCB2 tasks are difficult to learn and remember; additional practice opportunities would help the students to better retain the information and transfer the knowledge and skills to other situations while deployed. This is discussed in more detail below.

Some students reported that they were attending the class to be able to train other Soldiers in their units. As such, they indicated that they would like additional train-the-trainer materials or a commander's guide so that they can better teach the FBCB2 procedures. The dL instructors could provide them with some of the exercises that they use in the class so that other Soldiers have the opportunity to practice the procedures.

Finally, one recommendation made repeatedly by the students was for the class to spend some time training with the real FBCB2 systems ("greenboxes"). The students wanted some hands-on experience with real systems so they could familiarize themselves with the equipment (e.g., turning it on and off). By incorporating training with the real equipment into the course, the dL instructors would likely increase the transfer of the digital skills learned in the course to operational settings (cf. Laker, 1990). However, at the very least, it would require the remote classrooms to have greenboxes set-up and in working condition for the students to use. Providing this could significantly increase the cost of the dL course.

Lessons Learned / Training Recommendations

Although the dL instructors incorporated some of the following techniques in the dL method of FBCB2 instruction, we offer additional ways in which the instruction could be modified to enhance learning and transfer of the digital skills to operational contexts.

The recommendations contained in this section of the report reflect findings from the literature review conducted for the current project (as described in the Introduction), the current project's results, and training recommendations from a forthcoming ARI report and compact disk (cd)-based tool for digital skills instructors (Blankenbeckler, Wampler, Goodwin, & Dyer, in preparation). These recommendations also parallel the findings from Abell (2000) regarding the needs of Soldiers as distance learners and those of Sanders (2000) regarding constructivist principles and related training techniques.

First, we suggest that there is not an optimal mix of training techniques – it depends on the level of skill of the students which varies from class to class. A good approach is to train instructors to be knowledgeable about the different training techniques and when to use them. With this in mind, we offer a few specific recommendations for dL instructors reflecting the following eight areas:

1. Provide materials/instruction for student prerequisites,
2. Leverage student strengths and experience,
3. Train functions in a system-wide/realistic context,
4. Use PEs to foster problem-centered learning,
5. Leverage observe-only demonstration,
6. Expand practice opportunities,
7. Emphasize independent practice, and
8. Provide ample training aids.

1. *Provide materials/instruction for student prerequisites*. Enrollment in the dL operator courses did not depend on any apparent prerequisites. However, a minimum level of digital and tactical competency is essential for students to optimize their learning and avoid causing class interruptions or delays.
    a. *Importance of enablers*. Because FBCB2 is a computer system, some general familiarity or comfort level with computers is imperative for the students. Less obvious is knowledge of tactics, techniques, and procedures (TTP), tactical/technical terminology and associated acronyms. Basic tactical knowledge is essential to FBCB2 operation and to understanding the system's use in the field. For example, a student who is not familiar with military overlays that include boundaries and phase lines will find it difficult to learn FBCB2's overlay features. If a student does not understand foundation definitions, concepts and implications, then the instruction occurs in the abstract and learning to use the FBCB2 has no frame of reference.
    b. *Default assumptions*. Given the students' diversity in terms of rank, experience, and branch/military occupational specialty, the instructor should assume that some students lack the requisite skills and knowledge, especially acronyms and terminology related to tactical operations and computer interfaces. At the start of a course, a good step would be for the instructor to assess the students' knowledge of terminology, acronyms, computers, and military tactics.
    c. *Pre-training*. A means of imparting the requisites in advance would improve learning during the course. In the case of TTP, terminology and acronyms this could be a simple read-ahead packet provided well before the course and reinforced by a review on the first day. In the case of computer skills, the instructor must quickly identify students who require additional training and provide it at the first opportunity. For example, he could hold a computer skills class during lunch or after class on the first day of the course.

2. *Leverage student strengths and experience.* Determine start-of-course qualifications. At the beginning of the class, the instructors could find out the backgrounds and experience of the students and build on what the students already know.

a. For example, if the students have Infantry backgrounds, the instructors could relate some of the FBCB2 functions to land navigation – the students are used to navigating on the ground with GPS, now they have to learn how to navigate using FBCB2.
b. Or, if there are differences between an alternate communication method and FBCB2, then point out the major discrepancies to reduce negative transfer. For example, discuss the big differences between 9-Line Medical Evacuation (MEDEVAC) Request and a MEDEVAC Request using FBCB2.
c. Instructors can capitalize on the students' experiences by encouraging them to share real-world, relevant examples (Abell, 2000).

3. *Train functions in a system-wide/realistic context*. As much as possible, digital functions should be trained in context; they should not be viewed as independent of each other. They should be integrated in sequence, and students should practice them in reaction to an event that would occur in operational use. Thus, the training tasks should be realistic and should help the students see the big picture. Successful transfer of digital skills to operational contexts is a result of training that provides specific examples of when and how certain procedures will be used while performing one's job duties (e.g., Baldwin & Ford, 1988; Clark & Vogel, 1985).
    a. The digital skills cd-based tool encourages instructors to think of the whole task (not individual lessons) and think of alternative approaches to the Guided Demonstration-PE-Exam method.
    b. One way to obtain realistic operational examples and develop new PEs would be to talk to Soldiers and leaders who have been deployed and perhaps residential BCTC instructors.
    c. Even "buttonology" could be put in an operational context – e.g., "When this situation happens, you do the following…" This would help the students to understand why and how FBCB2 is used in the real world, with an emphasis on the tactical situation and its implications.
    d. Soldiers will be more motivated to learn if they can see the benefits of mastering the knowledge or skill and how it can be applied on the job after the training (Abell, 2000).

4. *Use PEs to foster problem-centered learning*. As noted in the introduction, more experienced students may learn digital skills best if they can shape their own learning experiences. Leibrecht et al. (2007) suggested that even students who are novices at the beginning of the course possess enough skill by the end of the course to benefit from PEs that encourage them to learn the system on their own. Further, problem-centered (constructivist) instructional techniques have been shown to be superior to guided demonstration instructional techniques because students are encouraged to integrate prior tasks and skills with newly learned ones. This helps students to master an ever increasing skill set.
    a. PEs can be developed that encourage the students to think how they would employ the system without first being shown step-by-step how to do it. Often the PEs simply repeat what the instructor did and stop there. But that is only the first step in student learning and does not guarantee that the student will retain the information or be able to apply the function in a different context (on the battlefield). PEs could be

developed that provide little guidance to the students so that they are encouraged to solve novel problems on their own.

b. Instructors should think of operational situations that will require users to perform certain tasks – this will help students to learn not only "how" to perform tasks but also "when" to perform these tasks.
c. Performing the tasks in multiple practice scenarios may help the students to apply the skills in different contexts when deployed.
d. Instructors may need an inventory of PEs so that they can adapt to specific classes by matching the scenarios to the backgrounds and experiences of the students.
e. Some research suggests that individuals do not learn from the experience per se but from reflecting on the experience. Students should be given some time after each PE to evaluate and discuss those learning strategies that worked well, those that did not work so well, and why (Abell, 2000).

5. *Leverage observe-only demonstration*. The technique of "demonstration" where the students watch the instructor prior to performing the steps themselves may help them to retain the information better than "guided demo" where they perform the steps for the first time along with the instructor. In guided demo, the students have to split their attention which makes it more difficult for them to think through the steps which is a key to remembering them.

6. *Expand practice opportunities*. Procedural knowledge, or the ability to perform a sequence of steps in a competent manner, is only acquired through consistent and extensive practice (Ackerman, 2006). As many of the FBCB2 tasks involve a sequence of steps, one practice session per topic may not be enough for the students to retain the information over time. Multiple practice sessions may be needed for critical tasks. Further, as the course presents a lot of information in a short period of time, additional practice opportunities would help the students to become familiar with the content and reduces the cognitive load associated with processing unfamiliar material (Kirschner et al., 2006).
    a. However, as this requires additional time, the instruction of other course topics may have to be curtailed. Instructors could utilize the findings of Bink et al. (2008) to determine which FBCB2 functions and procedures combat veterans used the most in deployed settings and allocate more practice time for these course topics.

7. *Emphasize independent practice*. Our results showed that one dL technique involved taking over the students' computers to show them the correct sequence of steps. Although the instructors may have to use this technique in certain situations, the students who are having difficulty may not retain the information as much as if they were encouraged to practice and learn the steps on their own. When they are in a similar situation when deployed, they may have difficulty remembering the procedures. If they are encouraged to learn it on their own, they may gain self-confidence, retain the skills better, and be better able to work independently. This is especially important for those students who are taking the class to train other Soldiers in their units.
    a. As this may require additional classroom time, the instructors should have additional PEs available for the other students who have completed the initial PE. This would provide the other students in the class with more opportunities for practice.

b. If the instructor must take over the student's computer to show the correct steps, the student should immediately be given the opportunity to practice the steps on his/her own.
c. Helping students to operate the system independently and retain the skills over time may mean that the course only covers critical tasks.

8. *Provide ample training aids*. The utility of student handouts is especially critical in the dL environment. The physical separation, especially in the absence of an AI, and the limited communication links make it more difficult to clear up student confusion.

Conclusions

Both the dL instructors and students acknowledged substantial value in the VTT approach to training digital skills and offered good suggestions for improving the training for dL environments. While the sampling approach was limited, the results provide insights and lessons for ensuring effective courses for ABCS operators. The findings contribute to the Army's efforts to enhance blended learning solutions to meet critical training needs. Many of the recommendations are applicable to both dL and traditional classroom settings, and we encourage instructors to use these ideas to make small changes to their training that may result in big differences in their students' proficiency levels.

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APPENDIX A

Instructor Observation Form

Part I. Class Details for Instructor Observations

Data Collection Form

Observer:_____
Date: _____

1. Course: Distributed FBCB2
2. Location: (Installation) _____ (classroom #) _____
3. Software version: _____
4. # of instructors: _____ # of classroom monitors: _____ # of students: _____
5. # of workstations: _____
6. Describe the training site (to include resources; draw a diagram of site below).

7. Duration of course (days/ hours) _____
8. Observation period: (from day/hour) _____(to day/hour) _____

9. Diagram of site:

PART IIA: Activity Chronology

ACTIVITY CODE	VID – video	DEM – demonstration
G/D – guided demo	PE – practical exercise	REV – review
BRK – break	TEST – quiz, exam, etc	LEC – lecture

SHEET NUMBER: _____
Observer: _____
Date: _____

Training Techniques	**MA** – uses **M**emory **A**ids	**RM** – **R**elates to **M**ilitary operation
EA – **E**ncourages **A**ctive learning	**PP** – **P**urpose and **P**ath	**RP** – **R**elates to **P**revious content
EP – **E**mphasizes **P**ractice	**RG** – **R**elates to **G**eneral knowledge	**SP**– points out unique **S**creen **P**rompts or cues
LC – **L**earning **C**heck	**RL** – **R**esponds to **L**earners	**dL –** Uses techniques specific to **dL**

Num	Activity Code	Time	Description of topics covered and instructor/student behaviors	Training Techniques

Part IIB. PE Sheet

Num (from Chronology)	**Exercise Type**: • Guided • Same as Demo • New situation • Integrate prior tasks	**Exercise Context**: • Military Ops • Job-relevant • Arbitrary	**How did instructor monitor progress?** • Asked for feedback • Observed Soldiers • Assistants observed	**Peer coaching observed?** Y / N	**# Reps of Same Exercise**	**Additional Comments**

Part III.

Start-of-course questions

1. What level of proficiency on this system were students required to have before taking this course? (check all that apply)

   __ No pre-requisite knowledge of the system was required

   __ Students had to understand the following software attributes and/or functions _____

   _____

   __ Students had to have completed the following course(s): _____

   _____

   __ Other (e.g. exam) describe: _____

   _____

2. At the beginning of the course, how did the instructor communicate the training objectives (i.e. topics or skills to be covered)? List those objectives if they are not listed in your chronology.

3. At the beginning of the course, what were students told to expect for a final test?

Final Assessment Description

1. How did the instructor evaluate student proficiency at the end of the training session? (e.g., knowledge (exam), performance (PE), etc.)

   a. _____Test of knowledge (written exam)
   ____ Recall (students repeated what was taught in class)
   ____ Application (students applied what was taught to solve problems)
   ____ Other (describe: _____)

   b. _____Test of performance/skill (PEs)
   ____ Recall (students repeated tasks taught in class)
   ____ Application (students applied what was taught to solve problems)
   ____ Other (describe: _____)

   c. ____ There was no evaluation of proficiency

   Describe the PE/Test and Feedback (if possible, obtain a copy of the exam):

APPENDIX B

BCTC-DODGE: FBCB2 Instructor Interview Questions

1. Have you used FBCB2 in an operational setting? Please provide specific details of how you have used FBCB2 in an operational setting.

2. Have you taught FBCB2 in a residential setting? Approximately how many times?

3. Approximately how many times have you taught FBCB2 in the distributed format? Other than at BCTC?

4. Have you taught any of the other ABCS systems in a distributed learning format? Approximately how many times? Other than at BCTC?

5. Have you had formal training as a dL instructor? If so, when and where did the training occur? Do you think it prepared you to teach FBCB2 in a distributed format?

6. Are there specific instructional design or learning principles that you follow when *developing your instruction*?
    a. Prompts: Instructional design techniques: e.g., scaffolding (instructor models the desired learning strategy or task, then gradually shifts responsibility to the students), advanced organizers (instructor provides ways to help students link their ideas with new material or concepts), GEL (guided experiential learning – specific sequence of demonstration, practice, and evaluation)

7. Are there specific instructional design or learning principles that you follow when *preparing to teach/present* the FBCB2 course?
    a. Prompts: Instructional design techniques: e.g., scaffolding (instructor models the desired learning strategy or task, then gradually shifts responsibility to the students), advanced organizers (instructor provides ways to help students link their ideas with new material or concepts), GEL (guided experiential learning – specific sequence of demonstration, practice, and evaluation)

8. What techniques for teaching FBCB2 have you found to be helpful in facilitating the students' learning of the system?
    a. Prompts: Various instructional activities, conducting learning checks, providing feedback to students, interacting with students, measuring performance, conducting PEs, motivating students
    b. *If the instructor has taught a resident ABCS course…*How do these techniques differ from teaching a residential ABCS course?

9. What techniques for teaching FBCB2 have you found to be helpful in keeping the students' all on the same pace as your instruction?
    a. *If the instructor has taught a resident ABCS course…*How do these techniques differ from teaching a residential ABCS course?

10. What techniques for teaching FBCB2 have you found to be helpful in answering students' questions regarding specific steps or procedures?

a. *If the instructor has taught a resident ABCS course*…How do these techniques differ from teaching a residential ABCS course?

11. What techniques for teaching FBCB2 have you found to be helpful in working with a student who is having much difficulty with specific steps or procedures?
    a. *If the instructor has taught a resident ABCS course*…How do these techniques differ from teaching a residential ABCS course?

12. *If the instructor has taught a resident ABCS course*…Do you think the dL approach is more or less effective for learning the system?
    a. Prompts: student/teacher ratio, ability to take over students' machines, different techniques used, different military population

13. Are there any specific advantages or disadvantages for teaching FBCB2 in a distributed format?

14. Have you received feedback from students regarding the FBCB2 course – positive, negative?
    a. Do you modify the FBCB2 course or instructional approaches based on student feedback?

15. Do you think that students retain the digital skills for FBCB2 over time? Do you know whether they receive refresher training on FBCB2?

16. How well does the available network, remote instructional capabilities, and interactive/ collaborative capabilities support teaching distributed ABCS courses?

17. What do you like best about teaching the distributed FBCB2 course?

18. What do you like least about teaching the distributed FBCB2 course?

19. What problems do you typically encounter during the course that affect the way you present the material or the degree to which the students learn the system?

20. What ideas do you have for improving the distributed FBCB2 course?

21. Any other comments and suggestions?

APPENDIX C

Student Observation Form

Part I: Class Details

Data Collection Form

Observer:_____
Date: _____

1. Course: Distributed FBCB2
2. Location: (Installation) _____ (classroom #) _____
3. Software version: _____
4. # of instructors: _____ # of classroom monitors: _____ # of students: _____
5. # of workstations: _____
6. Describe the training site (to include resources; draw a diagram of site below).

7. Duration of course (days/ hours) _____
8. Observation period: (from day/hour) _____(to day/hour) _____
9. Diagram of site:

Part II: Activity Chronology

ACTIVITY CODE	VID – video	DEM – demonstration
G/D – guided demo	PE – practical exercise	REV – review
BRK – break	TEST – quiz, exam, etc	LEC – lecture

SHEET NUMBER: _____
Date: _____
# of Students: _____

Student Behaviors	**OB – O**ther student **B**ehaviors are observed	**SM -** Instructor takes over **S**tudent's **M**ouse
AR - Asks instructor to **R**epeat step	**NP –** Multiple students do **N**ot **P**ay attention to the lecture/demonstration	**UO - U**ses **O**ther functions than those for current task
AQ - Asks instructor a **Question**	**PA –** Pays attention to lecture/PowerPoint presentation/Demonstration	**WF** – Multiple students **W**aits for others to **F**inish task/PE
GS - Works in **G**roups to **S**olve individual tasks	**PC - P**eer **C**oaching (Seeks/Gives help)	**WA - W**orks **A**head of instruction but on same task
IS - Works **I**ndependently to **S**olve problems	**RQ** – **R**esponds to instructor **Questions**	
LB - Lags **B**ehind instruction	**SC - S**ide **C**onversations during instruction	

Num = Number the classroom activities (Activity Codes) sequentially

Activity Code = Use the codes at the top of the page to indicate the instructional activity

Time = Record student behaviors for every 5-minute block of instruction

Descriptions = Capture examples of behavior; if **OB** is used please describe behavior in detail

Student Behaviors = Use codes of student behaviors; If behavior is observed once in a 5-minute period then record the behavior; If multiple students are observed performing the behavior then note that in the Description column.

Num	Activity Code	Time	Description of topics covered and instructor/student behaviors	Student Behaviors

Part III: Summary Questions

Summary Questions. (to be answered after each observation period).

1. What percent of this course covered operator (i.e. knobology) skills and what percent covered employment skills?

2. Was the material taught at an appropriate level of difficulty for the students? Did the students appear to be engaged?

3. Were there enough systems for all the students? Did hardware or software problems occur and if so did they impede progress in the class?

4. Were there any innovative teaching techniques that deserve special mention? If so, describe them.

APPENDIX D

Student Survey

BIOGRAPHICAL INFORMATION

1. Today's Date: _____

2. Rank/Grade: _____ **3. Branch**: _____ **4. AOC/MOS** _____

Time in Service as: **5a. Enlisted** ____ yrs ____ mos **5b. Officer** ____ yrs ____ mos

6. Status (circle one): Active Duty Army Reserve National Guard

7. Unit: _____ **8. Current Duty Position**: _____

9. Time in Current Duty Position: ____ mos

10. Military Education (Check all that apply)

NCOES	
PLDC/WLC	
BNCOC	
ANCOC	
1SG Course	
Other _____	

OES	
OCS/ROTC	
OBC/BOLC III	
OAC/CPTs Career Course	
PCC	
Other _____	

11. Deployment Experience (Provide information for the last 5 years)

	Position(s)	Total Months
OIF		
OEF		
Other _____		
Other _____		

12. Digital Training (Provide information for all that apply)

System	Training Course (Type, Month/Year of Training, # hrs)	Individual Training within Unit (Type, Average # hrs used per week)
FBCB2		
ASAS		
AFATDS		
MCS		
Other _____		

13. Digital Experience (Provide information for all that apply)

System	Used in Field Training (Average # hrs used per week)	Used in Deployment Ops (Average # hrs used per week)
FBCB2		
ASAS		
AFATDS		
MCS		
Other _____		

14. How comfortable are you using a computer? (Circle one)

0-Not at All 1-Slightly Comfortable 2-Moderately Comfortable 3-Very Comfortable

15. How much experience do you have using a computer? (Circle one)

0-No Experience 1-Little Experience 2-Moderate Experience 3-Much Experience

16. Why are you attending this FBCB2 training course?

_____

_____

FBCB2: Distributed Learning Survey

1) After taking the FBCB2 course, to what extent do you feel that you learned the system?

☐ I did not learn much at all
☐ I partially learned the system
☐ I learned all steps and processes of the system
☐ I became proficient and could teach the system to someone else

2) To what extent do you feel that the distributed format (instructor not located in the same room as you) affected your learning of FBCB2?

☐ Hindered learning greatly
☐ Hindered learning somewhat
☐ Did not hinder nor facilitate learning
☐ Facilitated learning somewhat
☐ Facilitated learning greatly

Please provide specific examples of how the distributed format either helped or hindered your learning of FBCB2.

3) To what extent was the FBCB2 course more or less effective than <u>other distributed learning courses</u> you have participated in.

☐ I have not attended other distributed learning courses
☐ Much less effective than other distributed learning courses
☐ Somewhat less effective than other distributed learning courses
☐ About the same
☐ Somewhat more effective than other distributed learning courses
☐ Much more effective than other courses

Please explain why this FBCB2 course was more or less effective in helping you to learn than other distributed courses. Please provide specific examples of differences.

4) To what extent was the FBCB2 course more or less effective in helping you learn the system than <u>resident ABCS courses</u>.

☐ I have not attended any resident ABCS courses
☐ Much less effective than other resident ABCS courses
☐ Somewhat less effective than other resident ABCS courses
☐ About the same
☐ Somewhat more effective than other resident ABCS courses
☐ Much more effective than other resident ABCS courses

Please explain why the distributed format was more or less effective in helping you learn FBCB2 compared to <u>resident ABCS courses</u>.

5) Please use the following scale to rate the difficulty or ease of learning the different FBCB2 functions or procedures that may have been instructed during the course. Please check the appropriate box.

FBCB2 Functions and Procedures	Very Difficult	Somewhat Difficult	Neither Difficult nor Easy	Somewhat Easy	Very Easy
Prep for Combat Configure Role; Clear Logs and Queues, etc					
Messages Prepare/send Cbt Msg; Spot Report; Addressing, etc					
Navigation Tools CLOS; LOS; Periodic Reminders, etc					
Orders Prepare and send Warno/Opord; Attach Overlay, etc					
Overlay Messages Create Objects; Save/Send Overlay, etc					

Please provide comments to explain why you had difficulty learning a specific function/task.

Please provide comments to explain why you found it easy to learn a specific function/task.

6) Please use the following scale to rate the effectiveness of different instructional activities that may have been used during the course. Please check the appropriate box.

Instructional Activities	Very Ineffective	Somewhat Ineffective	Neither Ineffective or Effective	Somewhat Effective	Very Effective
Demonstration of steps and procedures **without** the students using the system to follow along					
Guided demonstration of steps and procedures **with** the students using the system to follow along					
Lecture / PowerPoint slides					
Practical Exercise					
Video					
Review of material that was covered					
Test – quiz, exam					

Given that the instructor teaches this course from a remote location, please describe some instructional techniques that would have helped you learn FBCB2 better.

7) Please indicate how you feel about the pace of instruction for you.

- ☐ Extremely slow
- ☐ Somewhat slow
- ☐ Just Right
- ☐ A little fast-paced
- ☐ Extremely fast-paced

Please provide examples of times when you felt the instruction was too fast-paced and recommendations for how the instructor can keep everyone on the same pace.

8) To what extent did you work ahead of the FBCB2 instruction?

☐ Never
☐ Only during certain topics
☐ Throughout the entire course

If you worked ahead of the instruction, please explain whether the instruction was too slow or whether you have experience with using FBCB2.

If you have experience using FBCB2, what would make the instruction more interesting for you?

9) To what extent did you seek assistance from your fellow classmates regarding certain steps or procedures for FBCB2?

☐ Never
☐ Only during certain topics
☐ Throughout the entire course

If you asked your peers for assistance, were they able to help you to understand the steps or specific procedures involved in the task? What methods did they use that helped you understand the procedures?

10) To what extent did you assist other students in learning certain steps and procedures of FBCB2?

☐ Never
☐ Only during certain topics
☐ Throughout the entire course

If you helped other students, please describe which procedures you assisted with and the methods you used to help your classmates learn the steps.

11) To what extent was the instructor able to answer all of your questions and provide clarification for certain FBCB2 steps and procedures?

☐ Answered no questions / Clarified no procedures
☐ Answered some but not all questions / Clarified some but not all procedures
☐ Answered all questions / Clarified all procedures

If you felt that the instructor did not provide clarification, do you think that this was a function of the distributed format (i.e., would your questions have been answered if you were able to discuss them face-to-face with the instructor)?

Please explain how this affected your learning of FBCB2.

12) To what extent were you engaged and motivated to learn throughout the FBCB2 course?

☐ Not engaged/motivated at all
☐ Somewhat engaged/motivated
☐ Very engaged/motivated
☐ Extremely engaged/motivated

Please identify which factors influenced your motivation level, to include the distributed learning environment.

Please provide examples of the types of things that the instructor did to hold your interest in the class?

13) What did you like the best about the distributed learning course?

14) What did you like least about the distributed learning course?

15) What problems did you encounter during the course?

16) How would you improve the distributed learning course?

17) Any other comments and suggestions?

APPENDIX E

Instructions for Observations

Instructor Observer Instructions

BACKGROUND: The purpose of this project is to observe, record, and report distributed training techniques and the possible effects of those techniques on student learning of digital skills. A key objective of this project is to record instructor behaviors that occur in a distributed learning environment. As you observe the instructor please,

- Capture any and all information relevant to the project objective:
  "Identify learning principles in use and how to improve them."
- Observe – listen – record
- Record objective data; note if an entry is based on opinion. We will assess the data later.
- Be unobtrusive; do not interfere.
- Record as much detail as possible; when in doubt, write it down.
  (We should be able to reconstruct a mental picture of what occurred.)

>> The OBSERVATION FORM is divided into 3 parts:

- Part I, Class Details
- Part II, Instructional Activities and Practical Exercises
- Part III, Start-of Course and Final Assessment

Instructions for completing each section are below.

Part I, Class Details. The first page of the data collection instrument asks for details about the classroom. The questions are self explanatory.

Part II, Instructional Activities and Practical Exercises. Once the classroom instruction begins, there are two forms for recording instructional activities: the *Activity Chronology* form and the *PE/Guided Demo Detail Sheet*.

IIA, Activity Chronology. Use this form to record instructional activities as they occur, as follows:

Column 1 (Num) – Number the classroom activities sequentially on the chronology (use additional copies of the chronology page as needed). When the Demo Detail sheet is used, the activity number from the Chronology sheet should be entered in the first (Num) column of the Demo Detail Sheet.

Column 2 (Activity Code) – Use the codes at the top of the page to indicate the type of activity. If more than one line is needed to describe the activity, there is no need to write the activity code for each line.

Column 3 (Time) Note the time that begins each 5 minute observation period (see details of time-sampling observation procedure below)..

Column 4 (Description/Topics covered) – This space should be used for detailed notes about the course content and student and instructor behaviors. Detail is important; it's better to write down too much than too little. Use this space to:

- Describe the topic or task being covered as defined by the instructor; note the steps.
- Note examples of the checks on learning employed.
- Capture examples of the learning principles.
- Provide examples of the student/student or instructor/student coaching or tutoring that takes place.
- Explain any linkage between the current activity/task and previous activities/tasks.
- Note if some steps/points had to be presented multiple times.
- Capture clarifying questions asked by students.
- Record other pertinent information that will assist in understanding what transpired during the activity.

Column 5 (Learning Principles) – Using the abbreviations in the table at the top of the chronology page, enter all relevant learning principles exemplified by the activity described on that line of the chronology.

The learning principles are described in more detail below:

- Points out screen prompts or cues, to guide responses: The instructor points out flashing numbers, grayed out buttons, screen text, etc. that cue the student about what action is needed.
- Emphasizes practice: The instructor indicates the importance of practicing the tasks to gain the required skill.
- Responds to learner statements: The instructor modifies the instruction in some way to accommodate a question or request from a student.
- Encourages active learning: In addition to PEs, the instructor prods students to actively process the material. For example by asking questions, giving students problems to solve individually or in small groups, or having students answer each others' questions.
- Presents purpose and path: The organization of the class material is made explicit to students via a table or graphic and/or an effort is made to explain the reason for the organization. Students are reminded of this organization and where they are in the order of topics throughout the class.
- Relates to military operation: The instructor relates the material to military operations or knowledge either by making an analogy *("Overlays function just like acetate overlays on a paper map"*) or by describing how the software might be used during a military operation *("The next time you have to plan a convoy route, remember to use the CLOS tool."*).
- Relates to general knowledge: The instructor relates the material to general knowledge about computers, etc. "*This is similar to typical e-mail, operates like normal Windows functions.")*
- Relates to previous content: The instructor relates the material to some previously covered topic or exercise.
- Uses memory aids: The instructor provides memory aids (such as PACS [PLGR, Antenna, Computer, Screen] to remember startup sequence for FBCB2) or related techniques.

IIB, PE/Guided Demo Detail Sheet. Use this form to record information during PEs (Practical Exercises) or Guided Demos. The fields of this form are described below.

Column 1 (Num) – Use this to record the activity number. This number should match the activity on the Num column of the Activity Chronology form. If multiple PEs or demos are conducted for a single "Activity", then list each separately on the PE/Guided Demo detail using 1a, 1b, 1c, etc.

Column 2 (Exercise Type) – Indicate the nature of the exercise. Options progress from easy to difficult.

- Guided means students repeat the actions of the instructor by following along step by step.
- Same as Demo means that after watching a Demo, students must repeat all the steps on their own.
- New Situation means that after watching a demo, students must repeat the steps but enter new information in some of the fields (e.g., different addressees, different SPOT contents, new overlay).
- Integrated Prior Tasks means that students must combine knowledge of tasks or information learned at different times during the class in order to complete the PE successfully.

Column 3 (Exercise Context) – Indicate whether an attempt is made to relate the exercise to a military operation, a job-relevant task (not necessarily associated with an operation) or some arbitrary action like "send a free-text message with your name."

Column 4 (How did instructor monitor progress?) – Describe the means used to monitor student progress.

Column 5 (Peer coaching observed?) – Indicate whether or not you observed peer coaching/mentoring.

Column 6 (# Reps of Same Exercise) – Tally how many times the exact exercise was repeated.

Column 7 (Additional comments) – Use this space to record any other relevant information.

Time-Sampling Procedure: To simplify the quantification of learning principles, we will use a time-sampling procedure in which we will note whether or not learning principles occurred within 5 minute intervals. During any given 5 minute interval, record a description of the content being covered and any relevant student and instructor behaviors in column 4. In column 5 (this can be done in real-time or even at a later time) note which learning principles were exemplified by the behaviors in each row of column 4 (see example Activity Chronology below).

Using this sampling procedure, you can aggregate instances of each learning principle. For example if an instructor spends 10 minutes in a guided demo explaining how to send an overlay, you would describe the content of what he was teaching but rather than tally the number of screen prompts he indicates you would simply note "SP" in the 5th column for each 5 min interval that the instructor was doing the guided demo. Likewise you would note any other learning principles observed and ideally each learning principle would have a description in the same row of column 4.

You may note more than one instance of any learning principle during a five minute interval especially if they are discrete and separated by other activities. For example, an instructor may end one guided demo and then spend a couple of minutes answering questions and then begin another guided demo within one 5 min observation interval. Go ahead and note "SP" when the first guided demo ends and then "LC" (learning check) as the instructor asks questions and then "SP as the next guided demo begins. It's okay to record learning principles at a higher level of precision than we will actually report them.

If an activity spans across two time intervals, for example if a guided demo lasts more than 5 minutes, you would briefly describe the guided demo in each interval that it occurs (using ditto marks is acceptable as long it's clear what they refer to) and also indicate any learning principle observed during each 5 minute interval that the guided demo spans.

You only need to complete one row of sheet IIB (PE Guided demo detail sheet) for each guided demo/PE.

To help clarify this procedure, see the example Activity Chronology below.

Part III, Start-of-Course and Final Assessment. There are two groups of questions in part 3. The start-of-course questions should be answered when observing the beginning of the course. The final assessment questions only pertain to the assessment given at the end of the course.

It may be useful to talk briefly with the instructor just before the class begins to learn things like the learning objectives of the class or how the instructor intends to assess proficiency at the end of the class. Otherwise most of these questions should be addressed in the instructor's opening comments

IIA. Activity Chronology

ACTIVITY CODE	VID – video	DEM – demonstration
G/D – guided demo	PE – practical exercise	REV – review
BRK – break	TEST – quiz, exam, etc	LEC – lecture

SHEET NUMBER: 1
Observer: Jones
Date: 9-Feb, 2006

LEARNING PRINCIPLES	**MA** – uses **M**emory **A**ids	**RM** – **R**elates to **M**ilitary operation
EA – **E**ncourages **A**ctive learning	**PP** – **P**urpose and **P**ath	**RP** – **R**elates to **P**revious content
EP – **E**mphasizes **P**ractice	**RG** – **R**elates to **G**eneral knowledge	**SP**– points out unique **S**creen **P**rompts or cues
LC – **L**earning **C**heck	**RL** – **R**esponds to **L**earners	**dL –** Uses techniques specific to **dL**

Num	Activity Code	Time	Description of topics covered and instructor/student behaviors	Learning Principles
1	LEC	0815	Reviewed what they would cover for the day and reminded them of upcoming PE	PP
			told students to power up systems, answered questions from students	RL
2	G/D	0820	Inst provided steps to build 3D maps. Two students asked clarifying questions	SP, RL
		0825	cont G/D to 3D maps. Stopped multiple times to answer student questions, appears	SP, RL
			to be a problem with workstations. No AI is present so instructor is troubleshooting	RL
3	DEM	0830	nobody can build 3D map so instructor just demonstrated. Explained operational uses	SP, RM
4	G/D		Began a G/D to locate and select a map. Inst had to help some student properly configure	SP, RL
			their machines	
		0835	continued G/D on selecting a map	SP
		0840	continued G/D. stopped to repeat steps for a student. Reminded students there are	SP, RL
			multiple ways to accomplish this task. Asked students to describe alternatives.	RP, LC
5	G/D	0845	G/D on selecting "Battle Mode" and book marking maps. Inst notes activities 2 – 5 are	SP, RP
			a review of previous day's work.	
		0850	continued G/D. 1 student asked a question about sending bookmarks	SP,RL
6	G/D	0855	clean up system to prepare for PE. Used dual screens (PPTslides vs. System)	SP, PP

Student Observer Instructions

INSTRUCTIONS TO STUDENT OBSERVER

BACKGROUND: The purpose of this project is to observe, record, and report distributed training techniques and the possible effects of those techniques on student learning of digital skills. A key objective of this project is to record student behaviors that occur in a distributed learning environment. As you observe the students please,

- Capture any and all information relevant to how students respond to the instruction – these behaviors could take many forms such as working in groups to complete individual tasks, performing behaviors not related to the instruction, or performing behaviors to show that they are actively engaged in the instruction.
- Observe – listen – record
- Record objective data; note if an entry is based on opinion. We will assess the data later.
- Be unobtrusive; do not interfere. However, it is appropriate to walk around the room or look at individual computer screens to view the students' activity.
- Record as much detail as possible; when in doubt, write it down. (We should be able to reconstruct a mental picture of what occurred.)

>> The OBSERVATION FORM is divided into 3 parts:

- Part I, Class Details
- Part II, Student Observation Form
- Part III, Summary Questions.

Instructions for completing each section are below.

Part I, Class Details. The first page of the data collection instrument asks for details about the classroom. The questions are self explanatory.

Part II, Student Observation Form. Once the classroom instruction begins, please use this form to record the student behaviors as follows:

Column 1 (Num) – Number the classroom activities sequentially on the chronology (use additional copies of the chronology page as needed).

Column 2 (Activity Code) – Use the codes at the top of the page to indicate the type of activity. If more than one line is needed to describe the activity, there is no need to write the activity code for each line.

Column 3 (Time) Note the time that begins **each 5 minute observation period** (see details of time-sampling observation procedure below).

Column 4 (Description/Topics covered) – This space should be used for detailed notes about the student behaviors. Detail is important; it's better to write down too much than too little. Use this space to:

- Briefly describe (two or three words) the nature of the instruction. It is important to link the student behaviors with specific instruction – however, the person observing the instruction at Camp Dodge will record instructor activities in detail.
- Describe the student behaviors in detail – especially when the **Other student Behaviors (OB)** category is noted.
- Note when only single or multiple students are performing such behaviors.
- Provide examples of the student/student or instructor/student coaching or tutoring that takes place.
- Explain any linkage between the current activity/task and previous activities/tasks.
- Note if some steps/points had to be presented multiple times.
- Capture clarifying questions asked by students.
- Record other pertinent information that will assist in understanding what transpired during the activity.

Time-Sampling Procedure: To simplify the quantification of student behaviors, we will use a time-sampling procedure in which we will note whether or not a behavior occurred within 5-minute intervals. During any given 5-minute interval, record a description of the behavior being performed and any relevant student and instructor behaviors in column 4. In column 5 (this can be done in real-time or even at a later time) note which behaviors were exemplified in each row of column 4 (see the example Student Observation Form below).

Using this sampling procedure, you can aggregate instances of each student behavior. For example if an instructor spends 10 minutes in a guided demo explaining how to send an overlay, you would describe the student behaviors that were occurring during this time and rather than tally the number of students who were performing this behavior simply note "AQ" in the 5th column for each 5 min interval that the instructor was doing the guided demo. If multiple students were asking questions, then you could note this in the description column, column 4.

You may note more than one student behavior occurring during a five minute interval, especially if the instruction changes. For example, an instructor may end one guided demo and then spend a couple of minutes answering questions and then begin another guided demo within one 5 min observation interval. Go ahead and note all of the behaviors that occur during this timeframe. It's okay to record behaviors at a higher level of precision than we will actually report them.

If an activity spans across two time intervals, for example if a guided demo lasts more than 5 minutes, please indicate that this is the same demo as in the previous time interval. However, you may use "ditto" if the student behaviors are the same (see the example Student Observation Form below)

Part III, Summary Questions. The Summary questions should be answered after each observation period.

Part II Activity Chronology

ACTIVITY CODE	VID – video	DEM – demonstration
G/D – guided demo	PE – practical exercise	REV – review
BRK – break	TEST – quiz, exam, etc	LEC – lecture

SHEET NUMBER: 1
Date: 9 Feb 2006
# of Students: 20

Student Behaviors	**OB** – **O**ther student **B**ehaviors are observed	**SM** - Instructor takes over **S**tudent's **M**ouse
AR - **A**sks instructor to **R**epeat step	**NP** – Multiple students do **N**ot **P**ay attention to the lecture/demonstration	**UO** - **U**ses **O**ther functions than those for current task
AQ - **A**sks instructor a **Question**	**PA** - Pays attention to lecture/PowerPoint presentation/Demonstration	**WF** – Multiple students **W**aits for others to **F**inish task/PE
GS - Works in **G**roups to **S**olve individual tasks	**PC** - **P**eer **C**oaching (Seeks/Gives help)	**WA** - **W**orks **A**head of instruction but on same task
IS - Works **I**ndependently to **S**olve problems	**RQ** – **R**esponds to instructor **Questions**	
LB - **L**ags **B**ehind instruction	**SC** - **S**ide **C**onversations during instruction	

Num = Number the classroom activities (Activity Codes) sequentially

Activity Code = Use the codes at the top of the page to indicate the instructional activity

Time = Record student behaviors for every 5-minute block of instruction

Descriptions = Capture examples of behavior; if **OB** is used please describe behavior in detail

Student Behaviors = Use codes of student behaviors; If behavior is observed once in a 5-minute period then record the behavior; If multiple students are observed performing the behavior then note that in the Description column.

Num	Activity Code	Time	Description of topics covered and instructor/student behaviors	Student Behaviors
1	LEC	0800	Lecture on maps. Students listen to lecture, pay attention to PowerPoint slides.	PA
		0805	Con't lecture maps, ditto	PA
		0810	Con't lecture maps, ditto	PA
		0815	Con't lecture maps, ditto	PA
2	DEM	0820	Steps to build 3D maps. Two students asked clarifying questions.	AQ
		0825	Con't Demo 3D maps. Student works ahead of instructor and builds his own 3D map.	WA
3	G/D	0830	G/D 3D maps. Several students cannot keep up with the instructor.	LB
		0835	Con't G/D 3D maps. Instructor takes over mouse of one student to show him the steps of building a 3D map.	SM

SHEET NUMBER: 2
Date: 9 Feb 2006

Num	Activity Code	Time	Description of topics covered and instructor/student behaviors	Student Behaviors
	G/D	0840	Con't G/D 3D maps. Several students finish ahead of the instructor.	WF
4	G/D	0845	G/D to locate and select a map. Several students ask the instructor to repeat several steps.	AR
		0850	Con't G/D on locate and select a map. Student creates text messages.	UO
		0855	Con't G/D on locate and select a map. Students ask and receive help from fellow students on selecting a map.	PC
5	BRK	0900	Break	
		0905	Break	
6	G/D	0910	G/D on selecting "Battle Mode" and book marking. Several students ask questions about book marking.	AQ
		0915	Con't G/D on book marking. Several students talk in pairs.	SC
7	PE	0920	PE on creating and sending messages. Students work individually and in groups to complete the individual tasks specified by the PE.	IS, GS
		0925	Con't PE on messages. Several students ask the instructor questions. Several students ask	AQ, PC
		0930	Con't PE on messages. As students complete the PE, they use other FBCB2 functions.	WF, UO
		0935	Con't PE on messages. One student requests additional help from the instructor.	LB

APPENDIX F

Student Survey Results

Table F1
Results of Student Distributed Learning Survey

Items Frequency (Percent)			**Did Not Learn / Partially Learned**		**Learned All Steps / Became Proficient**	
Class 1 (n = 10); Class 2 (n = 6)			*FBCB2-1*	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*
Extent learned the system			6 (60%)	0 (0%)	4 (40%)	5 (83.3%)
	Hindered Somewhat / Hindered Greatly		**Did not Hinder nor Facilitate**		**Facilitated Somewhat / Facilitated Greatly**	
	FBCB2-1	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*
Extent distributed format affected learning	3 (30%)	1 (16.7%)	6 (60%)	2 (33.3%)	1 (10%)	3 (50%)
	Somewhat Less Effective / Much Less Effective		**About the Same**		**Somewhat More Effective / Much More Effective**	
Comparison to other distributed learning courses	0 (0%)	0 (0%)	2 (20%)	2 (33.3%)	1 (10%)	0 (0%)
Comparison to resident ABCS courses	1 (10%)	1 (16.7%)	3 (30%)	3 (50%)	0 (0%)	1 (16.7%)
	Somewhat Slow / Extremely Slow		**Just Right**		**A Little Fast-Paced / Extremely Fast-Paced**	
Pace of instruction	0 (0%)	2 (33.3%)	5 (50%)	3 (50%)	3 (30%)	0 (0%)
	Never		**Only during Certain Topics**		**Throughout Entire Course**	
Worked ahead of the instruction	4 (40%)	4 (66.7%)	4 (40%)	1 (16.7%)	1 (10%)	1 (16.7%)
Sought assistance from fellow students	0 (0%)	1 (16.7%)	7 (70%)	3 (50%)	3 (30%)	2 (33.3%)
Assisted other students	1 (10%)	0 (0%)	7 (70%)	3 (50%)	2 (20%)	3 (50%)

	None		Some		All	
	FBCB2-1	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*
Extent instructor answered all questions and provided clarification of steps and procedures	0 (0%)	0 (0%)	1 (10%)	1 (16.7%)	9 (90%)	5 (83.3%)
	Not		**Somewhat**		**Very / Extremely**	
Extent engaged and motivated to learn throughout the course	0 (0%)	0 (0%)	2 (20%)	2 (33.3%)	8 (80%)	4 (66.7%)

Student comments for the scaled responses above included the following:

- Instruction was too fast only when computers were slow.
- Transceiver Mgt too fast/unnecessary - should be a field rep or S6.
- When I needed help, instructor took over and just started hitting buttons.
- Recommended using one map or area of the world.
- Without an instructor on-site, we were able to help each other work through issues which was good for the team and increased learning.
- Tried to relate what was being done to something that they know, i.e. setting up an address book, setting up their x-box, etc.
- Great instructor! He asked questions/repeated steps/functions.
- Mobilization pending is #1. Classroom was conducive to learning - individual monitor/stations and instructor motivation and interest.
- It was good training. I wasn't familiar with computers.
- It was just right. Keep it the same.

Table F2
Ease of Learning Different FBCB2 Specific Functions or Procedures

FBCB2 Functions and Procedures Frequency (Percent)	**Very Difficult**		**Somewhat Difficult**		**Neither Difficult nor Easy**		**Somewhat Easy**		**Very Easy**	
	FBCB2-1	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*
Prep for Combat Configure Role; Clear Logs and Queues, etc	0 (0%)	0 (0%)	1 (10%)	1 (16.7%)	2 (20%)	3 (50%)	5 (50%)	1 (16.7%)	2 (20%)	1 (16.7%)
Messages Prepare/send Cbt Msg; Spot Report; Addressing, etc	0 (0%)	0 (0%)	2 (20%)	0 (0%)	1 (10%)	4 (66.7%)	6 (60%)	2 (33.3%)	1 (10%)	0 (0%)
Navigation Tools CLOS; LOS; Periodic Reminders, etc	0 (0%)	0 (0%)	3 (30%)	0 (0%)	4 (40%)	4 (66.7%)	3 (30%)	1 (16.7%)	0 (0%)	1 (16.7%)
Orders Prepare and send Warno / Opord; Attach Overlay, etc	0 (0%)	0 (0%)	4 (40%)	1 (16.7%)	3 (30%)	3 (50%)	3 (30%)	2 (33.3%)	0 (0%)	0 (0%)
Overlay Messages Create Objects; Save/Send Overlay, etc	0 (0%)	0 (0%)	6 (60%)	1 (16.7%)	2 (20%)	3 (50%)	2 (20%)	1 (16.7%)	0 (0%)	1 (16.7%)

Table F3
Effectiveness of Different Instructional Activities

Instructional Activities	**Very Ineffective**		**Somewhat Ineffective**		**Neither Ineffective or Effective**		**Somewhat Effective**		**Very Effective**	
	FBCB2-1	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*	*FBCB2-1*	*FBCB2-2*
Demonstration of steps and procedures **without** the students using the system to follow along	4 (40%)	0 (0%)	1 (10%)	1 (16.7%)	0 (0%)	1 (16.7%)	5 (50%)	3 (50%)	0 (0%)	1 (16.7%)
Guided demonstration of steps and procedures **with** the students using the system to follow along	0 (0%)	0 (0%)	0 (0%)	1 (16.7%)	0 (0%)	0 (0%)	7 (70%)	3 (50%)	3 (30%)	2 (33.3%)
Lecture / PowerPoint slides	0 (0%)	1 (16.7%)	2 (20%)	0 (0%)	3 (30%)	1 (16.7%)	4 (40%)	2 (33.3%)	1 (10%)	2 (33.3%)
Practical Exercise	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (20%)	1 (16.7%)	3 (30%)	1 (16.7%)	5 (50%)	4 (66.7%)
Video	0 (0%)	0 (0%)	1 (10%)	0 (0%)	4 (40%)	1 (16.7%)	4 (40%)	0 (0%)	0 (0%)	2 (33.3%)
Review of material that was covered	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (16.7%)	7 (70%)	3 (50%)	3 (30%)	2 (33.3%)
Test – quiz, exam	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (20%)	0 (0%)	5 (50%)	2 (33.3%)	3 (30%)	3 (50%)

APPENDIX G

ACRONYMS AND ABBREVIATIONS

ABCS	Army Battle Command System
AI	Assistant Instructor
ALM	Army Learning Model
AQ	Asks Instructor a Question
ARFORGEN	Army Force Generation Model
AR	Asks Instructor to Repeat Step
ARI	U. S. Army Research Institute for the Behavioral and Social Sciences
BCTC	Battle Command Training Center
BCT&DS	Battle Command Training and Distributed System
BRK	Break
CD	compact disc
DEM	Demonstration
dL	Distributed Learning
EA	Encourages Active Learning
EP	Emphasizes Practice
FBCB2	Force XXI Battle Command Brigade and Below
F2F	Face-to-Face
G/D	Guided Demonstration
GS	Works in Groups to Solve Individual Tasks
IS	Works Independently to Solve Problems
LB	Lags Behind instruction
LC	Learning Check
LEC	Lecture
MA	Uses Memory Aids
MC3-RC	Maneuver Captains Career Course for Army National Guard or Army Reserve Soldiers
MEDEVAC	Medical Evacuation
MTTs	Mobile Training Teams
NP	Does Not Pay Attention to the Lecture/Demonstration
OB	Other Student Behaviors Are Observed
PA	Pays Attention to Lecture/PowerPoint Presentation/Demonstration
PC	Peer Coaching
PE	Practical Exercise
POI	Program of Instruction
PP	Path and Purpose
RQ	Responds to Instructor Questions
REV	review
RL	Respond to Learners
RG	Relate to General Knowledge
RM	Relate to Military Operations
RP	Relate to Previous Content
SC	Side Conversations During Instruction

SM	Instructor takes over Student's Mouse
SP	Screen Prompts
SMEs	Subject Matter Experts
TTP	Tactics, techniques, and procedures
TRADOC	U.S. Army Training and Doctrine Command
UO	Uses Other Functions Than Those for Current Task
VID	Video
VTC	Video Teleconferencing
VTT	Video Tele-Training
WF	Waits for Others to Finish Task/PE
WA	Works Ahead of Instruction but on Same Task