

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

Research Report

**Application of Four Digital Technologies to a
Blended Learning Class in Advanced Stability Operations**

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Fort Leavenworth Research Unit

James W. Lussier, Chief

March 2011

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**U.S. Army Research Institute
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APPLICATION OF FOUR DIGITAL TECHNOLOGIES TO A BLENDED LEARNING CLASS IN ADVANCED STABILITY OPERATIONS

EXECUTIVE SUMMARY

Research Requirement:

This research report summarizes the learning and usability impact of four digital learning technologies used during two offerings (Fall 08 and Spring 09) of a new course in Stability Operations (SO) given at the US Army Command and General Staff College (CGSC). These technologies – Defense Connect Online (DCO), Active Worlds (AW), an electronic book (eBook), and an online discussion forum (Forum) – were incorporated into a complex blended learning environment, taught by a live instructor at the College, where students taking the class were a mix of on-site and remote participants. SO requires Army personnel to lead and participate as members of joint, interagency, intergovernmental, and multinational teams. The intent of the research is to provide empirical findings to assist in determining how application of these digital learning technologies influenced the learning experiences of students participating from a variety of locations and agencies.

Procedure:

A combination of qualitative and quantitative data were collected during the two offerings of the SO course as researchers took notes while observing on-line class presentations/discussions and conducted on-line surveys of participants' reactions to the four digital learning technologies. The SO course is organized into 12 2-hour class sessions. The first six provided academic instruction in the fundamentals of SO, where DCO was the "collaborative environment" for the virtual classroom. The first class was devoted to course introduction, participant introduction, some technology "checks," and basic introduction to SO. The next five classes were organized around the five sectors of SO: security, justice & reconciliation, humanitarian assistance, governance, and economic stabilization. Typically, a guest speaker gave a 30-45 min. presentation based on their experience in some SO capacity. Speakers were remotely located and had a mix of military and civil experience. The remaining six classes involved student role-playing as members of a Sudan Planning Team (SPT), where their task was to identify and develop several courses of action in Sudan that would be briefed to the UN Security Council. In Fall 08, these sessions were held in AW, a virtual world environment that resembles the on-line game, Second Life. In Spring 08, AW was only used for several optional planning sessions; the formal class sessions were held in DCO. In both classes, a discussion forum was used as a means of posting class assignments and providing attached reading materials. In the Fall 08 class, students were given an eBook (the iLiad) for reading the particularly large class reading assignments, such as the SO field manuals.

The course is intended for military officers at the O-4 level, so most students had considerable operational experience in some aspect of SO. In Fall 08, there were six students officially enrolled in the course, with four taking the class locally at Fort Leavenworth and two others attending "remotely." There were also three others auditing the course from diverse locations. Other frequent participants included representatives from Department of State (DOS), TRADOC, USAID, and other agencies. In Spring 09, there were six official students and one student auditing from Europe.

A series of Likert-scale surveys was conducted throughout each course. A 50-item pre-course survey of participants' prior use of the four digital learning technologies (and preferred methods of information sharing) was posted on-line during the first week of the course. Mid-way through the course, four on-line surveys, one for each technology, was posted in successive weeks to gauge participants' reactions to their in-class experience with DCO, AW, eBook, and forum, respectively. At the end of the course, a 50-item summative survey was posted that solicited participants' overall reactions to the technologies, comments on ways to improve the course, and comparisons among the technologies on select aspects of learning. Survey data were collected on-line and analyzed using SurveyMonkey, a low-cost web-based survey service.

Findings:

DCO. Access to DCO by non-military computers was not possible until the appropriate DOD root certificates had been accessed. Bandwidth and connectivity problems were prevalent, particularly during the Fall 08 course. Dropped audio was especially a problem, and resulted in considerable loss of comprehension. Use of chat was viewed favorably by all participants, and was a valuable supplement to the inconsistent audio. Part-way through the course, the video feature was deleted due to insufficient bandwidth for the number of course participants. Technology checks were time-consuming, and resulted in late start-up for most sessions. On the other hand, the audio and technical problems were much reduced in the Spring 09 course, although video continued not to be used. DCO, as an academic collaborative environment, has PowerPoint and other impromptu whiteboard materials to support lectures, group discussion, and student presentations. Other than PowerPoint, these materials were underutilized, due to a combination of factors including difficulty of use, lack of training, and in some cases, absence of advance planning. Nevertheless, the surveys revealed that most students preferred DCO over AW as an environment for promoting learning.

AW. AW was given high marks for ease of use, but was not viewed as contributing significantly to students' learning about SO. The modeled environment for the course was principally classroom settings, where students could select avatars and then navigate manually or via teleporters. In Fall 08, avatar navigation was viewed as a major negative, distracting the student from learning and, in some cases, posed a true obstacle to the student reaching the designated meeting point in time for a session. The supplemental materials available to support learning – prescribed “bots” as Sudan subject matter experts (SMEs), whiteboards, breakout rooms, and web sites to support research – were all underutilized due to difficulty of use, lack of instruction, and in some cases, inconsistent functionality. For these reasons, AW was not used as the required medium for sessions 7-12 in the Spring 09 course, but only as a between-class, optional group planning environment. Specific recommendations are provided throughout the report for how the individual features of AW could be modified to create a more effective learning environment.

eBook. Only students officially enrolled in the A523 Fall 08 course used the eBook in this research. Students overall found the eBook very easy to use and considered it valuable for the class. They particularly viewed it as useful for reviewing reference material, but noted that it would have been more valuable had additional field manuals (FMs) and joint publications (JPs) been pre-loaded on the device. The interface with the Internet did not appear to be enabled for this course, so its ability to receive updated information (via the iRex web site) was not utilized. However, it appears to have considerable potential for providing access to large-volume material that would simply be too daunting if obtained via the Web or some other means. Also, its

capability to receive the latest updates in doctrinal publications would seem to hold considerable promise for future applications.

Forum. The primary uses of the Forum for the course were to read posted information from the instructor, directions for accessing specific material, articles to download, and feedback surveys to complete. The Forum was used more extensively in Fall 08, where more remote participants were involved. Students liked the Forum as a way to have all course-related information in one location, although its internal organization was viewed as confusing by some. Despite some technical difficulties accessing information, most participants were comfortable with this method of obtaining information and liked having updated information about the course in one location. The Forum was not used, however, as a means for socializing, communicating with the presenters, following-up on class discussions, or participating in on-line discussions.

Utilization and Dissemination of Findings:

Lessons Learned. Based on our observations of the course and analysis of the survey data, we offer six lessons learned about incorporating digital learning technologies into blended learning courses. One, voice is the primary medium for information exchange, so that preservation of its quality and continuity is critical to the learning process. Other media, including video, chat, e-mail, and PowerPoint, while important, are only supplements to the primary voice modality. Two, it is important to determine the most effective technology to meet the needs of the course objectives and use the simplest technology that will get the job done. Students prefer familiar technologies to sharing information (e.g., telephone, e-mail), so more advanced technologies should only be dropped into a blended learning course if they have true value-added for the learning process. Three, bandwidth limitations will continue to place obstacles on who can and cannot participate, so that planning should be done in advance of any class or exercise. Until these bandwidth and connectivity issues can be resolved, it is important to restrict non-student participation to those who are contributing to the class in either technical or substantive ways. Four, because of the large number of complex technical issues that must be addressed in any blended learning application, high levels of IT support will be needed and should be made available. Five, blended learning is a much slower process than face to face instruction, so that one must plan for a slower pace and incorporate more time for course sessions as needed. Finally, it should be recognized that exploratory environments are not the same as learning environments. That is, a learning environment, where the primary focus is on information sharing and communication is different from a three-dimensional setting where free-form navigation, exploration, and visualization are promoted.

Recommendations. Five recommendations for future offerings of the blended learning course are provided. One, consider having an earlier start time and/or a longer session length to compensate for the inevitable technical problems. Two, consider having a dedicated helper to the course instructor whose job would be to respond to chat messages, e-mail, and conduct communication checks. Three, prior to class start-up, the Army could hold a short tutorial on optimal methods of presenting material within a blended learning environment. Four, as part of the course preparation, it would be advisable to create an IT steering group with responsibility to support troubleshooting technology problems at the various participant sites. Finally, instructors might consider holding a brief, one-hour tutorial on the skills and procedures needed to access DCO (including using its interface) and navigate with AW (including avatar manipulation).

APPLICATION OF FOUR DIGITAL TECHNOLOGIES TO A
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Introduction

Stability Operations (SO) requires Army personnel to lead and participate as members of joint, interagency, intergovernmental and multinational teams. Advanced Stability Operations A523 is a new course at US Army Command and General Staff College (CGSC) that provides Army personnel with a better understanding of SO. A523 is presented as a blended learning course that includes multinational, interagency and intergovernmental students working together. It provides a unique opportunity for multiagency collaboration.

This research report summarizes the learning and usability impact of four digital learning technologies used during the six week period from 29 October – 3 December, 2008 (Fall 08) and from the four-week period from May 4, 2009 – June 4, 2009 (Spring 09). The technologies – Defense Connect Online (DCO); Active Worlds (AW); an electronic book (eBook); and an online discussion forum (Forum) – were incorporated into a complex blended learning environment, taught by a live instructor at the College, where students taking the class were a mix of on-site and remote participants. The intent of the research is to provide empirical findings to assist in determining how application of these digital learning technologies influenced the learning experiences of students participating from a variety of locations and agencies.

Procedure

Researchers observed (qualitative) and conducted surveys (quantitative) of participants' reactions to the four digital learning technologies. There was at least one researcher present, via on-line connection, at every class.

The authors' roles in the class were as observers and outside evaluators, and at least one of the authors (often more than one) was present, via on-line connection, at every class. While we did provide input on occasion and did offer some suggestions from time to time, our primary role was to observe, take notes, and conduct on-line surveys of participants' reactions to the four digital learning technologies. Our work on this project was jointly funded by the United States Army Research Institute for the Behavioral and Social Sciences (ARI, contract no. W91WAW-07-C-0004) and the US Army Training and Doctrine Command (TRADOC, contract no. W912SU-08-P-0054).

The report is divided into five sections. We begin by describing the particulars of the Advanced Stability Operations course, including its content focus and objectives, the types of students who took the class, and how the course was organized relative to the four digital learning technologies. We then describe the technologies themselves, focusing on how each was used in the present context. We next summarize our observations of the class sessions, including our own experiences with the technologies, comments from other participants, and qualitative accounts of problems, workarounds, and successes. We then report the results of the on-line surveys that were administered throughout the course, including surveys of each technology that were given mid-course, as well as a final, follow-up survey that asked respondents to compare the four technologies on various dimensions. We conclude the report with some final comments regarding our observations and survey results, and then present lessons learned from the class experience and offer recommendations for use of these technologies in future blended learning courses.

A523 Advanced Stability Operations Course

A523 is offered by the Department of Joint Interagency and Multinational Operations within the College and is intended to facilitate coordination by emphasizing topics of interest to DOS repre-

sentatives, such as adopting a whole of government approach; building capacity in host nation (HN) security forces; and establishing allegiance, trust, and confidence of the people in the region of interest. The tight DOD-DOS linkage in conducting SO is formalized within FM 3-07 in terms of the five US government (USG) sectors and their corresponding DOD “pillars:”

DOS		DOD
Sector 1: Security	----- >	Pillar 1: Establish Civil Security
Sector 2: Justice & Reconciliation	----- >	Pillar 2: Establish Civil Control
Sector 3: Humanitarian Assistance & Social Well-Being	----- >	Pillar 3: Restore Essential Services
Sector 4: Governance and Participation	----- >	Pillar 4: Support to Governance
Sector 5: Economic Stabilization	----- >	Pillar 5: Support to Economic & Infrastructure Development

This course gives students an in-depth exposure to the tactics, operations, strategy, and doctrine associated with Stability Operations (SO). As described in FM 3-0 (Operations) and FM 3-07 (Stability Operations), SO entails maintaining or reestablishing a safe and secure environment while providing essential government services, emergency infrastructure, and humanitarian relief. Under Department of Defense (DOD) Directive 3000.5, SO enjoys the same priority as combat operations (offensive and defensive), and is entitled to comparable resources for execution and training. Because the lead agency for SO is the Department of State (DOS, specifically the Department of Coordination for Reconstruction and Stabilization (S/CRS)), DoD entities may operate in a designated lead role or in a support capacity. In turn, this places a premium on DOS-DOD interagency coordination for successful execution of SO missions.

Participants came from a diverse gathering of agencies, including the military (DOD), DOS, coalition partners, the various United Nations (UN) organizations, other agencies such as the US Institute of Peace (USIP) and US Agency for International Development (USAID), and non-governmental organizations (NGOs). The application of digital learning technologies was intended to facilitate interagency coordination and reinforce information sharing among these diverse groups.

Course Objectives and Content

The primary course objective is to obtain, through reading, discussion, and practical exercises, an in-depth understanding of the elements that comprise a comprehensive, effective SO mission. From thorough analysis, the student should understand the implications of SO at the tactical, operational, and strategic levels. At the enabling level, students are expected to comprehend how Army doctrine supports each of the five USG sectors listed above as well as demonstrate an understanding of how the key concepts in FM 3-07 relate to each of these sectors. Besides FM 3-07, students are expected to read a series of recent publications (e.g., portions of FM 3-24, Counterinsurgency) describing the genesis of SO as a mission as well as historical accounts of how SO evolved to its present form.

In addition to receiving a military perspective, the course provides students with readings and guest speakers from civilian sectors (e.g., US Institute of Peace, Department of Peacekeeping and Stability Operations Institute) with expertise in such areas as peacekeeping, international

relations, post-conflict resolution, justice and reconciliation, and cultural awareness, among others. Students were expected to read FM 3-7 and critically assess its treatment of the five sectors from their own experience and perspective. In conjunction with the academic information, students were expected to demonstrate, through a series of practical planning exercises, the core principles of SO as applied to a real-world region, the Sudan. The five-sector approach that was the organizing theme of the academic focus in the first half of the course is used again, in the second half of the course, to structure the Sudan SO planning exercises.

Students and other Class Participants – Fall 08

The course, an elective offering by the College, was intentionally kept small in anticipation of bandwidth constraints on use of the digital technologies. There were six students officially enrolled in the course for credit, with four taking the class locally at Fort Leavenworth and two others attending “remotely” from other locations. Besides the official students, there were three others auditing the course, in diverse locations (Iraq, Scandinavia, East Coast (USA)), resulting in a total of 9 students for the purpose of assessing learning impact. As well, there were two individuals from DoS and one Naval Postgraduate School student (by correspondence) who participated remotely. There was also a smattering of other individuals who were present at some of the classes in an exploratory or observation capacity. These included several foreign liaison officers, representatives from TRADOC, and associated instructional technology (IT) staff from the College. Depending on the session, anywhere from 6 to 10 (including the authors) of these non-students were present during classroom presentations and discussions.

The course is intended for military officers at the O-4 level (Major) and, as such, represents individuals having considerable operational experience. This was evident during the participant introductions, as the students had extensive prior experience in various peacekeeping and SO-related roles throughout the world, including such places as the Middle East, Serbia, and Africa. The non-students, too, had extensive SO-related experience and their comments added immeasurably to the value of the course. Technology issues aside, this breadth and depth of experience made the student contributions highly informative – hence one of our focus issues quickly became identifying which aspects of which technology promoted student interactions and the associated high-value information sharing.

Students and other Class Participants – Spring 09

For the Spring course, there was six officially enrolled students, one student auditing the course from abroad (Europe), and second student auditing the course because of an interest in the topic and how it was presented. All six formal students were local to Fort Leavenworth. The students had a broad range of SO-related experience, including working in the military police, Judge Advocate General (JAG), and civil affairs sectors. One student was originally from an East African nation. Unlike the Fall 08 course, there was no connection to DOS in the course as schedules could not be coordinated. However, there were several frequent observers to the class (besides the authors) who were based on the East Coast.

Course Format and Organization – Fall 08

The course is organized into 12 class sessions or seminars, each lasting two hours. The first six were focused on academics, where Defense Connect Online (DCO) was the “collaborative environment” for the virtual classroom. The first class was devoted to course introduction, participant introduction, some technology “checks,” and basic introduction to SO. The next five

classes were organized around the five sectors, where typically a guest speaker gave a 30-45 minute presentation on their experience in some SO capacity. Speakers were always remotely located, and they attempted to use DCO to provide a voice presentation and supporting slides. They came from the US Institute for Peace (USIP) and the US Army Peacekeeping and Stability Operations Institute (PKSOI). Besides the class presentations, students were asked to critically evaluate a section of the FM 3-07 and gave a short in-class synopsis of their critique. The voice, chat, and PowerPoint (PPT) capabilities of DCO were used to support the presentations for each student.

Throughout the course, information on each class session (e.g., start time, readings, content, other assignments, speakers) was posted on a discussion forum hosted by Partners International Foundation (PIF)/Center for Applied Innovation (CAI), a not-for-profit organization. Students were told that all information relevant to the course, including documents (as pdf attachments) and web links, could be found on the forum. Notably, e-mails were not used to disseminate course information, only the forum. The forum was also used to host three tutorials, developed by Stottler-Henke, that incorporate historical case studies to promote understanding of SO planning concepts.

Besides the forum, official students in the course were given, for use during the six-week period, an electronic book (eBook) distributed by eBook Outfitters and manufactured by iRex, a company based in the Netherlands. The eBook is a lightweight, monochrome tablet with button-activated (or via stylus) page turning capability along with selected annotation and linking features. A number of the course readings, including the voluminous field manuals, were pre-loaded on the eBook for student use.

The remaining six classes “met” in Active Worlds, a virtual world environment that resembles the online game, Second Life. For the second half of the course, the students were organized into a Sudan Planning Team (SPT) whose task was to identify and develop several courses of action (COA) in Sudan that were to be briefed to the UN Security Council. Students were asked to role play various aspects of the SPT, with several tasked to represent the US African Command (AFRICOM) planning staff, others serving as USG Integration Planning Cell (IPC) members, and the remaining students assigned to be either coalition liaison officers (LNOs) or Sudan-based UN representatives. For each of the AW-based classes, students selected an avatar, entered the virtual classroom, and, during some of the sessions, then broke up into their separate planning cells and convened in one of the CGSC breakout rooms to perform their specific planning activities. Students created PPT slides summarizing the interim and final products of their COA analysis throughout the exercises. Interestingly, two subteams were formed towards the end of the course, one tasked with looking at a military-oriented COA and the other a civilian-focused COA. The latter subteam had a Humanitarian Assistance (HA) focus, but their COA could include some military forces (e.g., UN PK forces, AFRICOM forces) for security purposes. The AW virtual environment was used to support intra-subteam brainstorming and inter-subteam integration of COA concepts for a final, end-of-course presentation to the (fictional) USG Special Envoy and USAFRICOM Commander. Course Format and Organization – Changes for Spring 09

The course format and organization remained much the same for the Spring 09 course, with the following exceptions. First, because AW is not allowed to run on military computers, it was not used as the principal environment for the second half of the course. Instead, students would continue to meet sessions 7-12 within DCO. They would, however, be allowed to use AW on

their own personal computers for several work sessions scheduled by the students between classes. We will report on the nature of these outside-of-class work sessions in the Results section. Second, eBooks were not utilized during the Spring 09 course. As a result, we only administered three digital learning technology surveys, with the mid-course eBook survey omitted. We also deleted any reference to eBooks in the Final Course survey. Third, during the second half of the course, in which a Sudan planning exercise was to be conducted, the course would be administered by two experts from the Army War College. Both experts were AWC students, one a Marine LtCol and the other an Army COL, had extensive experience in conducting SO with both strategic and operational knowledge.

Four Digital Learning Technologies

Before discussing the qualitative and quantitative results of our evaluation, it will be helpful to provide a more complete – yet still abbreviated – description of the four digital learning technologies and how they were used in the A523 course. Each technology is therefore briefly described below in its own subsection. Our intent here is to give the reader sufficient technical details of the technologies so the relative learning impact findings may be interpreted within an appropriate context.

Defense Connect Online

DCO is an enterprise collaboration tool that is designed to support large group, geographically distributed presentations, real-time communication, and shared work. A joint product of Carahsoft and Adobe, with open source contributions by the Jabber Software Foundation, DCO may be considered a lower cost alternative to the widely-used InfoWork Space (IWS) tool that DOD has employed for the past several years to conduct briefing and planning sessions in both operational and training settings (IWS FEB 2008). With a DCO Web portal as an entry point, users can be scheduled to convene at a common time (such as a class time) where they may sign as either guests or via a user name and password. Capabilities of DCO include voice over Internet Protocol (voIP), instant messaging or chat (via the Jabber-based Extensible Messaging and Presence Protocol (XMPP)), small-screen streaming video and dynamic screen content. Compared to the higher per-seat cost of IWS, DCO is touted as a practical alternative in which users are not required to download large amounts of dedicated software to run the capability on their own computer. For the present application, course participants required only an up-to-date Adobe Flash plug-in for their browser and three current DOD security certificates to enable secure browser-based communications.

The basic screen interface that appears on the user's workstation or laptop is depicted in Figure 1. Once the user has signed in and been "let in" by the DCO meeting manager, the application appears on top of the user's desktop with the interface configuration like that shown. The segments of the interface are called "pods." The upper left pod displays named icons (based on the user's sign-in name) or a picture of that person if they have a web camera. This is the region where both audio and video control is exercised. With permission from the moderator, the user may click on a talk button to speak to all who have presently signed in. To simplify the interactions, the moderator might elect to go "hot mic," in which case the moderator speaks uninterrupted by other attendees. If desired, the moderator can give hot mic control to another speaker so they may enjoy the same privilege. In all cases, a green bar appears next to the icon or video of the individual who is speaking. If the user has a web camera, they have the ability to either freeze their image for a still shot, have the video of them stream to the group, or have it removed

altogether (and revert to an icon). As each new person signs in, the icons/video of the others will re-size so the total space used for this feature remains the same. When the number of signed-in participants gets large, the space devoted to an individual icon/video becomes correspondingly rather small.

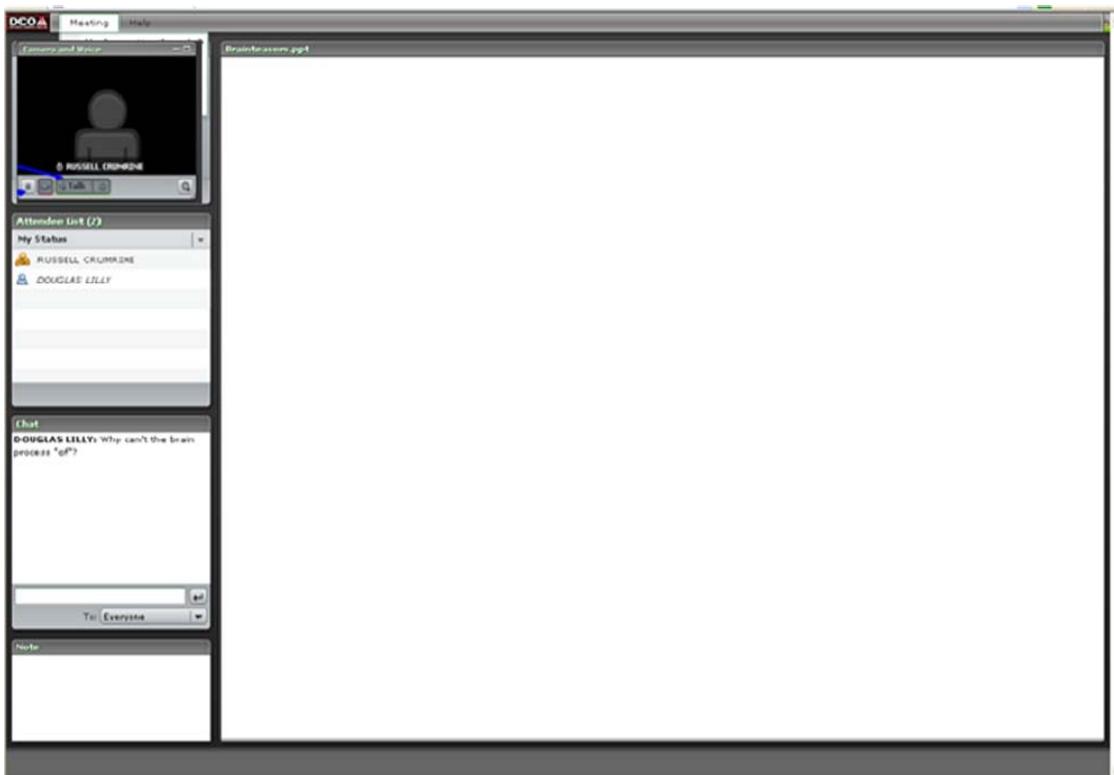


Figure 1. Basic interface for Defense Connect Online.

Below the icon/video pod is the list of attendees who are presently signed in to the meeting room. The list is presented in alphabetical order by screen name, with the moderator always on top. Thus, when a new person enters the room, the entire list is altered to preserve the alphabetical order.

Below the attendee list is the chat pod. The lower portion of the pod has a box that allows the user to enter chat text which is then sent to the meeting room by pressing a small button to the right of the box. Below this is the TO drop-down menu, which lets the user determine who receives the chat message. The default is a public message to everyone in the room, although the user may change the setting in the menu to send a private chat to an individual in the meeting room. In the chat window, the user sees, in chronological order (i.e., most recent message on the bottom), the public messages that have been sent by everyone, with their user name attached to the message. Private chats the user has been having are shown (only to them and the recipient) in the window in colored text. As chat messages continue to come in, the user will have to use the scroll bar to bring earlier messages back into view.

The lower left pod is for Notes that can be taken by the moderator and then displayed to the group. This feature was not used in the present application of DCO.

The main screen area is devoted to white board presentations. Typically, this will be used for PowerPoint presentations, although other applications can be loaded there as well. The moderator has default control over what is displayed there as well as the relative size (within the portal) that appears on attendees' screens. When a guest speaker is presenting, as occurred in this course, then the moderator will relinquish control of this area to the guest speaker so they may control the pace of their own presentation.

DCO was used as the virtual classroom for the first six class seminars, and served in a limited capacity for the last six sessions, principally as a backup to AW when problems were encountered.¹ Class participants were given a specific URL and time for accessing each class session. The first link was sent via e-mail, with the subsequent ones posted on the forum. When the user clicked on the link, they entered the DCO portal, where they remained until the moderator granted access to the "classroom." Once there, the user would see the icons/video of participants who had entered previously, with whatever chat had occurred. When accessing the system, the user would have to work through audio wizard to ensure compatibility with the voIP setup. The moderator, who was always the course instructor, would start each class period with a "comm. check" to ensure that everyone's voice could be heard by the class. With the technical details out of the way, the class would begin. The primary means of communication was by voice, where the video streams of the participants played a minimal role. The white board was used for PowerPoint presentations, which initially contained the lecture material of the instructor. In later sessions, it was used for the guest speaker presentations. The instructor controlled the flow of the class, where chat was used by students to ask questions or ask permission to speak. This was done instead of having participants click their talk button unannounced, as that would result in disruptions and general confusion. Depending on the nature of the topic, and on the overall quality of voice communications, much of the class discussion in DCO was done with chat and the majority of questions asked of the instructor or the guest speakers were chat-based as well.

Active Worlds

AW is a 3-D virtual world that runs with a browser plug-in connecting to servers that are operated or licensed by Activeworlds, Inc. Access to AW requires a relatively unrestricted connection to the Internet to ensure unfettered communication with the AW servers. This requirement has limited its availability to some users working from DOD (.mil) or DOS (.gov) computers. Similar in concept to the online game Second Life, AW lets users select an avatar which is then able to move through the virtual environment in three dimensional space (LIA, 2008). After installing the executable file (plug-in) on one's computer, the user enters the world with a pre-approved user name and password. For this course, a "world" had been created (IBM was the contractor) that participants could explore, which included several buildings, information centers, and various meeting rooms. An example of the main virtual classroom is shown in Figure 2.

Avatar movement is managed through the four arrow keys, allowing the user to move up, down, left, or right. To move faster, the user holds the control key with the arrow key. The up and down movement allows the avatar to in effect "fly" through the environment, where one's view is correspondingly changed. A more efficient method of movement is by teleporting, in which a

¹ This was the case only for the Fall 08 course. In Spring 09, DCO was used as the principal meeting place for all 12 class sessions. AW was only used for two extra-class planning sessions.

pull down menu in the upper part of the screen allows the user some options for immediate movement to pre-arranged locations, such as a particular room or information center. As indicated in Figure 2, avatars can either be standing or sitting, where one clicks on a seat to have the avatar sit down. As with flying, the avatar's vista changes with his/ her position. There are some other options for avatar movement that are less productive but potentially enjoyable, such as walking backwards or even dancing.



Figure 2. The virtual classroom created within Active Worlds for the A523 course.

There are several other aspects of viewing this world that influence how one experiences the AW virtual environment. First, the user can set their view point to look straight ahead, up approximately 30 degrees, or down the same amount. This determines what the user sees in the virtual world, and is useful when, for example, one wants to look down at the table when sitting. Second, the user can set the “visibility” or how far ahead one can actually see in the world. This can be set for particular distances or be defaulted to a more normal type visibility that gradually degrades with distance. Third, the user can set their view perspective. With a first person view, the user does not see their own avatar but sees everyone else’s literally “through one’s own eyes.” A third person view lets the user see their own avatar in the world, with the eye point behind and slightly raised above their avatar.

For the course, users were given several options for avatar appearance, including a male or female Army or business-dressed person. Typically, the system remembers one’s choice of avatar from a previous visit so that one need not select an avatar. This can cause problems, however, when one is in the first person view since if the user has failed to select an avatar, they appear in the world as a small purple box with their name – which is always in white text – embedded in the box. The user’s name appears in white text above their avatar so they can be recognized by others in the environment.

AW has voice and chat capabilities comparable to those in DCO. A panel in the upper left of the screen lets the user see a list of who has entered the world as well as an indication of who is presently talking. They also use this window to control the volume of their own voice when speaking as well as the volume of the voices they hear. Below the main world screen appears a text chat box, detachable from the world window, which displays a chronological listing of text

messages that have been sent by visitors to the world. As with DCO, one can "chat" either in public, to everyone, or privately to a designated individual.

There are a host of other features available in AW, only some of which were used in the present application. For instance, distributed around the world are various "bots," automated avatars that can be queried for information. These bots have pre-scripted dialogue that can be initiated when asked the right question, either by voice or text chat. Also, AW can be configured to have an organized set of Web links that take users to specific Web sites depending on what they click on. These links can be grouped by topic and located in various information centers or kiosks. When the user clicks on the link, the Web site appears within the AW environment, so the user does not have to leave AW to view the Web site. However, the corresponding window for this information is smaller than a normal full-page Web screen, which can make viewing difficult.

For the course, AW was made available to participants by having each go to a web link and download the AW executable from TRADOC. In fact, the use of AW within the course is part of TRADOC's series of experiments to determine the relative effectiveness of virtual worlds to promote student learning within a blended learning environment. To support the present application, the AW environment consisted of a CGSC virtual classroom, various breakout meeting rooms, and information centers where students could go to obtain information about Africa and the Sudan. These rooms and centers could be accessed either through avatar movement or through teleporting. One bot was present that could be consulted as a subject matter expert (SME). This bot was in the Sudan Center. The CGSC classroom and breakout meeting rooms each had a bot that had to be queried to gain control of the presentation screen.

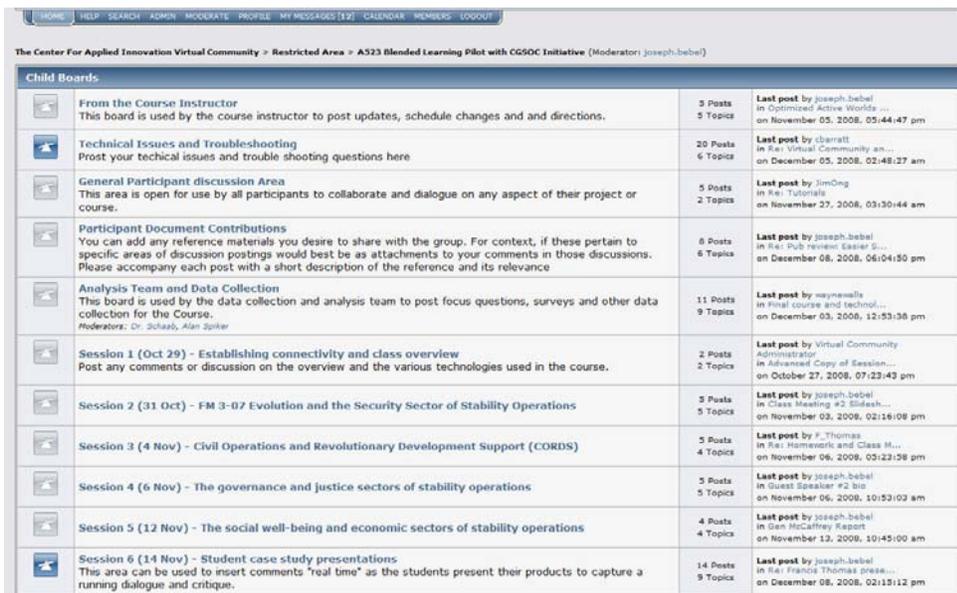
In the Fall 08 class, the last six sessions were held in the AW environment, in which students were told to enter AW at a specific time and date; this information was conveyed via the forum. As with DCO, comm. checks were initiated to ensure that everyone could both receive and convey voice, and text chat was used to ask questions and issue confirmations. Though not used often in this application, there were small white boards within the classroom where PowerPoint presentations could be loaded. Voice was the preferred method for conveying information, where as with DCO the instructor acted as moderator and controlled "who had the floor" when speaking. AW was used by the instructor to convey information to students regarding assignments and planning exercises they were to perform. It was also used by students to have group and subgroup meetings, in which their avatars met in the same room and exchanged information by text chat (mostly) and (less often) by voice. Occasionally, the white board feature was used to display PowerPoint presentations; this capability was primarily used during the last several class sessions when the group's agreed-upon courses of action in Sudan were presented.

In the Spring 09 class, AW was not used for any of the formal class sessions. It was, however, used for two outside-class planning sessions. These were scheduled during the previous class session, where students had AW installed on their personal laptops and held the session remotely located from one another. The capabilities of AW for the Spring 09 class were identical to that in the Fall 08 course.

Besides the formal class assignments, there were occasions during the classes when group discussions were held involving all participants, students and non-students alike. These discussions tended to be a combination of voice and chat, and depending on the topic, one medium was used more than the other. The avatars for all participants were visible during the discussions, which certainly gives the appearance of a true virtual conference.

Forum

Discussion forums, or Forums as they are more generally called, are designed to support asynchronous, organized discussions among multiple participants on topics of mutual interest. Hierarchically organized, the superordinate topics or categories are established by the Forum site manager, where the topic names, listings, and organization can be modified based on the density of postings that occur. The manager can grant limited-access permission to other users for control of intermediate categories. Subordinate topics are defined by the users with the subject names they use in their postings. Unlike blog comments, which are listed simply in chronological order of time posted, Forums give users the ability to see discussions organized by topic, and can set up their access to the Forum to show only topic posts they have not yet read. They can also arrange to have e-mail notification of new posts in topics they are particularly interested in. While a variety of software products are available to support Forum sites, the A523 course used by the Forum currently is hosted by CAI/PIF, which uses a tool built on forum software offered by Simple Machines©, LLC. An example of the layout for the CAI/PIF forum is displayed in Figure 3.



The screenshot shows a forum interface with a navigation bar at the top containing links for HOME, HELP, SEARCH, ADMIN, MODERATE, PROFILE, MY MESSAGES (197), CALENDAR, MEMBERS, and LOGOUT. Below the navigation bar is the forum title: "The Center For Applied Innovation Virtual Community > Restricted Area > A523 Blended Learning Pilot with CGSOC Initiative (Moderator: Joseph Bebel)".

The main content area is titled "Child Boards" and contains a table listing various forum categories. Each row includes a category name, a brief description, the number of posts and topics, and the most recent post information.

Category	Description	Posts	Topics	Last Post
From the Course Instructor	This board is used by the course instructor to post updates, schedule changes and directions.	3 Posts	5 Topics	Last post by Joseph Bebel in Optimized Active Worlds ... on November 05, 2008, 05:44:47 pm
Technical Issues and Troubleshooting	Post your technical issues and trouble shooting questions here	20 Posts	6 Topics	Last post by liberratt in Re: Virtual Community an... on December 05, 2008, 02:48:27 am
General Participant discussion Area	This area is open for use by all participants to collaborate and dialogue on any aspect of their project or course.	5 Posts	2 Topics	Last post by JimOng in Re: Tutorials on November 27, 2008, 03:30:44 am
Participant Document Contributions	You can add any reference materials you desire to share with the group. For context, if these pertain to specific areas of discussion postings would best be as attachments to your comments in those discussions. Please accompany each post with a short description of the reference and its relevance	8 Posts	6 Topics	Last post by Joseph Bebel in Re: Pub review: Easter S... on December 08, 2008, 06:04:50 pm
Analysis Team and Data Collection	This board is used by the data collection and analysis team to post focus questions, surveys and other data collection for the Course. Moderators: Dr. Schaeff, Alan Spiker	11 Posts	9 Topics	Last post by waynawells in Final course and technol... on December 03, 2008, 12:53:36 pm
Session 1 (Oct 29) - Establishing connectivity and class overview	Post any comments or discussion on the overview and the various technologies used in the course.	2 Posts	2 Topics	Last post by Virtual Community Administrator in Advanced Copy of Session... on October 27, 2008, 07:23:43 pm
Session 2 (31 Oct) - FM 3-07 Evolution and the Security Sector of Stability Operations		3 Posts	5 Topics	Last post by Joseph Bebel in Class Meeting #2 Sidech... on November 03, 2008, 02:16:08 pm
Session 3 (4 Nov) - Civil Operations and Revolutionary Development Support (CORDS)		5 Posts	4 Topics	Last post by F. Thomas in Re: Homework and Class M... on November 06, 2008, 03:23:58 pm
Session 4 (6 Nov) - The governance and justice sectors of stability operations		5 Posts	5 Topics	Last post by Joseph Bebel in Guest Speaker #2 bio on November 06, 2008, 10:53:02 am
Session 5 (12 Nov) - The social well-being and economic sectors of stability operations		4 Posts	4 Topics	Last post by Joseph Bebel in Case Hecaffrey Report on November 13, 2008, 10:45:00 am
Session 6 (14 Nov) - Student case study presentations	This area can be used to insert comments 'real time' as the students present their products to capture a running dialogue and critique.	14 Posts	9 Topics	Last post by Joseph Bebel in Re: Francis Thomas pres... on December 08, 2008, 02:15:12 pm

Figure 3. Category listings in the Forum used in course A523.

As seen in the figure, the Forum home page provides a layered listing of the contents of the site, as the user must click on a given superordinate category, such as Session 2, to see the topics and posts associated with that category. There is thus a tradeoff between having an at-a-glance listing of the categories contained in the site and the subsequent direct entry of mouse-clicks to probe deeper into a category to see its topics and posts. Because the user will usually have to drill down several layers to find a topic and the associated posts of interest, it is imperative that the organization of categories be done carefully, with the users' information requirements and preferences in mind. Indeed, after one has delved several layers deep into a Forum's hierarchical organization, it is easy to "lose the thread" of what brought them there in the first place. A navigational tool to help alleviate this problem is a "bread crumb" menu or a series of

categories/subcategories/topics that the user clicked on to get to his/her current location in the Forum. The bread crumbs can be seen in the top line of Figure 4, where one starts with the CAI virtual community as the highest order category, and progressively moves into subcategories (Restricted Area, A523 Blended Learning Pilot, etc.). Figure 4 also shows some of the topics that would appear when the user has clicked on the category Session 2.

Subject	Started by	Replies	Views	Last post
Class Meeting #2 Slideshow	joseph.bebel	0	18	November 03, 2008, 02:16:08 pm by joseph.bebel
Bio on Today's Guest Speaker (10/31)	joseph.bebel	0	20	October 31, 2008, 07:59:29 am by joseph.bebel
Note on Homework	joseph.bebel	0	18	October 29, 2008, 07:07:00 pm by joseph.bebel
3 Homework Articles to Read for Friday, Oct 31st	joseph.bebel	0	17	October 29, 2008, 07:02:03 pm by joseph.bebel
URL for Class Meeting #2, October 31st	joseph.bebel	0	21	October 29, 2008, 06:09:59 pm by joseph.bebel

Figure 4. Topic listings in one of the Forum categories used in course A523.

The Forum was used in a variety of capacities throughout the A523 course, particularly during Fall 08. As can be seen from Figures 3 and 4, the Forum was organized at the higher level by class session, so that students would go to the upcoming session number (1, 2, ... 12) to obtain necessary information for that session. Once there, the student would find the URL to access DCO for that session (for sessions 1-6 in Fall 08) as well as information on homework requirements for the session, readings (typically in pdf format), slide presentations, and even notes from the previous class sessions. If desired, the student could create their own topic to generate a discussion of some course-related topic (e.g., experiences in Sudan) as well as posting their own attachments. The attachment process is fairly straightforward, as it follows basically the same logic and procedures as with e-mail. However, there are size limits on attachments, and this posed some technical challenges on occasion during the course.

In a very real sense, the Forum served as the “information glue” throughout the Fall 08 course since it was the one source of information that participants depended upon when problems arose with the other digital learning technologies. In particular, the Forum allowed the instructor to include technical information for course sign-on, posts for course content, as well as specific guidance on what the students were to accomplish before the next course session. Since this was a blended learning exercise, where students and other participants were geographically distributed over multiple time zones, the instructor’s logistic requirements for keeping everyone informed would have been overwhelming without some means of asynchronous information management. The Forum served that role throughout the entire course.

The Forum received far less extensive use in Spring 09. In part, this was because there were fewer “extended entities” involved in the class, so that the course instructor simply e-mailed to a select list of participants (about 10) the DCO link for the upcoming session as well as any other messages (e.g., about course assignment, guest speaker) pertaining to the session. The Forum was still used as a way for central posting of some attachments and there was an occasional message posted, but by and large e-mail was the primary means of conveying information during the Spring 09 course.

eBook

Electronic books or eBooks are the digital technology equivalent of a printed book, where the document is displayed on a dedicated hardware device called an eBook reader. After a long, protracted start, there are now a number of eBooks on the market, each with their own set of advantages and disadvantages. Prior to the A523 course, TRADOC conducted an in-depth trade research to identify the eBook reader best-suited for the blended learning environment. Among such candidates as Amazon's Kindle and Sony's Reader, they settled on the iLiad manufactured by iRex and distributed within the US by eBook Outfitters. A depiction of the iLiad is provided in Figure 5.

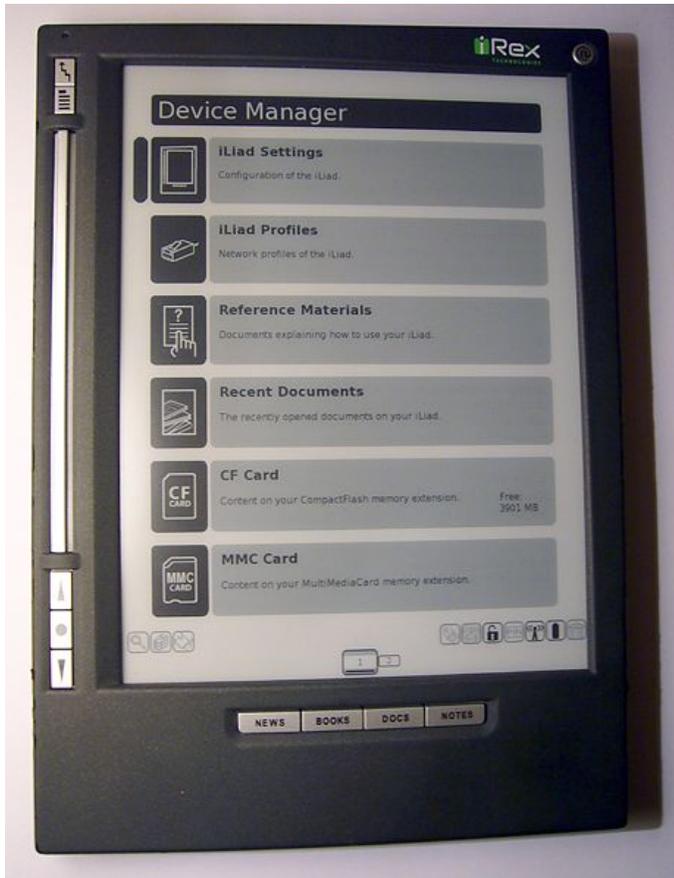


Figure 5. The eBook – iLiad – used in the A523 course (Note: not to scale).

The physical and functional features of the iLiad are briefly described here, and will serve as a useful framework for considering the capabilities of electronic books in general compared to their hardcopy counterparts. The iLiad was selected by TRADOC for this experiment primarily because of its display size (8.1-inch diagonal), resolution (1024 X 768), light weight (14 oz), high screen brightness, and perhaps most importantly, its ability to display content of any type on the device, not just content supported or maintained by the manufacturer. With its Linux-based operating system, the iLiad allows the user to load many types of content on the device (text, HTML, Adobe PDF, and mobipocket). If the user has control of the original document, virtually any type of content can be formatted for display on the iLiad's 8.1-inch screen. The ability to

have unrestricted content is an absolute must for blended learning courses where a wide range of continually-updated content (as with field manuals, doctrine, slide presentations, etc.) must be accommodated.

The device is intended to emulate as much as possible the advantages of a paper book, while incorporating useful electronic functionality. Its dimensions (6.1-inch width x 8.5-in. height x .6-in. depth) give it the size of an A5 document, equivalent to a 6”x9” stenographer’s notebook. The metal bar on the left of the display can be pressed (left or right) to turn the pages just like in a book. The “soft” keys on the display allow the user to fast-forward or hyperlink throughout the documents as an alternative to linear reading. A touch screen and stylus capability lets the user access documents and pages quickly, where the stylus can be used to annotate pages (like a highlighter); these annotations can then be stored permanently (but separately) along with the document. The device comes with a wireless capability that lets the user connect to the iRex web site to obtain the latest software modifications to the system or in future releases to possibly download other content. There is also a USB connection so the user can transfer content directly from their computer to the iLiad. The battery life of the device, a key issue for this technology, is reasonably long, on the order of 8 hours of constant “real world” use. The device can display images of several types of formats (JPG, BMP, PNG), but only in monochrome. The screen contains 160 pixels per square inch, with a total resolution of 1024 x 768 pixels.

In Fall 08, the iLiad was issued as a six-week loaner to all formal students in the A523 course. We had no direct observation of its use by the students since they were either at Fort Leavenworth or Fort Monroe. The authors did receive several iLiad demonstration units, courtesy of eBook Outfitters, which helped form the basis for survey questions and gave us a context for interpreting the student comments on the survey. Prior to the course, selected course content was pre-loaded on the iLiad units assigned to the students. This included several field manuals and selected articles on Stability Operations. There was no further requirement for students to download other content, such as through the device’s wireless capability, and as far as we know no one did so. Students liked being able to download classroom materials and have these materials in a single location, although due to the slow speed of the eBook, it sometimes was difficult to keep pace with the instructor when using eBooks in class. As noted earlier, eBooks were not used at all during the Spring 09 course.

Observations of Class Activities – Fall 08

This section summarizes our observations of the experiences that students and other participants had with the digital learning technologies during the six-week Advanced Stability Operations course offered in Fall 08. Our observations were focused principally on strengths and weaknesses of the technologies to support the objectives and vision of the course. As such, we will delve only lightly on issues of course content and instructional pedagogy, and then only as they relate to the application of the technologies. These observations are intended to serve as a prelude to the quantitative survey results that are presented in the subsequent section.

Pre-Course Issues

The week before the class was to start, e-mails were sent to participants informing them of a specific time when a “technology check” would be performed to ensure that everyone could access DCO, the collaborative environment that would be used for the first six sessions. Also in the e-mail was the URL link to enter the DCO portal as well as information concerning the DOD security certificates that would be needed to allow each individual’s computer to access the DCO

software. Because DCO is a military application, non-DOD users needed to download specific DOD Root certificates; military users could obtain that access through their CAC cards. However, since the course is designed to promote collaboration between DOD and non-DOD organizations, it is important to establish reliable means for connecting DOD and non-DOD computers for shared access to virtual environments.

This connection turned out to be more difficult than anticipated. In particular, the initial identification of the necessary certificates was unsuccessful since several of the specified certificates had expired or were not present as expected. An independent Google search by one of our IT specialists identified the updated and missing certificates required for non-DOD access to DCO. Once these were identified and the URL links e-mailed to the non-DOD participants, all were able to access the DCO site. As a result of this unexpected activity, only participants with DOD computers could participate in the initial “tech check.” Therefore, a second “tech check” had to be scheduled for the day before the class was to start to include the non-DOD participants.

Because of the difficulties in getting the certificates identified as well as the multiple time zones encompassed by the geographically distributed participants, there was never a time before the first class started that everyone could get together for a technical checkout. Indeed, some participants were not able to join in at all until the first class session. The inability to get all the technical issues ironed out ahead of time imposed severe time demands during the first class, as discussed below.

Class Start-up with DCO

The initial class session was devoted to ensuring that all participants could successfully connect to DCO as well as transmit and receive audio. To ensure that the participant’s voice could be heard, it was necessary to work through the calibration steps in the DCO audio wizard. This was a little unsettling since it took the user away from the DCO environment while the steps were accomplished. Since connectivity was not always reliable, there was a natural tendency to assume that something had failed when in fact it was just a delay in receiving a signal. This was most evident during periods of silence when some participants, the authors included, thought the audio had failed when actually there was nothing being said. Distinguishing periods of silence from lost audio was made more difficult because the green talk bar that identified the currently active speaker was not always working and even when it was, it was not always visible once the number of participants exceeded a dozen or so, so that the icon/camera pod in the upper left of the interface was quite crammed with symbology.

During the first class, there were enormous demands on the instructor who encountered multiple interruptions due to technical, administrative, and logistical issues. The participant introductions, for example, took a long time since there was the inevitable delay in waiting for the person to respond, where time-outs were required to talk some of the participants through the audio wizard calibration steps. Also, the bandwidth of the individual participants influenced the type of signal delay they encountered, adding further to the introduction time. Looking at the icon/camera pod, we saw that some participants chose to have a continued video feed of themselves, others had a still frame (i.e., camera pause), while others entered only with an icon, either by choice or because they did not have a web camera. As it turned out, the visibility of the participants in the icon/camera pod was not very useful other than the added global “presence” of seeing background scenes from participants who were in faraway places such as Iraq. When the

interruptions became too much, the instructor wisely went “hot mic” to keep control of the pace and limit future disruptions.

In addition to the technical delays noted above, there was also considerable time devoted to establishing connectivity with several of the particularly “remote” participants, one located in Iraq and another in Ghana. As might be expected, these locations were especially challenging and while DCO did permit periodic access to voice and video, the connectivity was not maintained throughout the session. Although we were able to have a fairly reliable connection with one of the participants from Iraq, our other Middle East-based participant (a USAID representative who traveled to several countries during the class sessions) and our Ghana representative had very limited participation.

By the time all the introductions, technical comm. checks, audio calibrations, and re-establishment of lost connections with remote participants were completed, fully one half of the class time from the first session had passed. Over the first six class sessions, it was fairly common that anywhere from 10-30 minutes was needed to complete the technical communications checkout. In fact, this start-up procedure was so time-consuming that by mid-way through the course, a protocol had been established that the class would not begin (i.e., course content would not be delivered) until 15 min. after the official start time. This procedure was also used throughout the last six sessions, when AW was the collaborative medium.

Connectivity, Bandwidth, and Interactivity Issues with DCO during Sessions 1-6

As the instructor worked through the technical issues during the class startup, the problems with DCO connectivity and bandwidth requirements became apparent. First, there was considerable dropped audio, where some of the speaker’s words dropped out, making it difficult to extract meaning. This is particularly a problem when there are no accompanying slides, as when the instructor is providing course information or discussing course requirements for students. The loss of audio varied with the participant, and was more of a problem for participants who had less capable servers and networks. The students at the College, who were using the resident network, fared better, but at times everyone had difficulty.

Use of Video. The extent to which participants used the video aspect of the DCO communication pod varied. While a consistent video presentation would have helped supplement presentations, particularly when audio was dropped, there were simply too many participants using the system for video to be effective. In addition, the green talk bar, which indicates who is talking, was also not effective, either because it did not always work for a given speaker or because for some participants there was sufficient ambient noise through their microphone that the green talk bar would come on even when they were not speaking. This was unfortunate since it made it difficult to tell who was talking since recognition of an individual’s voice was problematic due to distortions and delays. The authors’ experience with the audio was mixed, as the extent and frequency of dropped audio seemed to decline over sessions. However, it was always a factor and made it difficult to determine, when there was silence, if it was due to lost audio or to simply not having anyone speaking at that time.

Connectivity problems with DOS were particularly acute, and plagued communication throughout the entire course. For example, the DOS participants tended to experience more dropped audio throughout the course than others, and they were unable to transmit voice within DCO. The reasons behind these problems were not entirely clear, though it was compounded by the lack of dedicated IT support on the DOS side as well as having a less capable network, lower

bandwidth, and older computers. These issues will need to be addressed in the future as DOD and DOS increase their efforts at coordination within Stability Operations and other mission areas.

Guest Speakers. Similar technical issues also arose when the course brought in guest speakers. Specifically, speakers were slated to give presentations on the different SO sectors – governance, justice, economics, etc. – beginning in class session 2. Speakers within the military, either co-resident at the College or from the PK Department at the War College, were able to present their information via DCO, although there were audio problems with one speaker. Locations not able to use DCO included the US Institute of Peace and a speaker from PKSOI who need to connect while TDY. As a workaround, the speaker “called in” their presentation on speaker phone and went “hot mic” for all participants to hear. This method worked surprisingly well, in part due to a drastic reduction in dropped audio. On the other hand, the instructor had to handle the PPT slides for the speaker, which resulted in some inevitable lags, lack of synchrony, and occasional confusion. It also eliminated the possibility for students to ask questions since the handling of voice communications would be too confusing over speaker phone. As well, chat was not an option since the speaker was outside the DCO environment. As a fallback, students were encouraged to follow-up the guest presentations with questions that could be asked within the Forum. It did not appear that this opportunity was used very much, which is to be expected since it would have had to occur after the session was over.

Differences from Face-to-Face Classrooms. As one listened to the various presentations, either within DCO or outside (via speaker phone and hot mic), the authors were struck by how this blended learning is quite different from a face-to-face classroom. First, one is almost totally dependent upon audio to convey information and meaning, with the video capability of DCO virtually disregarded. It is quite clear that certain speakers are more effective in this “voice-only” environment, because they: (1) speak slowly enough, with sufficient pausing, that the periodic dropped audio is not a hindrance to extracting meaning; (2) speak loudly enough that everyone can hear them; and (3) use slides containing more text information than usual to help supplement the inevitable dropped audio. Indeed, the speakers who only had pictures for slides, without accompanying text, failed to perceive that much of the impact of their presentation was lost on participants who were struggling just to hear them and understand every second or third word – that is a very difficult way to comprehend someone’s message.

In considering the challenges to speaking in this environment, presenters should liken their experience to someone who is talking to a non-English speaking audience where their audio must be simultaneously translated into the audience’s language. The authors have had this experience, and it requires a very different style of presentation to be effective. Thus, one must speak slowly, clearly, audibly, with frequent pausing to help the translator catch up, and to monitor the group for understanding. Frequent references to graphics are particularly helpful in this situation just as they are in the blended learning environment. In short, instructors, guest speakers, students, and other participants in a blended learning environment must realize that the demands on communication are much greater, and quite different, than they are in a live classroom.

Technology Glitches. There were other instances where technology glitches added to the general confusion and made it difficult to comprehend what was going on. For instance, when a speaker went “hot mic” during a presentation, that feature would occasionally get stuck, precluding the class from asking questions via voice. While the chat capability afforded the opportunity to ask questions, a period of time inevitably ensued when the speaker and/or

instructor had to troubleshoot what had happened and attempt to rectify the situation. These glitches, as with the others, took time away from presentation of course content. In addition, if participants used voice (instead of chat) to ask a speaker a particularly long question, there was a problem with the rest of the class following the discussion when audio was lost during the lengthy transmission. The use of chat, either as the primary method of asking question or as a supplement, and asking shorter questions, are certainly more effective ways for querying speakers during a blended learning class.

Session #5. By session #5, the instructor had discontinued the use of video altogether in DCO, so that only a series of static icons were displayed in the communication pod. Apparently, when the number of participants exceeds 10 in the present DCO application, the limited bandwidth is overwhelmed by excessive video, resulting in the loss of audio that we had been experiencing. This change did appear to help the audio problem, as the episodes of a lost audio were less frequent and less disruptive. Since the video had been little-used anyway, this turned out to be a good solution for the class. Unfortunately, the DOS participants were still not able to transmit audio; the talk/record function in their DCO application was inactive for some reason.

However, even by the fifth session there were still technical problems that were fairly disruptive. For example, the instructor learned that an unannounced server change had been made in the CGSC library where they were holding their class, which resulted in multiple shutdowns of Windows from their machines and hence a loss of DCO for all participants. Later on, it was discovered that with the new server the class could only be held for two hours before the connection would shut down. Since the instructor and his IT staff were accessing the server some 15 min. before the official start time, for purposes of setup and connectivity checks, this meant that the class ended 15 min. early once the 2-hour period had elapsed. This problem caused a premature termination of sessions #4 and #5 until the source of the problem was identified.

Server Problems. With the server change at the College, the instructor experienced periodic losses of audio beginning in session #4 that generated considerable downtime during the last three sessions for which DCO served as the virtual collaboration environment. For instance, during several guest speaker presentations, the instructor lost audio and was thus not able to follow what was being said. Since he was also controlling the slides for the guest speaker, this loss of audio was quite problematic. As these connection problems were experienced, they manifested themselves in other disruptive ways, such as the instructor not being able to download some PPT files in advance. This downloading, which could take a while, sometimes had to be done during class, resulting in some lengthy downtime periods for participants.

Another problem caused, we think, by the server change was the need for the instructor and resident students to restart their systems several times during class. This restart, in turn, necessitated that each user had to renew their permissions to enter DCO, all of which took considerable class time. In addition, the remote participants were unaware of this occurrence initially, since all that was apparent to them was another period of unexplained silence. This happened several times and appeared to be a consequence of a “hiccup” with the server’s connection with the Internet.

In session #6, the registered students gave formal presentations on specific aspects of FM 3-07, which was a graded event. Unfortunately, one of the students’ voice transmissions kept getting lost, and there were problems with his connection supporting a hot mic capability. He eventually was able to present. This particular episode, in which the student was required to use a

combination of voice and chat to communicate, pointed out the difficulties in multi-tasking that audiences are faced with as they must monitor both media, as well as take notes. This presents a fairly stiff cognitive challenge to students and other participants, not to mention the instructor who must grade the activity.

Unique Aspects of Blended Learning. Because the periodic loss of audio requires speakers to repeat themselves and pause, individual presentations take longer than expected. As a result, there was little if any time for participants to query the students regarding the assumptions they were making or to solicit any amplifying information about their rationale or thought process. Indeed, it was all the instructor could do to fit the presentations, sans question periods, into the allotted time. The compressed pace of the presentations was unfortunate, as it represented a lost opportunity for the students and other participants to gain from an extended dialogue on highly focused Stability Operations topics. While follow-up questions to individual students were occasionally asked via the Forum, a temporal discontinuity between presentations and feedback is not instructionally very effective. Students did, however, post their analyses on the Forum which were then assessed and critiqued by the instructor. Once again, the Forum served quite well in an adjunct instructional role.

Another aspect of blended learning that should be kept in mind is the difficult burden placed on students who are not speaking in their native language. In the present case, several of the students were foreign exchange officers who, despite being relatively fluent in English, nonetheless have noticeable accents that are harder to comprehend in a static-laden communications environment where dropped audio is frequent. Couple this aspect with the natural tendency for people to speak softer when they are stressed, and it is inevitable that communication to a widely dispersed, distributed audience becomes much harder. Speakers were invariably asked to turn up their transmission volume (which did help some), yet it is difficult to know how loud one is talking or how well they are being heard. In the absence of visual feedback, with the video stream turned off, speaking in these settings is hard since one is never really sure how they are being heard or understood. As an interesting aside, the resident students do have immediate feedback in that while they are all communicating via DCO, they can still hear and see each other since they are all in the same room. This, in effect, creates a class within a class as offline communications and more extensive communication feedback can be provided.

The periodic loss of audio and reduced volume has perhaps the greatest impact on comprehension when attempting to hear individual words that carry extensive meaning. In particular, military terminology and acronyms are hard to discern with dropped audio, this being especially problematic for civilians (such as DOS personnel) who are not well-versed in “DOD-speak.” In this regard, the DOS participants recommended having a sheet of acronyms and definitions of terms that could be included in each PPT slide set and would be available for viewing during presentations. They could also be distributed in advance of the class to facilitate DOS-DOD communication.

Class Startup with AW – Session #7

The mid-point of the class, session #7, was the transition to using AW as the collaborative environment. During the end of session #6, while still meeting in DCO, the instructor informed the class of the upcoming sessions in AW, where everyone was told that DCO would be used as the backup environment in case problems with AW were encountered. A URL link was provided in the intervening period, via the Forum, to download the executable file necessary to access the

TRADOC world created within AW. Participants were told that they should enter the TRADOC virtual world and explore the virtual CGSC classroom that had been established. In addition, participants could explore several information centers, also virtual entities that had been set up to provide informational material concerning Sudan, the AOR (area of responsibility) for the upcoming lesson exercises. Once participants had entered AW, they were encouraged to gain familiarity with avatar movement and the general experience of being in a virtual world. Most students availed themselves of this opportunity. Unfortunately, the AW site was not always functional during the period between sessions #6 and #7, and indeed, the authors themselves experienced the unavailability of the site while trying to gain site familiarity.

At the beginning of session #7, one of the authors went in with a pre-assigned user name and password, and began exploring the virtual world within AW. Interestingly, the voice connectivity was quite good as we were able to hear all the students who had logged into the site, including the DOS representatives who we were never able to hear within DCO. However, we were not able to tell who was speaking. Subsequently, the instructor had problems with his own voice connectivity, requiring that everyone go to the backup environment, DCO, to complete the session. It took approximately 40 minutes, after class started, to reach the point where a return to DCO was successfully executed.

Once back in the DCO environment the instructor, having preloaded the slides into the meeting, began. At this point, the instructor gave participants the context for the hands-on exercises that would comprise the remainder of the course. Specifically, the class was told they were to act as a Sudan Planning Team (SPT), where their task is to brief the UN security council on recommended courses of action (COAs) to be taken in the (fictional) USG Special Envoy and USAFRICOM Commander on the recommended courses. The report date for the UN Security Council briefing would coincide with the date for the last class, session #12.

In the last 30 min. of this session, working within DCO, the instructor provided students and other participants the information necessary to conduct the subsequent COA planning activities. This included assigning a particular student to be the SPT leader. This individual, an active duty Air Force officer, had been on a CENTCOM Horn of Africa (HOA) planning team in the past year whose charter was in fact the Sudan region. This student had access to real-world, validated planning materials, which would jump start and facilitate the planning efforts of the students. This student provided some initial briefing on the obstacles ahead for Sudan planning. He was one of the CGSC-resident students in the A523 class, and during his presentation, he was frequently interrupted by a building intercom announcement.

Connectivity, Bandwidth, and Interactivity Issues with AW during Sessions 8-12.

Due to the rash of technical issues in the previous session, Session #8 started with everyone logging onto the DCO site. No video was used (i.e., audio-only) to preserve bandwidth. As the participants grew in number to 14, the relative sizes of the participant icons in the communications pod shrank accordingly, making it impossible to tell who was talking since the green talk button was occluded.

While still within DCO, the student SPT leader gave a short briefing describing a “whole of government” approach to developing COAs for eventual presentation to the UN Security Council. The plan would be to focus on each of the five sectors, individually, considering both military and civilian options to addressing the crises in Southern Sudan and the Darfur region. They would begin with the Security sector, and then consider the others, in turn, in later class

sessions. The students were to return to the virtual CGSC classroom in AW, where they would hold short brain storming sessions to begin developing the plan. The members of the IPC would meet in one of the breakout rooms whereas the students role-playing as AFRICOM planners would meet in another. As observers, the authors would circulate between the rooms to cover both planning subgroups.

After a break, participants returned to AW. Unfortunately, there were voice connectivity problems that made it impossible to hold the planning sessions. One could hear voices in the background, but it was unclear who was talking. We could see participants' avatars, but there was no audio, and in fact, there was no audio icon in our communication panel. As an amusing aside, while in the breakout room for the IPC, we observed that one of the participants had not selected an avatar, and thus appeared as a small purple box. The other IPC participants were trying to join up with that individual, but because of his small avatar size, they could not see him even though he was right at their feet. They eventually did link up by exchanging chat messages, but the incident points up the fact that what one sees in the virtual world is dictated by their viewing angle and direction. Thus, one is not able to see everything in the world and must adjust their gaze accordingly just like in the real world.

After some minutes of attempting to establish voice connectivity, chat messages were sent out by the instructor requesting that everyone return to DCO to complete the session. Apparently, there were some problems with receiving the proper permissions to enter the virtual world with all the desired capabilities, so that voice connectivity and the bots were not enabled. That issue would be addressed before the next session (Session #9) was to be held. We then returned to DCO, where meeting as a single group, Security sector issues were discussed. Unfortunately, the poor audio quality made it difficult to hear everything that was being discussed. Also, the use of slides or a common white board would have been helpful to compensate for the poor audio. However, since even being in DCO for this session was unexpected, there was simply no time to make those types of arrangements.

At the end of the session, the instructor indicated that several planning documents would be posted in the Forum and that they should be looked at before the next session. Also, participants were encouraged to enter the Sudan Center and Africa InfoSphere, located in TRADOC's AW, to review current information concerning the political, economic, and social situation in Sudan. This would provide necessary background information to consider the HA sector and its role in the COAs being developed.

Session #9. The original plan for Session #9 was to start in DCO. However, the DCO router was down so we had to meet in AW. Participants straggled in as they discovered that DCO was down. Most participants, including us, had to telephone in to CGSC to determine what had happened. Once in AW, there was some confusion about which room to be in and some participants were not sure how to make their avatar sit in the chair (this is done by clicking on the chair, but there are no instructions for this). So while waiting for class to start, there is a scene of some avatars sitting, some standing, and some moving around trying to either find the right room or determine how to sit down. The audio was mostly working, although the instructor was not able to hear the voice of one of his resident students via AW.

Session #9 finally started about 30 minutes into the class period, with a brief presentation by one of the participants (role-playing as a UN representative) on the Governance sector. Problems with the speaker's microphone made it difficult to hear, and there was no use of slides, which

would have helped to compensate. Also, none of the avatars were able to sit down for technical reasons, so the entire time all the avatars were standing. For awhile, we had participation from one of the Iraq-based participants, although he later lost connectivity with the session. We are now able to see who is speaking by the green audio bar in the communications panel, which is a great aid.

As a general rule for speaking in a virtual classroom, one requests permission for speaking by having their avatar stand up. That rule was inoperative in this session since all avatars could only stand. Alternatively, participants used chat messaging to request permission to speak from the instructor. As it was, there were several fairly long pauses during the session that again, as in DCO, were unsettling since one was never sure if it was a technical glitch or simply a pause in the conversation.

During a presentation on the HA sector, it would have been helpful to have some of the information supplemented with either slides or a map since Sudan is a large, complex country with multiple regions and diverse populations. A useful capability of AW that was exploited during the presentation was when one of the participants provided a URL link in the chat window to a news site describing a recent outbreak of violence in the Congo region involving refugees from the Sudan. Participants were able to access the site within Internet Explorer while staying in the AW environment. While this exchange was occurring, it was notable that an advantage of chat is that the message remains in the window which can then be consulted later as a cue for further discussion or a memory jogger about some other point. Thus, chat messages are a valuable adjunct to voice during group discussions.

Following the presentation on HA issues, subsequent discussions were held concerning Governance and Economics. During the discussion, the instructor gently reminded the students that the presentations would be more fruitful if everyone had done the background reading prior to the class. Because there is potentially so much information to absorb, it would have been helpful if African subject matter experts (SMEs) on the various sectors would have been available to the class. Whether the SMEs would join the class through AW, DCO, or the Forum, having such expertise available would certainly make the class a richer experience for all participants.

Session #10. This session began in AW, where there was an attempt to start the class closer to its slated schedule. The instructor created some slides for this presentation, but had to wait for IBM (the AW contractor) to upload them. Unfortunately, this coordination process took a long time, and they were forced to begin the class presentation without the desired slides. Following a slide-less briefing by the class leader, the class was divided into two groups, where each would pursue planning on a separate COA. One group (the one with the AFRICOM planner role-players) was to focus on a military-oriented intervention and they would meet in the Security breakout room in the CGSC building. The other group (the one with the IPC role-players) would focus on a non-military-based intervention and would meet in the HA breakout room. During this initial discussion, one of the DOS participants on the IPC subgroup reported having trouble with her audio, and was only picking up every “fourth word or so.” As observers, we would switch between the two breakout rooms to observe each subgroup. Since movement would be frequent, it was convenient that the teleport feature would allow us to navigate immediately by selecting the desired breakout room in the Teleport menu.

We began our observations in the HA breakout room. One of the DOS participants attempted to send a URL link to the rest of the group via the Chat window. Unfortunately, that link did not

work. She later sent a link to a pdf file containing a recent report on UN activities. That link did work, and the report was both timely and informative. It is notable that while there is a white board available in each breakout room, it requires some type of log-in, and was thus not attempted while the class was in session.

While the breakout sessions were occurring, they did finally get the slides up in the main classroom. Interestingly, while observing in one of the breakout rooms, we could hear “disembodied” voices from CGSC, which was focusing on technical issues. These outside audio transmissions occurred on several occasions throughout the later sessions of the class.

We shifted our observations over to the Security breakout room to observe the military subgroup plan their COA. At the time, the focus of the discussions was on measurement and how one could assess success in implementing the COA. One of the participants, the one role-playing a coalition LNO, was providing highly useful insights concerning the ways that Scandinavian countries use their military forces to provide security support in non-provocative ways. Unfortunately, it was very difficult to hear much of what he was saying and indeed, we learned over time, that there were some technical issues with the audio that day. Part of the problem may have been the large number of people who were in that breakout room, as a number of (other) observers were present as well.

In this regard, it was hard to move one’s avatar around in the small room and we had to ask, several times via private chat, for people to move so we could find a place to stand. As a procedural aside, it would have been helpful to have some guidance about how to move and position one’s avatar in the breakout rooms that would facilitate group interaction. Also, it is not clear where the presenter should be since there are no chairs in the room. Curiously, however, we did see one of the participants arrive in the room with their avatar sitting in a chair. This was an IT person who obviously had additional knowledge of breakout room capabilities that were unknown to the rest of us.

Later, there was no voice at all and participants started sending chat messages to inquire as to what to do next. During this exchange, the IPC subgroup leader e-mailed his Fact Sheet to everyone that described some useful planning principles. This, in turn, initiated some delays as people waited for the e-mail to arrive and, in some cases, excused themselves while they printed the document and retrieved the document from the printer. The alternative was to read the Fact Sheet on the same screen as AW (unless they have two displays), which can complicate screen management. Time was then spent quickly reading the sheet prior to holding further discussions regarding security and HA aspects of a civilian-oriented COA. Our observation in this instance, and it was experienced fairly often throughout the sessions, is that participants receive additional materials and must quickly peruse them and incorporate the new information into further thoughts and discussion. This is fairly difficult and represents a faster pace of analysis than is typical in a face to face classroom.

Due to the problems with the audio, discussions about the contents of the Fact Sheet had to be done via chat. Chat discussions are simply slower than voice, so it took longer to work through some of the desired HA issues and the IPC subgroup continued to meet through the break period to ensure all participants’ points of view were heard. We then all reconvened in the main classroom. At this point, the class leader’s slides had been uploaded and now appeared on one of the white boards. There was also a smaller, second board that could be used for slides. To end the

session, the class leader briefed participants in the two subgroups regarding what he is looking for in the COAs relative to each of the five sectors.

Session #11. The class started in AW but was delayed 30 minutes while troubleshooting connectivity problems. During this period, there were numerous issues involved in getting the audio up and running as well as difficulties loading the slide presentation. While the instructor considered returning to DCO, they stayed in AW. By the end of the troubleshooting period, all participants had audio working and only one of the DOS participants lacked the ability to talk.

The class then divided into their planning subgroups and each met in their assigned breakout room. The instructor warned the class that they may not have presentation ability in the breakout rooms, so once again, the small whiteboards were not used in either room. Interestingly, while voice was working in the breakout rooms, it was almost never used. Participants held their discussions almost entirely with chat. The session's activities focused on further development and vetting of the Sudan COAs. Without a visual reference, collaboration on the plans was difficult, and there was considerable evidence in the chat records that participants were struggling to keep track of which document or sector (HA, security, etc.) was being discussed. For instance, it was routinely difficult to know whether the COA plan we were working on was to address a particular sector, such as security or HA, or if it should simultaneously address all of them. Interventions by the class leader and/or instructor were usually needed to resolve that confusion; however, they were floating between the two breakout rooms so their inputs were not always available.

After a break, all participants reconvened in the main classroom where each group presented their plan and then the entire group voted on which plan to follow. The whiteboard was used to tally the votes for each COA. This aid was helpful, and it at least demonstrated that the white board serves a valuable function; hopefully it can be utilized more fully in future courses. Voting was done by sectors, where each COA was compared relative to their ability to achieve success in each of the five sectors. When the final voting was tallied, the plan developed by the military contingent (role-playing AFRICOM planners) was the winner. During the voting, we were asked to vote in the DOS participant's stead on one of the sectors when she dropped out of the world briefly.

Session #12. Prior to class, the instructor was working with the DOS participant to get her voice capability enabled. The distinction was noted between capture volume (what others hear) and playback volume (what the speaker hears). For most of the class, the DOS participant was able to speak and hear, although she lost her speaking ability towards the end of the session. The class leader momentarily lost his view of everything in the world (avatars, chairs, etc) but was able to recover it when he left the room and came back in, which reset the system. The instructor noted that when someone leaves the room and comes back, the volume is automatically reset to the minimum.

Because the class was meeting in the main room, most of the interaction was via voice, with very little put into chat. This final session was a mix of student and participant comments on the class and student presentations. This time, the presentations were supplemented with slides that were displayed on the white board, as shown in Figure 6. This greatly aided communication and clarity.



Figure 6. Use of the white board in Active World’s virtual classroom.

During the student presentations, we realized that, because of our viewing angle and distance, we could not read the contents of the screen from where we were sitting. We had our avatar get up and walk around to try the different views. We noted that there were many spots where the screen could not be seen based primarily on distance and viewing angle. It would seem that for a virtual classroom, the font size of the white board needs to be considered along with the viewing geometry of the room, where every seat should be designed to see the white board, for example. Presentations should be tested in advance and guidelines documented for font size, type, and virtual distance.

Another presentation issue involves the position of the speaker relative to the class. In particular, if the speaker faces the class as a normal speaker would, they have no way to tell if the slides have changed or are correct without turning around. As a result, speakers tended to face their own slides to monitor slide transition, with their backs to the class.

The final minutes of the session were devoted to comments from the students and other participants. One of the participants, not a student but a highly experienced former military officer, offered his opinion that what takes 30 min. in the real world will take triple that in AW. Thus, more upfront planning and review is needed so that less time is wasted during setup. He also cited the severe infrastructure differences between DOS and DOD, including what sites can be connected. He suggested exploring the possibility of having people bring their personal laptops to the class and using wifi even with its bandwidth challenges. He also cited the utility and quality of the Forum as a communication medium, and he utilized it as a way to keep up with the class while he was traveling during the course. He suggested considering training a team to work with the Forum as a productivity enabler in future classes.

Our Iraqi-based participant provided his comments, which unfortunately we were not able to fully comprehend because his audio faded in and out due to bandwidth issues. He found AW challenging due to its variable performance. Despite these challenges, he was surprised it worked as well as it did. He worked with technical support (AT&T, TRADOC) extensively to maintain connectivity, and was impressed with how often he was able to participate. The instructor noted that this was a good test of the ability to get participants from faraway places like Iraq involved in blended learning, and much can be learned from this experience.

One of the military students commented that this was his first time in a SO planning exercise and he learned much from that. He indicated that this experience would have been aided had he been able to interact with and become familiar with the military participants sooner, prior to the course, as this would likely improve coordination. The instructor suggested that this could be arranged by holding some telephone meetings and discussions during the week or two before class started.

One of the foreign LNO participants was highly supportive of the exercise and hoped it would be the wave of the future since people do not have to leave their home or workplace to attend. He looked forward to attending a class in the future when he could select an avatar clothed in his country's military uniform.

The instructor ended the course with his own critique of the technologies. On balance, he was very impressed with the class participants as they exceeded his expectations given the immense technical hurdles that had to be overcome. He would have preferred that AW be kept very simple, as students did not need exotic capabilities like dancing and swimming avatars to navigate. The teleport functions were seen as a great addition in this respect. Significantly, he recommended that AW be considered more for homework than classroom activities.

He also felt that the course showed that DCO was not infallible, and has its own set of technical challenges. Thus, there is a need to look at the respective pros and cons of AW and DCO. While it is a trying experience to get AW up and running, it is actually easier to use than DCO once those initial steps have been completed. His wish was to improve the coordination and interoperability with DOS so that more DOS participation can occur in future classes, where the vexing computer and connectivity problems can be more fully addressed for the next SO course, scheduled for Spring 2009. Our observations for this class are summarized below.

Observations of Class Activities – Spring 09

This section summarizes our observations of the experiences that students and other participants had with the digital learning technologies during the four-week Advanced Stability Operations course offered in Spring 09. Since the format, organization, and pace of the Spring 09 course matches that in Fall 08, we will not repeat observations of content-related activities. However, as before, we will discuss instructional pedagogical issues and how these were either enhanced or hindered by the various technologies.

Pre-Course Setup

To our knowledge, there was no attempt to convene a pre-course meeting to review technology or join-up procedures. Instead, e-mails were sent out to all participants indicating the time and date of the first class meeting. Since all the official students were local, it is likely that any required coordination occurred on a face-to-face basis. Since most computers already had DCO

certificates installed for the Fall 08 course, fewer students had difficulties accessing DCO on the first class session.

Academic Class Sessions 1-6

In the initial session, it was made clear that DCO would only be utilized in audio-only, with no attempt to use the video feed option. This was doubtless a reflection of the bandwidth problems experienced during the Fall 08 course when connectivity became difficult with multiple participants using video. Thus, DCO would be rendered in the audio-only mode, supplemented with chat and of course the whiteboard. For this first session, it took approximately 30 minutes before the instructor was able to get to his first slide. During this time, there were multiple attempts to get the sound working for everyone as well providing speaker capability to participants so they could use their microphones. This initial set-up was marked by extended periods of silence. However, no doubt part of this was because the majority of participants – and all of the official students – were located at Leavenworth and could communicate with the instructor directly. There were only several remote participants, including the authors, who had to rely exclusively on the audio for information.

In contrast to the previous class, the voice quality rendered in DCO was for the most part quite good. There were, to be sure, periods in which the speaker's voice was clipped. However, on balance, everyone's voice came through clearly most of the time. The consistency of the audio added greatly to a positive participatory environment and certainly facilitated the exchange of information. Actual discussion of the course specifics did not begin until 45 minutes into the class period, as there were several delays due to problems with the instructor's voice cutting out. The instructor was able to cover all the points on his agenda and the PowerPoint slides worked fine within the whiteboard function. During this introduction, the instructor indicated that AW would be used as an optional capability between sessions 7 and 8 and perhaps during one other optional period. Also, the instructor indicated that the planning exercise sessions (7-12) would be administered and taught by two instructors from the Army War College who have extensive SO backgrounds. The instructor ended class early by noting that several outside agencies would have individuals "pop in" and observe throughout the class.

Session #2. The second session began promptly at class time.. One of the instructors from the War College was given administrator privileges and took control of the class by using the "hot mic" capability. After class began, several of the students had technical problems, one involving voice and the other a 404 error while logging in. The War College instructor began his presentation with control of his slides residing at Leavenworth. There were some coordination issues early on with the slides, including difficulties advancing in the right direction as well as keeping track of which slide was being discussed. To that end, it would be advisable for any Distance Learning application to have every slide numbered to facilitate communication when problems arise.

The War College instructor obviously had experience with Distance Learning as he carefully explained the desired procedure for "turn taking" when asking questions during the presentation. This discussion had immense payoffs as there was extensive student discussion, with give and take participation throughout the instructor's briefing. This participation is all the more impressive given several technical issues that arose which involved a 5-minute wait while the slides were reloaded. Despite these glitches, the students' involvement in the presentation remained

high and the class participation continued once the slides were reloaded. Eventually, the War College instructor was able to control his own slides which greatly facilitated the presentation.

Besides the slide problems, the speaker intermittently lost voice capability during the presentation. In addition, several of the students had problems with their microphones, a problem that was particularly notable with one student who had an especially soft speaking voice. Also, there seemed to be problems with the Leavenworth network that not only affected voice capability but also necessitated that all local computers periodically refresh, necessitating that users re-log into DCO. Even though the instructor put in a trouble ticket, the cause of the problem was never determined. In addition, it was clear that the Leavenworth students were operating from computers in an open environment as the background noise was occasionally distracting for the remote users such as the authors.

Session #3. The guest speaker from the US Peacekeeping Institute was able to use DCO to present his slides. This stands in contrast to the previous class where such speakers had to call in via telecom and go on “hot mic.” There were nonetheless some fluctuations in the speaker’s audio, several times to the point that it was difficult for anyone to hear him. It appeared to be due to bandwidth limitations on his end, as no other participant encountered volume problems that we were aware of. Nevertheless, the presenter did a good job using chat to field questions and then ask participants to come up on voice when their questions needed amplification.

Toward the end of class, the instructor asked students to post any technical issues they were having as comments within the General Participant Discussion Area of the Forum. This recording of technical issues is a potentially useful feature.

Session #4. The voice check process was becoming more efficient. As was noted during the Fall 08 class assessment, DCO’s listing of attendees in alphabetical order, rather than based on time of entry, is less than optimal when attempting to monitor who has and has not checked in. That is, the list reorganizes (to retain its alphabetical order) whenever someone new checks in. There was also a long period of silence while students were checking in, making it difficult for remote users to determine whether there were technical problems responsible for the silence. Indeed, during the first 15 minutes of class, while waiting for the stragglers to show up, there were intermittent reports of “can you hear me.”

There was some voice clipping of the speaker (from the US PK Institute), though his presentation was for the most part quite clearly heard. For this speaker, students tended to ask questions, some of which were asked privately, making it at times difficult to know what question was being answered. Interestingly, there were several rounds of students asking questions via chat with other students answering the question, also in chat, all the while the instructor was discussing some point verbally. This made for a very rich exchange of information and, within limits, is a very efficient method of information transmission.

The speaker was able to convey most of his presentation without difficulty. However, at least once, the instructor had to reset the speaker’s privileges to allow him to have hot mic functionality and control of the slides. This may have been a network issue specific to Leavenworth, although the root cause is not exactly clear. Since there were few technical glitches during this session, the speaker was able to cover a considerable amount of material regarding the rule of law and its role for an occupying force. Unfortunately, there were not many slides with supporting material, so keeping up with the information flow was a challenge. There was some voice clipping, but not enough to cause any significant loss of information.

During the presentation, the speaker would occasionally stop and respond to the most recent question displayed in the chat window. Unfortunately, older questions, ones that had been in the chat window for awhile, and which were not initially seen by the presenter, would get ignored by this method. Once again during the presentation, it was noted that all the Leavenworth users had to re-log in to their session due to problems with their local network.

Once the speaker finished, with about 10 minutes of class time left, there was a period of silence during which it was obvious that the Leavenworth students were discussing issues with the instructor. Unfortunately, the remote users were not able to track these discussions or tell what was going on before the DCO period ended.

Session #5. The class started approximately on time once again. The speaker, from USIP, was able to use DCO for her presentation. There was a delay at the beginning when, once again, the Leavenworth network required a refresh of all the computers. The speaker's communications were mostly free of clipping or audio loss. Students once again asked questions via chat, where the instructor served as a mediator to ensure that none of the questions in the chat window were missed by the speaker. The slides, which displayed interesting graphic examples of the topic under discussion (use of local and military police to enforce rule of law), did not contain text that would have been helpful as an adjunct to the audio presentation. Other than some problems at the beginning concerning how the hot mic (and associated hands-free capability) should be used, the session was conducted without a hitch. Student participation was high, as the interplay between chat (for questions) and voice was effective.

Session #6. There were technical problems involving microphones with several students seeming to be stuck on the hot mic function. Part of the confusion is that when there are multiple participants the attendee window appears as two vertical stacks, making it difficult to see which mic icon is green (activated). Once the mic issues were resolved, there was another delay as the student presentations had to be loaded. This took a few minutes such that the class did not actually begin until 30 minutes into class time. As a general rule, it would be advisable to have the presentations loaded in advance, particularly when there is to be multiple speakers.

During several of the presentations the camera and voice capability cut out briefly. This required that each user reactivate camera/voice if they wanted to speak. Also, the screen shifted to just a comm. window – the white board disappeared – on several occasions as if someone clicked on it. Each time, the problem was corrected fairly quickly. Because of difficulties in uploading the fourth speaker's slides, the instructor elected to end class early, such that two student presentations would be given during the next class. It should be noted that several of the students posted their slides on the Forum for all to see. This is an excellent practice and should be encouraged for all speakers.

Sudan Planning Exercise Sessions 7-12

Because of difficulties with uploading slides in the previous class, the beginning part of Session #7 was devoted to completing the final two student presentations. During one of the presentations, there was considerable buzzing in the background which was quite distracting for the listeners. Having the local students use computers in an open environment can create sound distractions for remote participants who rely solely on the audio for their information. For some reason, the slides "dropped off" for the fifth student presenter, requiring a system restart. In addition, the instructor's computer starting recycling, causing another delay.

Once the student presentations were completed, the two War College instructors took over. There was another delay as one of the instructor's slides were uploaded. Two files were supposed to be uploaded, but only the first file made it. The instructors began by making student assignments. Like the previous class, several students were assigned the role of AFRICOM Sudan planners. Other class members were assigned the role of USAMIS LNO, UNAMID LNO, and IPC planner. The War College instructor's brief included some basic information on Sudan, including cultural history and important whole-of-government information.

When the discussions involved exchanges of audio information, it became clear that the green mic icon was not an accurate indication of who was speaking. This is valuable information to the listener, but it proved useless since it was not reliable. The War College instructor moved fairly quickly through his slides, where the students were told that their first assignment for the Sudan planning exercise is to perform a Joint Intelligence Preparation of the Operational Environment (JIPOE). They were given a set of slide frames to create the JIPOE information. At the end of class, a time was established for the students to meet within AW to work on the JIPOE. This would occur on off-hours prior to Session #8. For our purpose, we refer to this as Session #7.5, which we discuss below.

Session #7.5. This extra session met in AW. The students and the two Fort Leavenworth instructors were to meet in the world's CGSC classroom. At the start, one student was in hot mic, which created some static. Another student was using private chat by mistake. One of the War College instructors was also in AW for this session along with an observer from TRADOC. There was a pronounced voice echo at the beginning of the session, with several students having trouble getting their avatar to enter the classroom. We did as well, as our teleport function was not working. We were finally able to enter the classroom by using the CTRL SHIFT function in AW to penetrate walls.

There was a very pronounced echo when one of the Fort Leavenworth instructors began talking. Students began asking the instructors questions using a mixture of voice and chat. The questions pertained to how they were to complete the JIPOE slides. The major issue concerned level of detail and how much depth the students were expected to provide. The instructors reminded the students that their analysis and reporting to the (fictional) USG Special Envoy and USAFRICOM Commander at the strategic (vs. operational) level, so it will by definition be at a higher level with less detail required.

Although a white board capability exists in AW, at no time during this session were any PPT slides presented. This was unfortunate since use of the slide capability would have facilitated information exchange and helped to stimulate the students to ask more questions. Slides would also have helped when the War College instructor began talking about a DIME (diplomatic information military economic) framework involving reduced military involvement, where his voice was cutting out. From our vantage point, it seemed like the AW collaborative environment was not conducive to having the students ask questions; this is in contrast to the frequent give and take we were seeing in DCO.

Some of the problems in this regard were technical and some procedural. For example, one student was having mic problems and not able to talk. Consequently, the instructor encouraged him to ask his questions via e-mail. Another student was talking but nobody was able to hear him; he was prompted to use the chat feature to ask his questions. There was some echo when several of the other students were speaking. Indeed, throughout this extra session there were a

number of audio problems that included echoes, voice clipping, and in some cases, no sound at all. Though we are by no means certain, it seemed that some of the audio problems were time-based (i.e., they occurred for certain periods in the session and then disappeared) rather than centered on particular speakers.

The students were encouraged to meet in several of the AW classrooms for subgroup breakout sessions. However, the students resisted this suggestion and stayed together as a group. Interestingly, it was clear to us that all the students were meeting in AW individually; that is, they were participating from their own personal living quarters. This is not surprising since each student was using his or her own personal (non-military) laptop to operate AW.

It should be mentioned that one student tried for nearly an hour to get his avatar into the appropriate AW location (the CGSC classroom). Only at the end of class was he successful. The class leader had been trying to reach this student by e-mail during the hour but was unsuccessful. This student reported trying to talk while searching for the classroom but nobody heard him. At the end of this session, the student class leader (and primary briefer) was left in the CGSC classroom talking to one of the Leavenworth instructors. Part way through the discussion, the instructor left (certainly due to technical reasons), after which the student class leader commented that “It looks like I’m talking to myself.” This ended the optional AW between-class session.

Session #8. A considerable amount of work had been done on the JIPOE slides since the AW session. The designated class leader briefed the slides, where his audio quality was quite poor due to (probably) some mic problems. It was especially hard to hear one of the students, who is from East Africa, because of his natural soft voice. Part way through the session, several students dropped out due to technical problems as they lost comms. The class leader, who was doing the briefing, attempted to reenter DCO several times; this took more than 5 minutes of class time. He was finally able to re-enter and continue the briefing. Due to the delays, the class went slightly over the allotted 1 hour 50. IT specialists were unable to determine if this was due to problems with the local network or DCO.

Session #9. The class was recorded as before but the results were not posted on the Forum nor disseminated to the class as far as we know. After a few minutes, we did hear the instructor’s voice, as he explained something to the local students. It is clear that the instructor is wearing two hats, one as the live instructor for the local students at Fort Leavenworth and a second as the distance learning instructor. This certainly creates a high workload for that individual and is something to keep in mind for future blended learning efforts.

The class began with the class student leader continuing his briefing. There was a 5-minute delay while a headset problem was attended to. There were multiple green on-mic icons lighting up, again indicating the unreliability of this feature. The student continued his briefing where there were no slides being shown; the lack of slides made it difficult for remote participants to fully comprehend the discussion. There was considerable discussion during the student’s presentation, all of which was by voice with no chat used at all. After awhile, one of the War College instructors asked for speaker privileges so he could load a PPT slide. As he briefed the class on strategic issues concerning a whole-of-government approach to Sudan, he indicated his inability to use the Forum. Consequently, all of his communication with course participants would be through e-mail. A brief tutorial on Forum fundamentals would have been helpful for the War College instructors.

Once the War College instructor finished his presentation on possible courses of action, the student class leader resumed his presentation. After a brief pause while the 45-slide package on courses of action (COAs) is loaded, he began a focused discussion on each COA. During this presentation there was considerable off-mic discussion among the students which remote participants are not able to neither follow nor comprehend. There was an unusual amount of voice clipping during the discussion, resulting in some periods where we could not really tell what was going on. With the slides up on the white board, it would be helpful if the presenter could annotate the slides to highlight key points. At one point, we saw the presenter's cursor appear on the white board, but this was followed by silence so we were not able to determine what they were trying to do. In addition to the voice clipping, there was a noticeable echo when the student class leader was speaking.

While we could see some individual letters being placed on the white board, the presenters were never able to get this feature – real-time construction of PPT slides – to function properly. In essence, the students were attempting to use DCO as a brainstorming tool without instructor intervention. This was a good concept but, unfortunately, the technology could not support it. More off-mic discussion occurred between the local students which again we could not comprehend. At the end of the session, the students agreed to meet in AW before the next class (which we label as Session #9.5) in order to more fully develop their COAs.

Session #9.5. This session meets in AW and was only attended by the students. The students initially appeared as avatars outside the CGSC building, after which they moved into the main classroom. As observers, we were struck by the change in tone with students much freer to express themselves as individuals vice classroom officers. It is clear that AW can serve as an effective social gathering medium where, between the voice and avatar media, individuals can behave much like real people, outside their designated duty positions. Thus, we heard considerable joking and bantering among the students while they wait for all the classmates to join in.

The same student class leader took charge as he had for the previous meetings. They exchanged slides amongst themselves previously, but this was done via e-mail rather than the Forum. All the students were in attendance except the student auditing the class from Europe; the time of this outside class session was in the middle of the night for Europe. The discussion was exclusively by voice, though several students attempted to talk to one of the bots for information on how to use the white board feature in AW. After a few minutes of trying, they gave up and exchanged slides using e-mail. It was clear that all the students were on AW using personal laptops from different physical locations. Still, there was a true sense of “togetherness” that is not present in DCO nor with a telecom. This is clearly an excellent feature of AW as a social networking tool.

The student discussion was focused on some basic concepts of Sudan politics, geography, and culture. There was some variability in the students' knowledge of these issues, where frankly more interactions with fundamental tutorial information would have been helpful. There was some background noise while several of the students were talking, which was quite distracting. With students on hot mic, one could hear very personal sounds in the background such as a baby crying.

The discussion then turned to how to exercise various non-military options within the DIME (diplomacy – information – military – environment) strategic analytic conception. The students had a healthy exchange of views concerning the extent to which a more military-focused COA

would be suitable for Sudan. There was noticeable voice clipping during the exchange but we were still able to determine the gist of what was being discussed. During the discussion, it was revealed that the one student who was not present was trying to enter the AW classroom but had been unable to. His classmates were trying to give him instructions, via e-mail, on how to do so. With the rich discussion, the students were able to more fully develop their various COAs, so that by the end of this extra session, they had both identified three distinct COAs (for Sudan intervention by AFRICOM) as well as begun to flesh them out.

Since they were not able to get a shared whiteboard feature to work within AW, they each opened up their COA PPT package and began to work semi-independently on the slides. This independence results in a loss of shared understanding among the various participants since they could not see what each other was doing with their slides. Indeed, there was some confusion over what slide one of the students was working on. In addition to numbering the slides, it would be advisable before the next A523 course offering to include some tutorial information on how to use the whiteboard feature of AW so that collaborative slide development is possible. At the end of class, the students agreed to exchange slides via e-mail in order to coordinate their COA development efforts. Since several students did not remember their Forum passwords, the e-mail option was viewed as the most expedient for this purpose.

Session #10. Class started at 10-min. past the nominal start time, with the class leader continuing the COA briefing. One of the War College instructors was trying to talk but no one heard anything until he re-did his comm. check. The student leader indicated that he would pause after each slide to receive questions from the instructors. Despite this procedure, the leader failed to notice the instructor's question via chat until two more slides had been briefed. At this point, the instructor began using voice; the student was then made aware of the question and reversed the slides until the questionable slide was displayed.

Part-way through the briefing, a second student took over the presentation. His voice was crackling such that there was considerable static and he was hard to hear. It was possible that his mouth was too close to the mic. After receiving a question from the instructor, there was a very long pause while an issue was being considered. As a remote participant, one is truly "left hanging" during this period since it is not clear if there are technical difficulties vs. a natural break in the action. During formal presentations such as in this session, participants are naturally reluctant to interject questions since this would be seen as an unwelcome introduction.

While the second student was being questioned, his work partner spoke up to help answer the question. Unfortunately, her voice cut out so that we could not tell what she was saying. As it turned out, her computer was being refreshed on the network so that she was put out of DCO completely. She came back on-line several minutes later and the discussion continued. Thereafter, a problem with one of the student's mic caused another several-minute break in the discussion. It was then resumed, where the focus of the discussion concerned the feasibility of having US forces in Africa serving under the command of some entity other than AFRICOM, such as the AU. There was a period of silence while the class leader reviewed the chat questions that had accumulated during the discussion. At the end of class, one of the students indicated that he was having trouble getting into the Forum in order to check messages and post slides. It was arranged that he would receive IT help outside of class to have the problem resolved.

Session #11. The class was focused on the War College instructor's critique of the students' COA briefing slides for US involvement in Sudan. His voice was clipped as was the

student class leader's. There were some long pauses while the student waited for feedback from the instructors who must do the critique in real-time. The procedure for receiving instructor feedback on the slides was fairly slow since there was no annotation capability – the instructors must give their responses verbally. Another problem was that the student really has no way of knowing when the critique for a given slide is over; they are naturally hesitant to talk over the instructor so they waited until a fairly long period of silence had occurred. A second student briefed the third COA and, once again, the instructors were required to mull over the details in real-time.

After awhile, the two instructors indicated the need to go off-line and discuss the COA critiques with each other, face to face. At one point, one of the instructors responded that “we’re thinking” when asked if they had more comments. It is clearly difficult to provide detailed, well thought out critiques when one is on the spot like that. This is a place where the digital learning technology should be helping the instructors, such as through slide annotation or even some type of structured chat. Nevertheless, there was a very long period of silence, upwards of 10 minutes, while the instructors caucus to come up with their formal critique of the students’ plan.

After the pause, one of the War College instructors then detailed their critique of each COA, in turn. The level of detail and breadth in the critiques is impressive and clearly could only have been developed by individuals having extensive knowledge of both SO and Africa. The class leader indicated that he wasn’t able to process everything the instructors said, so he would go over the notes taken by another student. It is clearly difficult to both take notes and have the lead responsibility for speaking. This would have been a good time to use DCO’s recording function and have the instructors’ critique played back to the students, although students needed a CAC card to access recordings.

With the instructors’ formal critique ending after the first hour, the students elected to stay in DCO for the second hour in order to modify the briefing slides in accordance with the instructors’ comments. At this point, the instructors left DCO and indicated that they may be contacted via e-mail if there are any further questions. Two of the students, the ones role-playing IPC entities, were given a partial assignment to provide some further detail concerning diplomatic options. One of the students was the Europe-based officer. They agreed to coordinate their efforts via e-mail and private chat over the next hour. The rest of the students continued to work on the COA slides in the Leavenworth classroom. While they stay on DCO, it was recognized that this was not really necessary since they are all in the same room together. We could see the slides move in the white board, but the interactions were face-to-face so we couldn’t tell what was being said. The IPC role-players then signed off DCO, having agreed to coordinate their efforts via e-mail.

Session #12. The student leader had e-mailed the revised COA slides to the War College instructors prior to the start of class. While the student was briefing, the instructors “lost comm,” requiring the student to repeat his briefing on the five slides that were missed. Later, another system refresh on the Leavenworth network caused a brief delay while the student’s audio was lost. There was then some confusion over which particular slide the instructors wanted to change. Again, this suggests the need to have slides prominently numbered to facilitate communication.

The instructors were trying to get the student to slow down his brief and cover the slides in more detail; however, problems with the audio delayed their ability to convey this request. There was

another system refresh a few minutes later, creating another brief delay. For some reason, it was difficult to hear one of the instructor's audio during the slide critique. The instructors switched their critiques to chat, which unfortunately the student leader did not see until after several more slides had been briefed. Once he saw the chat questions, he reversed the slide to get to where the critiques started.

The instructors then provided some final, formal critique of the COA slides. At this point, the audio for both War College instructors was hard to understand, reflecting a combination of voice clipping and volume fluctuation. As a wrap-up, the Leavenworth instructor indicated that he would do a face-to-face "after action review" with the students concerning their COA briefing slides and other class projects. Participants signed off from DCO 20 minutes early so the Leavenworth instructor could close out the class with the students.

Survey Results – Fall 08 and Spring 2009

An initial survey was developed to assess students' pre-course experience with and use of the four digital learning technologies and similar capabilities. The focus was to obtain some quantitative data concerning depth and breadth of experience with the technologies as well as prevailing student attitudes toward their use. This survey was made available to students during the week prior to the start of the course and during the first week of the course. They were e-mailed to participants individually in a Word document. Returns were obtained during the following week, and the results are summarized in the next subsection below. Copies of the surveys are available from the authors upon request.

In the subsequent weeks, four surveys were constructed, one for each the four digital learning technologies of interest. Survey questions were tailored to address the types of uses the technologies were expected to have and, importantly, their reactions to the usability and usefulness of the technologies during the course. To avoid overloading the students, surveys were administered on a distributed basis during the middle weeks of the course, starting with DCO one week, followed by surveys on AW, eBook, and the Forum on successive weeks. Surveys were administered using SurveyMonkey, a low-cost web-based survey service that provides centralized storage of results and limited analytic capabilities. Surveys were uploaded on the SurveyMonkey site, followed by an announcement being posted in the Forum indicating its availability and the time window desired for a response. Respondents then accessed the survey, made their responses electronically, and upon hitting a "final submit" button, sent the survey back to us for analysis and interpretation. The results of the mid-course surveys are also presented in the next subsection.

The evaluation concluded by administering a 50-item final course survey that asked course participants a series of questions that had them compare the relative advantages and disadvantages of the technologies on various dimensions of usability, usefulness, and impact on learning. This survey provides a precise look at what aspects of the technologies worked, which did not, and what could be done better in the future. The results are presented in the following subsection as well.

Pre-Course Survey

The pre-course survey describes the demographic characteristics of the respondents and their experience with and preferences for blended/distributed learning. This is followed by a summary

of their familiarity with each of the four digital learning technologies and their opinions regarding preferred methods of information sharing.

Demographics (Fall 2008). Eight participants responded to the survey, two of whom spoke English as a second language. Five had military experience that ranged from 15 to 32 years. All but one respondent had experience working in stability operations, where their experience ranged from 1-to-15 years across such diverse areas as:

- Business/operational leadership
- Balkans/EUCOM/PACOM
- Sudan, Lebanon, Pakistan earthquake
- Peacekeeper in Angola
- SSTR in Africa/Persian Gulf/Russia
- Trained Soldiers in SO

Participants' past and present duty positions covered a wide area of expertise within SO, including:

- Army officer
- Air Force officer
- Non-governmental Organization (NGO)
- Homeland Defense expert
- LNO to JFCOM
- LNO to TRADOC
- Department of Foreign Service Center

Based on the roles and experience of the students, it appears there was great interest from a diverse population of experts on the topic of SO. The collective expertise in the class thus held the potential of enriching our overall understanding of SO, particularly in information sharing among different organizations.

Demographics (Spring 2009). Six participants responded to the survey in the Spring course, two of whom spoke English as a second language. The first language of these two was German and Kiswahili (Kenya), respectively. All had military experience, and all but one had worked in stability operations. The extent of their experience ranged from 1-to-13 years across such diverse areas as:

- Military Police in Bosnia and Iraq.
- SO in Central and South America
- Army Engineer working on land reclamation
- Multiple tours in Iraq

Experience with Distributed/Blended Learning (Fall 2008, Spring 2009).

Fall 2008. Student prior experience with distributed/ blended learning was mixed, with three students reported having no experience and five students having participated in four or more distance learning (dL) courses. This experience breakdown is displayed in Table 1.

Spring 2009. None of the six students had participated in distributed/ blended learning prior to the course. Interestingly, two of the students felt that a dL course would be less enjoyable than a face-to-face even though they had never participated in a dL course (see Table 1).

Table 1
Student Prior Experience with Distance Learning

Number of Previous dL Classes	Fall 2008	Spring 2009
None	3	6
1 - 3	0	0
4 - 6	3	0
7 or more	2	0

Fall 2008. For the five students who had taken at least one dL class previously, their attitude towards dL was explored further by comparing the amount of learning, enjoyment, and amount of effort they perceived as being involved in a dL class versus that from a traditional classroom. We looked at three dimensions for comparison: learning, enjoyment, and workload. As shown in Tables 2-4, relative preferences for dL and traditional face-to-face classes across the dimensions are somewhat mixed, with a common view to be rough equivalence in workload but with a slight preference for traditional classes in terms of learning and enjoyment.

Table 2
Preference for dL over Traditional Classroom for Amount of Learning

Learning: dL versus traditional face-to-face	Frequency
I learn more in face-to-face courses than in dL.	2
I learn about the same.	1
I learn less in face-to-face courses than in dL.	1

Table 3
Preference for dL over Traditional Classroom for Enjoyment

Enjoyment: dL versus traditional face-to-face	Frequency
I find face-to-face courses as more enjoyable than dL courses.	3
Equally enjoyable.	2
I find dL as more enjoyable than face-to-face courses.	0

Table 4

Preference for dL over Traditional Classroom for Workload (N=5)

Workload: dL versus traditional face-to-face	Frequency
I find dL involves more work than face-to-face courses.	1
Equal work.	4
I find dL involves less work than face-to-face courses.	0

Spring 2009. Since none of the students had previous experience with dL, they did not respond to follow-up questions on dL. Interestingly, although these students had no previous experience with dL, two stated that they preferred face-to-face instruction

Familiarity with Digital Learning Technologies.

Fall 2008: eBook. Six of the eight students who responded to the survey had never used an electronic book before, one reported using an eBook a few times, and one owned an eBook and used it frequently. Since a major feature of eBooks is to provide an alternative way to read text, the survey asked additional questions regarding how students typically read material for instruction and for pleasure. Frequency of responses to these questions are displayed in Table 5.

Spring 2009: eBook. Four of the six students had never used an electronic eBook and two had used one a few times. Frequency of responses to these questions are displayed in Table 5. Students in this session did not have eBooks available for the course.

Table 5

Student Preferences for Reading Class Material and Other Information

What is your preferred method of reading class material?	Fall 2008 N=7 or 8	Spring 2009 N=6
Hard copy	3	5
Computer screen	1	0
Both	3	1
What is your preferred method of reading for pleasure?		
Hard copy	7	6
Computer Screen	1	0
Both	0	0
When you read hard copy material for class, which do you do? (Check all that apply.)		
Make separate notes	5	0
Highlight/underline	4	4
Make notes on material	4	2

Outline material	2	0
When you read information on a computer for a class, which do you do? (Check all that apply.)		
Print and read from hard copy	6	0
Highlight important passages	2	1
Make notes on the computer (If not PDF)	2	0
Make separate notes	2	2
Outline the information	1	0

These findings suggest that, prior to this course, participants had limited experience with eBook technology and that many would prefer to read material from a hard copy vice a computer screen.

Defense Connect On-line (DCO). DCO is a net messaging, collaboration tool designed to support large group, geographically-distributed presentations, real-time communication, and shared work. In both sessions, the respondents were equally divided in their experience with DCO, with half having no or very limited prior exposure and half having a good deal of experience with DCO. These frequencies are shown in Table 6.

Table 6
Student Prior Experience with DCO

Number of Previous DCO Experiences	Fall 2008	Spring 2009
None	3	3
1 - 5 times	1	4
6 – 10 times	1	2
More than 10 times	3	0

We next asked students which methods of communication they prefer over DCO-type net messaging (see Table 7). Student responses indicate that most (Fall 2008) or at least half (Spring 2009) preferred face-to-face meetings and video conferencing, both of which involve visualization of participants.

Table 7
Student Preferred Methods for Communication over DCO

What methods of communication are better than net messaging for successful communication?	Fall 2008 N=7	Spring 2009 N=6
Face-to-face	6	3
Video conferencing	5	2
Exchange hard copy of material	3	0

Whiteboard	3	0
Audio conferencing	3	0
Telephone	2	2
File transfer	2	1
Email	2	2
Net radio	1	0
Chat/instant messaging	1	1
Text messaging	1	0
Program sharing	1	1
Groupware	1	0
Electronic bulletin board	1	0
Geo. Information systems	1	0

Those who had previously used DCO used it primarily for work, school, and connecting with family and friends. Both sessions reported that face-to-face communication was preferred over DCO.

Participants were then asked to respond, using a Likert-type scale, to the following two items addressing understanding intent.

-How satisfied were you that your intent was understood when you used net meetings?

-How satisfied are you that you understand the intent of others when using net meetings?

Interestingly, participants from both classes reported that they were somewhat dissatisfied that their intent was understood by others in net meetings but satisfied that they understood the intent of others. This highlights a possible challenge with net meetings, unclear intent. Instructors may need to check more frequently for common intent in net meetings than when meeting face-to-face.

Forum. Discussion forums, or forums as they are more generally called, are designed to support asynchronous, organized discussions from multiple participants on topics of mutual interest. Only one student reported having no prior experience with forums, with the distribution of experience summarized in Table 8.

Table 8
Student Prior Experience with Forum

Number of Previous Forum Experiences	Fall 2008	Spring 2009
None	1	0
1-5 times	2	2
6-10 times	3	0
More than 10 times	2	4

Students were next asked how they used the forum. These responses are shown in Table 9. As can be seen, respondents mainly have used forums for information sharing. From their comments, we infer that they believed they would use the forum in a similar way during the class.

Table 9
Student Prior Uses of Forums

What functions do you use in a forum?	Fall 2008 N=7	Spring 2009 N=6
Read articles posted by others	5	4
Comment on topics of interest	4	3
Read comments posted by others	4	3
Participate in threaded discussions	4	3
Post articles of interest to the group	3	3
Check calendar for events	3	1
Take surveys	2	2
Communicate with a particular colleague or expert	2	0
Socialize with others	2	1

Virtual Collaboration Environment. Most of the students had little or no experience with a virtual collaborative environment, as would be represented by Active Worlds. Of those who reported using a virtual environment previously, the primary purpose was for gaming.

Table 10.
Experience with Virtual Collaboration Environment

Number of Previous Experiences	Fall 2008	Spring 2009
None	5	3
1-5 times	2	0
6-10 times	0	3
More than 10 times	1	0

Information Sharing. Because a primary use of the digital learning technologies for this blended course was to promote and encourage information sharing, we devoted a series of questions in the pre-course survey to determining students' attitudes towards and preferences for information sharing using all the various methods now available for doing this. This includes cruder methods, such as hardcopy and whiteboards, along with the electronic means that are ubiquitous in work settings, such as e-mail, file transfer, and video conferencing. The first question addressed how "comfortable" students were with using the various methods for information sharing based on past experience. The responses are presented in Table 11. As can be seen, all students reported being comfortable exchanging information face-to-face and by exchanging hard copies of material, neither of which involves technology. They were equally comfortable with email.

Table 11
Comfort with Information Sharing Technologies

Check all of the means of information sharing below that you are <u>comfortable</u> using? Check all that apply.	Fall 2008 N=7	Spring 2009 N=6
Face-to-face	7	6
Exchange hard copy of material	7	6
Email	7	6
Video conferencing	6	3
Telephone	6	6
Whiteboard	4	3
File transfer	3	4
Audio conferencing	3	5
Chat/instant messaging	3	5
Text messaging	3	5
Program sharing	3	4
Net radio	2	3
Electronic bulletin board	2	1
Groupware	1	0
Geo. Information systems	1	1

We next asked students what information sharing methods they preferred to use when working with team members during a class project or a planning exercise. The response patterns were fairly straightforward, as shown in Table 12. All students reported favoring the telephone and email when conducting planning activities or completing class assignments as part of a geographically distributed group. Similarly, they currently use telephone and e-mail mostly to distribute information when working in a team. These frequencies are shown in Table 13. All other information sharing methods were reported being used with much less frequency by students.

Table 12.
Previous Information Sharing Methods in Previous Classes

How do YOU interact with team members when developing a class project or planning activities with distributed (geographically separated) team members? Check all that apply	Fall 2008 N=7	Spring 2009 N=6
Telephone	7	6
Email	7	5
Video conferencing	3	2
Face-to-face	3	2
Chat/instant messaging	3	2
Whiteboard	2	1
File transfer	2	2

Audio conferencing	2	1
Program sharing	2	1
Electronic bulletin board	2	0
Text messaging	1	1
Virtual collaboration	1	0
Net radio	1	0
Forum	1	1
Groupware	1	1
Electronic bulletin board	1	0
Geo. Information systems	0	0

Table 13.
Preferred Methods for Distributing Information within a Team

How do YOU currently distribute information when working in a team? Check all that apply	Fall 2008 N=7	Spring 2009 N=6
Telephone	6	5
Email	6	6
Video conferencing	3	1

Table 13 (Continued).

Preferred Methods for Distributing Information within a Team

Audio conferencing	3	1
Chat/instant messaging	1	0
Whiteboard	2	1
File transfer	2	3
Audio conferencing	3	0
Program sharing	2	2
Forum	2	2
Text messaging	2	2
Electronic bulletin board	1	0
Groupware	1	0
Virtual collaboration	0	0
Geo. Information systems	0	0
Net radio	0	1

There has been an increasing emphasis within the U.S. military for distributed team members to develop a common operating picture to enhance situational awareness. Participants in the Fall 2008 course were asked how they developed shared situational awareness (SSA) in distributed teams. Interestingly, participants reported preferring the same two tools they are most familiar with to develop shared situational awareness: e-mail and the telephone. Video conferencing, where a picture can be added, also was chosen by all students as a method for developing SSA. The complete set of frequencies is displayed in Table 14.

Based on the survey responses listed above, it is clear that students expressed a strong pre-course tendency to favor familiar technologies, such as the telephone and email, for sharing information, distributing information, and developing SSA. Video conference was seen as the next most used technology, particularly when developing SSA.

Table 14.

Preferred Methods for Developing Shared Situational Awareness in Distributed Teams

How do YOU develop shared situational awareness when working in a distributed team? Check all that apply.	Fall 2008 N=7
Telephone	6
Email	6
Video conferencing	6
Audio conferencing	3
Chat/instant messaging	3

Table 14. (Continued)

Preferred Methods for Developing Shared Situational Awareness in Distributed Teams

Audio conferencing	3
Whiteboard	2
Forum	2
Text messaging	2
Groupware	2
File transfer	1
Program sharing	1
Electronic bulletin board	0
Virtual collaboration	0
Geo. Information systems	0
Net radio	0

Issues that influence information sharing. Finally, students were asked to rate the influence of ten factors (e.g., technology, language, culture) in sharing information during face-to-face and distributed information settings. Our interest was in determining whether certain factors show a differential influence between two settings and, as such, might serve as a moderating variable when we consider the impact of the different learning technologies on the class (see Figure 7). Each factor was rated on a five-point scale, with 1 = No Influence and 5 = Severe Disruption. Separate ratings were obtained for the two settings. Results are reported as means.

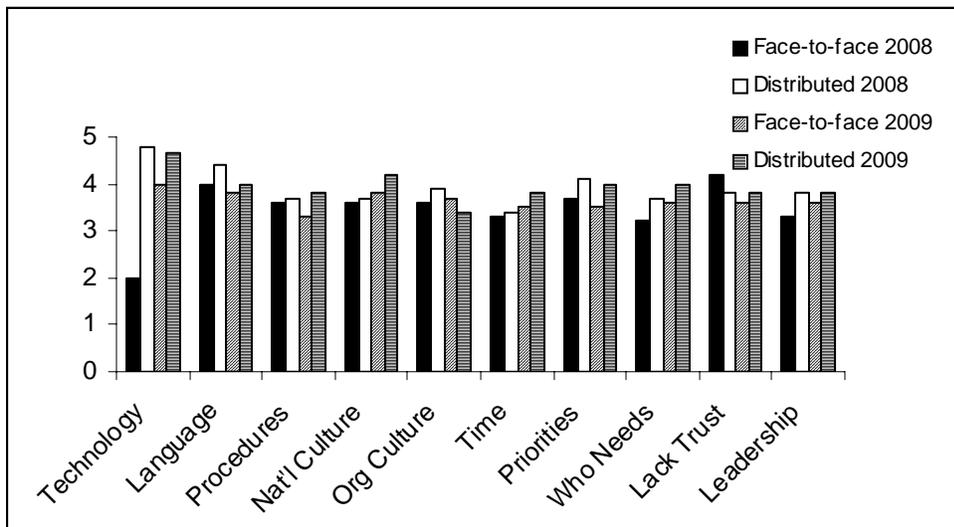


Figure 7. Influence of factors on face-to-face and distributed information sharing.

Looking at the distribution of ratings, and recalling that the higher bars mean greater disruptive influence, it is clear that that ALL issues influenced information sharing with the exception of technology during the Fall 2008 class. Due to the small sample size (Fall 2008=7 and Spring 2009=6), differences were not assessed statistically. That being said, technology issues for distributed information sharing had the highest negative impact. Moreover, with the exception of technology issues, there was little difference between the influences of these factors on information sharing in face-to-face or distributed settings.

Mid-Course Surveys

In the following section, we summarize the mid-course survey results for each of the four digital learning technologies: Defense Connect Online, Active Worlds, eBooks, and Forum. Electronic books were not used in the Spring 2009 course so the eBook survey was not administered during this session. Also, the Forum was used differently by instructors in the two sessions. In the Fall 2008 session, the instructor posted all notices, class assignments, presentations, and updates on the Forum. During the Spring 2009 session, the instructor sometimes used email to communicate with students. Finally, Active Worlds (AW) was required for class participation during the Fall 2008 session but was optional for students in the Spring 2009 session.

Defense Connect Online. The DCO mid-course survey was presented in three parts. Students were first asked to rate how much of a problem they experienced in using each of 14 DCO features or issues (e.g., following audio, chat window, private chat) during the course. A five-point scale was used, where No Problem was scored as a 0, a Minor Problem was a 1, and a Major Problem was a 2. Seven students responded to the survey in the Fall 2008 and five responded in the Spring 2009. Both groups identified similar areas of concern, but the Spring 2009 class found those issues less disruptive than did the Fall 2008 class. Because the findings are similar, the results are combined in this summary.

Problem Features. To provide a well-rounded depiction of the survey findings, we organize our interpretation of the “problem” DCO features based on a combination of ratings and the nature and density of student comments. While there was no issue where all students reported problems, four areas stand out as problems based on a consideration of the ratings and associated comments. The first issue was “technical problems stopping the class.” Notable student comments included that it “interferes with my learning”; that “for my specific case, this has made the course very difficult to keep up with” and “when the system “refreshes” everything that is being said is lost to the one whose system is refreshing...this is really bad and leaves the participant wondering what was missed.”

Another major problem reported by students was “following audio” and the highly related “audio problems,” which includes dropped audio and echoes. Major complaints here, expressed in the comments, included difficulty “understanding the meaning of the speaker,” “had trouble hearing,” “audio is inconsistent ... that is a problem.” Given that audio is the “critical element of the discussion,” its consistent quality is essential to the learning process.

Another feature that we would categorize as a major problem, based on participant comments only, was the “ability to ask questions during a lecture.” Specifically, one student noted that it “kills the adult learning model, ending up as a lecture every time.” In addition, several students noted that “aside from my own connectivity and software problems, I like the ability to send text messages to one or more participants. You necessarily lose a great deal of potential interaction in this kind of virtual community (compared to face to face meetings).”

Five DCO features could be characterized as “minor problems” based on the rating and comment data. First, the pictures of the people joining DCO in the Video & Camera Window (upper left hand corner) would shrink in size as more participants joined the environment, making it difficult to identify who is speaking. While annoying, students commented that “I don’t really need to see them, unless they are doing something funny.” Another student reported “no problem” while a third noted that “you would be much better to be able to identify and more easily see speakers; otherwise, you need not bother with actual video of participants - just the presentation slides, etc.” This was a lesson learned and the video was turned off during the Spring 2009 class.

A second minor problem feature could perhaps have been classified with the major problems above – “time it took to begin class due to technical issues.” It was certainly a notable problem as indicated by student comments such as “a significant time-waster” and “this cut instruction by 1/2 to 1/3 that is bad.” Another student commented that “I have had continuing connectivity and software functioning problems throughout the course that have caused me to miss many sessions and homework.” On the other hand, another student reported that “I see continuous improvement as we get used to the equipment.”

Another borderline minor problem for DCO was experiencing “long periods of silence where one was unsure if anyone was talking or whether it was a technical problem.”

A fourth minor problem feature was that the “DCO windows (Chat window, Video& Camera Window, Attendee list) often changed size and position on the screen since they were controlled by the moderator.” One student noted that this was “an annoyance at the first class, but not a problem since.” Another interpretation was quite interesting, as the student indicated “that this is caused by the presenter changing them it is not a problem; it is a feature.”

A final minor problem feature entailed “not being able to change the size and position of the windows on one’s own screen.” One student put it into perspective by noting that “compared to all the other problems this was not a biggie.” Another student indicated that window control would be a “nice feature if they were given permission;” however, students felt that the instructor “handled this okay.”

The remaining DCO features in the survey were characterized as “no problem” based on low ratings and, in some cases, positive comments. For example, “determining who was talking” (other than the moderator) was rated fairly low. While one student indicated that this “just added to my disorientation,” another student commented that “people need good radio skills ... no different than radios we already use.” Yet another student noted that “I’m okay here.” However, another student suggested that speaker identity could be “indicated by some sort of text message; video does not really add much to the discussion.”

The two chat features we surveyed, chat window and private chat (sending, reading chat), both had ratings of 0 and were clearly “no problem” for any student. Indeed, comments included “this actually worked and was my lifeline” and were “very useful in this kind of discussion.” However, one student indicated that they “wish they could speak to more than one person” in a private chat, such as having a two-way or three-way offline chat.

Another well-rated feature was the PowerPoint slides, both reading text and their content, both of which had ratings of 0. While it was pointed out that the text was “a bit small,” students “had no problem with this.

In summary, students had the most difficulty with technical issues distracting from class, particularly if these issues interfered with the audio. There was some concern that students were not able to ask questions or make comments during lectures. Students found the chat function as a useful means of communication. In addition, they reported that reading content from the PowerPoint slides was useful.

Learning Influence. Students were then asked to rate how these same 14 DCO features influenced learning. A bi-polar scale was used, where -2 = negative influence, 0 = no influence, and 2 = positive influence. For the most part, students responded similarly in both classes with the exception of two items (see Table 15). Table 15 presents the 14 DCO features in ascending order of mean rating (for the Fall 2008 course), such that the negative influences are listed first.

Table 15.
Influence of DCO Features on Learning

DCO Feature Mean Rating (-2=negative influence, 2 = positive influence)	Fall 2008 N=4	Spring 2009 N=5
Negative Influence		
Technical problems stopping the class	-1.75	-1.6
Long periods of silence-unsure if anyone was talking or was technical problem	-1.75	-1.2
Audio problems – dropped audio, echoes	-1.15	-1.6
Minor Influence		
Determining who was talking (other than the moderator)	-.75	.4
Pictures of the people joining DCO in the Video & Camera Window (upper left hand corner) – size, ability to identify who is speaking	-.50	-.4
DCO windows often changing size and position on my screen (Chat window, Video& Camera Window, Attendee list)	-.25	.2
Not being able to change the size and position of the windows on my screen myself	-.25	-.2
Ability to ask questions DURING a lecture	.25	.6
Mixed Influence		
Following audio – understanding the meaning of the speaker	.25	.8
Time it took to begin class due to technical issues	-1.5	-.6
Positive Influence		
Chat window – sending chat, reading chat	1.5	.8
Private chat – sending chat, reading chat	1.5	.8
Reading text on PowerPoint slides	1.5	.8
Content of PowerPoint slides	1.5	.8

Based on the pattern of results above, students’ ratings clearly mirror those found in the response to technical issues. As before, students reported that the chat feature and the PowerPoint presentations enhanced learning, whereas audio and technical issues detracted from learning.

Attitudes. In the final section of the survey, students were asked to rate their agreement with six Likert-type statements describing some general aspects of DCO. A five-point scale was again used, with 2 = strongly agree, 0 = neutral, and - 2 = strongly disagree. Topics include guest speakers, PowerPoint slides, technical problems, connectivity, and video. Six students responded to each survey item during the Fall 2008 session and five responded during the Spring 2009 session. In some cases, respondents provided comments that explained their ratings.

The ratings to these statements are summarized in Table 16, where they are presented in descending order (based on Fall 2008 responses) of average rating such that the “strongly agree” statements are listed first. Within each statement, we have included the amplifying comments from Fall 2008. Interestingly, the findings from the Fall 2008 class and the Spring 2009 class are very different. This appears to be because of the variability of responses in Spring 2009, with four of the six items containing both strongly agree and strongly disagree responses

Table 16.
Likert Attitudes towards DCO on Select Topics

Attitudinal Statement/Comment (-2=strongly disagree, 2 = strongly agree) (Fall 2008 N= 5 or 6; Spring 2009 =5)	Fall 2008	Spring 2009
Strongly Agree		
I would have learned more if PowerPoint slides were sent to me before the class If there is the ability to ask questions, face to face discussion is more effective This response takes in account the minimum amount of interference which materializes due to technical difficulties	1.2	-.2
I learn more from listening to a speaker in person than I did from speakers in the DCO sessions Materials were posted on the Forum site and anyone could have read them before class. This was helpful, and slightly decreased frustration in trying to connect and hear. Could be included in tutorials. This would enhance the preparation process	1.0	-.4
Audio was more effective than video for my learning Video of presenter's face is irrelevant for this kind of lecture unless tech connections are high-speed and completely without problems. this became a large distraction	1.0	.4
Neutral to Slight Disagree		
Video was more effective than audio for my learning Audio and the presentation materials are key; these would be sufficient for most class disc	-.33	-.2
Not having to travel makes up for the technical problems I experienced with DCO Tech problems have prevented me from using the DCO for most sessions so I have not benefitted much from them so far. The downloaded course materials have been very interesting	-.50	.6
Strongly Disagree		
I never lost connectivity or had to re-enter the DCO site more than once during the DCO class sessions	-1.33	-.4

Active Worlds. Five participants completed the survey on Active Worlds in Fall 2008 and three completed it in the Spring of 2009. Of the three respondents in Spring 2009, one student never used Active Worlds and the other two used it one or two times. All but one of the respondents described themselves as novices. Students were required to use Active Worlds for portions of instruction during the Fall 2008 session, but use of Active Worlds was optional in Spring 2009. Therefore it is difficult to compare the two sessions. Table 17 indicates the frequency with which respondents reported using AW in various ways during the course. The remaining tables and figures on Active Worlds are based on results from the Fall 2008 class only.

Table 17.

Frequency of Affirmative Responses to Varying Uses of Active Worlds

How do you use Active Worlds?	Fall 2008	Spring 2009
Listen to class presentations.	4	0
Went to learning centers to read about Sudan	3	0
Hold informal chat discussions with classmates	2	0
Collaborated with classmates to do assignments	1	2
Hold "virtual" meetings with classmates to distribute responsibilities	1	2
Went there for personal fun-play with avatars	1	1

Students were then asked what they liked best and least about AW. Comments (from Fall 2008) about what they liked best about the system included the following:

- Meeting in an international forum but feeling I am a part of it and the appreciation I received from participating
- Able to communicate and partition conversations into break rooms. ... IWS already does this as well
- Not sure yet
- Information available
- The possibility to be in the virtual world
- You can talk to everyone at once
- It is logically organized

When asked what they liked least about AW, students made the following comments:

- It doesn't make sense to walk around and up stairs and so forth inside of a computer ... avatars did not add value to voice and text, power point was hard to upload and pass control, needs a whiteboard capability to make shared notes on
- Not sure yet
- Inability to manipulate avatar detracted from actual learning. Also, inability to use on government computer
- As first experience, None

- Spotty connection in conversation especially when we were getting directives from the boss
- The Active Worlds environment was too slow on my computer (build the graphics).
- Moving the avatars around was a bit difficult at first.

The survey then asked students to express their opinions regarding the usability of Active World. Participants responded on a five-point Likert-type scale, with 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, and 5=Strongly Disagree. Therefore, the lower the score, the more in agreement the participants were with the survey item. For readability, the results of the usability are presented in three figures (Figures 8-10), where each figure presents the average rating (out of 5) for a portion of the survey items.

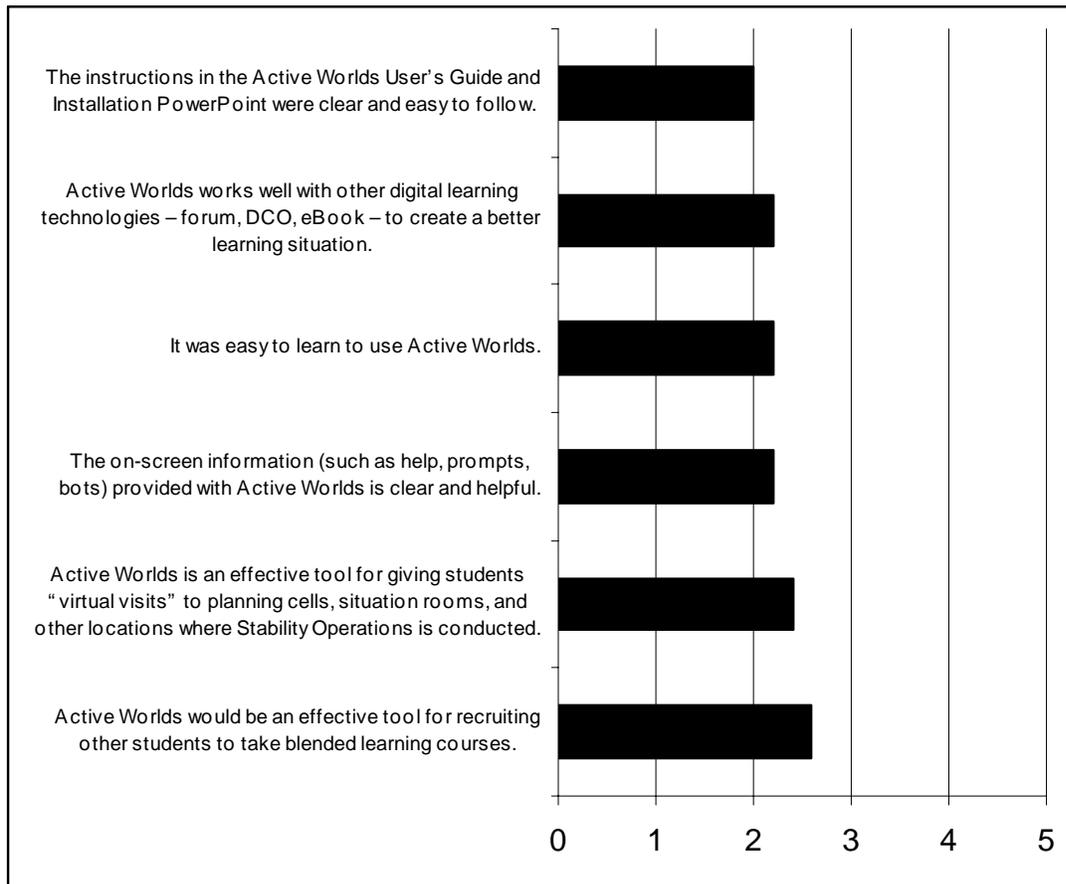


Figure 8. Average usability ratings for Active Worlds (Part 1).

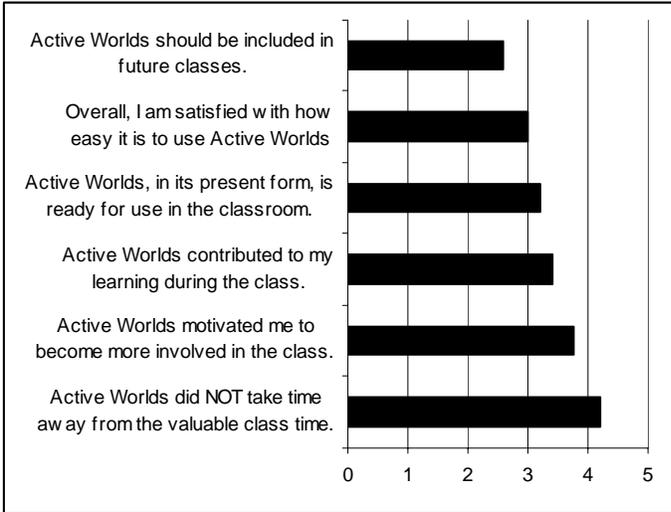


Figure 9. Average usability ratings for Active Worlds (Part 2).

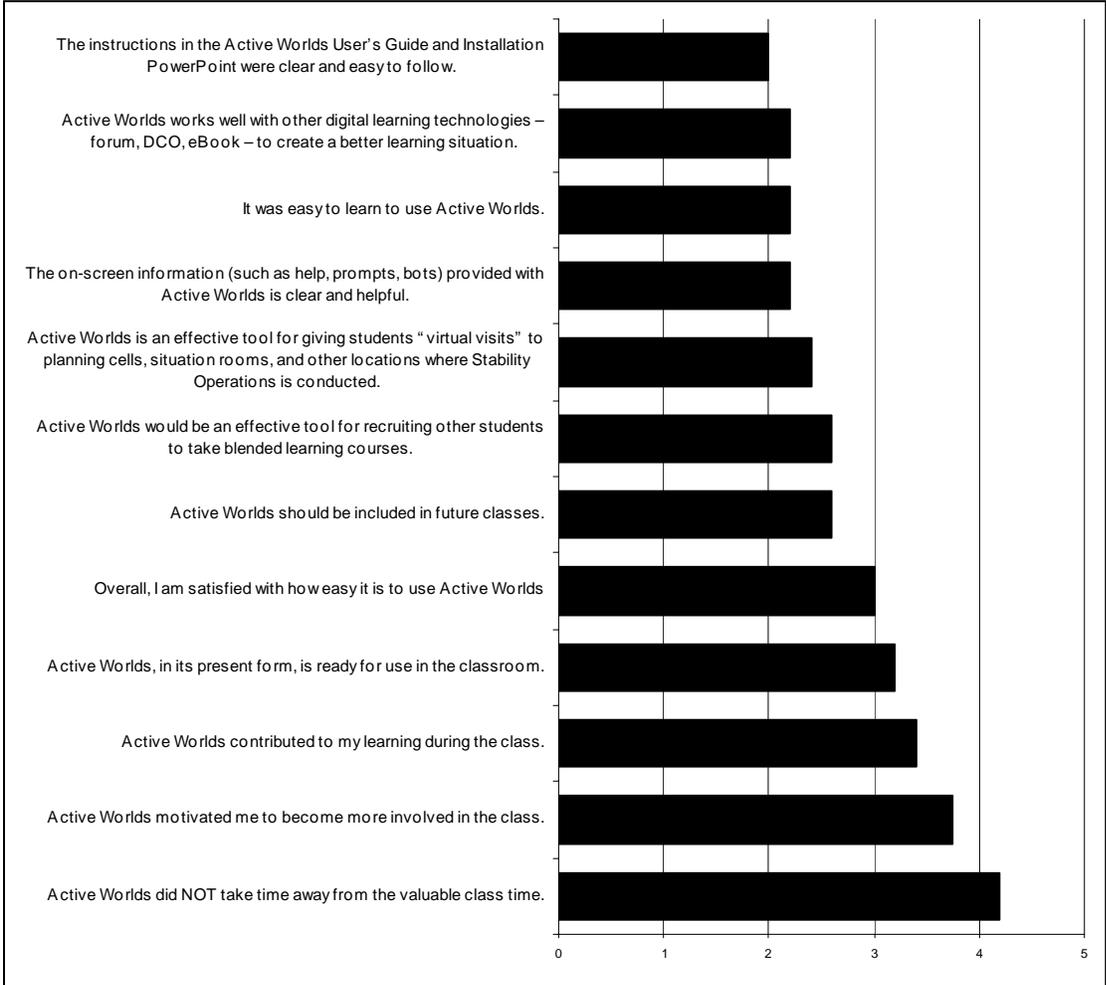


Figure 10. Average usability ratings for Active Worlds (Part 3).

From a usability standpoint, students found AW quite easy to use. On the other hand, students saw AW as taking away valuable time from the classroom and distracting from learning. Students provided the following amplifying comments on these issues:

- Detracted from the adult learning model and group interaction. Took class time to set up and get everyone working ... killed at least 1/3 and as much as 1/2 of the time just dealing with technical problems
- My learning experience did not increase, compared to using DCO or regular classroom settings
- AW kills class time as well as participation
- Does NOT support or enable the adult learning model
- Seems to provide the same incentives as DCO.
- Not an enabler, not efficient, has unnecessary features (avatars, etc)
- I think that in the future the avatars will be ourselves.
- Most of our students dropped the class after their first exposure to AW
- May motivate civilians.
- Real visits to real planning cells would be much more useful and informative
- AW doesn't interact with other technologies ... DCO is just an alternative to the same basic types of communications we did in AW (neither work that well).

When asked if AW was “ready for the classroom,” participants provided the following comments:

- Depends on the course ... maybe a computer science class on building virtual worlds or something, it's still flaky and has lots of unnecessary "features" for simply conducting adult graduate education via distance learning.
- Needs better reliability. Needs better interaction: all students should sit, the person who asks a question should stand up, presenter should be in front of the class, etc. Needs better understanding of tools to better focus on the required product of the session/lecture: why not use the whiteboard to list the most important statements or COA-elements that the students come up with.
- Once I understood all of the controls I could ... again wasting class time researching AW instead of Stability Operations.
- First the avatar doesn't matter, I just need to be able to communicate so being able to look like anything in particular has no real purpose especially when all of the military look the same anyway it doesn't help you to tell one person from another (their name above them in text is the only way to do that).
- Chat was essential as some could not communicate using voice ... however, Yahoo Messenger or MIRC chat are better implementations of chat than AW (AW adds nothing in terms of its chat capability to free COTS and GOTS software already widely used and distributed ... the ones we already use have better chat capability).

- Easier to quickly do an electronic keyword search in the manual in a side frame (get more info in the manual and you can read it and do it at the same time) than to ask the Bot.
- AW would be very hard to use without teleport and it would be annoying walking around, going in doors, up stairs, etc for no reason inside a computer just to get to a room to VoIP and chat with fellow students.
- No learning objectives are accomplished through moving my avatar around no matter what it is doing (i.e., it has nothing to do with learning Stability Operations).
- Sudan Center; Conflict Center; African Learning Center: Mostly it is a 3D view of a bunch of hyperlinks ... a webpage would accomplish the same objectives.
- For all learning centers: these are mainly a nice way of providing hyperlinks. In that sense they are useful, but it does not really add to systems like DCO.

These comments may be particularly relevant as several of the respondents are experts in adult learning.

Figure 11 provides the average ratings for questions regarding the adequacy of technical support and related capabilities for students in the Fall 2008 A523 course. The questions were asked based on observations of the students to determine if these issues were common to a majority of the students. It should be pointed out that IT support for AW was available throughout the six-week course period and during each class session, though for students outside the College the support was provided by telephone or e-mail. Again, participants responded on a Likert-type scale with, 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, and 5=Strongly Disagree. Therefore, the lower the score, the more in agreement the participants were with the survey item.

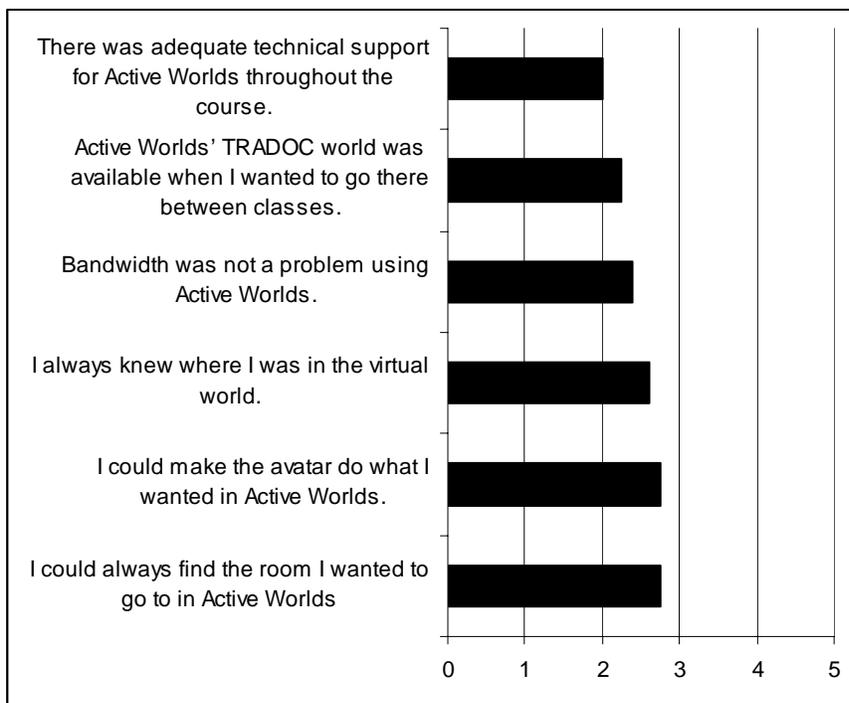


Figure 11. Average ratings for technical adequacy of Active Worlds.

Finally, Fall 2008 students were asked to rate the usefulness of a variety of the functions of Active Worlds. Participants responded on a Likert-type scale, with 1=Very Useful, 2=Useful, 3=Not Useful, 4=Couldn't Use, and 5=Didn't try. These average rating data cannot be directly compared to the other survey questions as the scale differs. There are two positive responses (Very Useful and Useful) and one negative response (Not Useful). No one selected the "Couldn't Use response." Three students selected "Didn't Try" for the item: Ask the Bot questions and one student did not try Avatar Movement. The "Very Useful" and "Useful" responses were combined and compared with the "Not Useful" responses. As seen in Figure 12, students found the Chat and Voice functions to be most useful. Avatar Movement and Customizing Avatar Appearance were found to be the least useful.

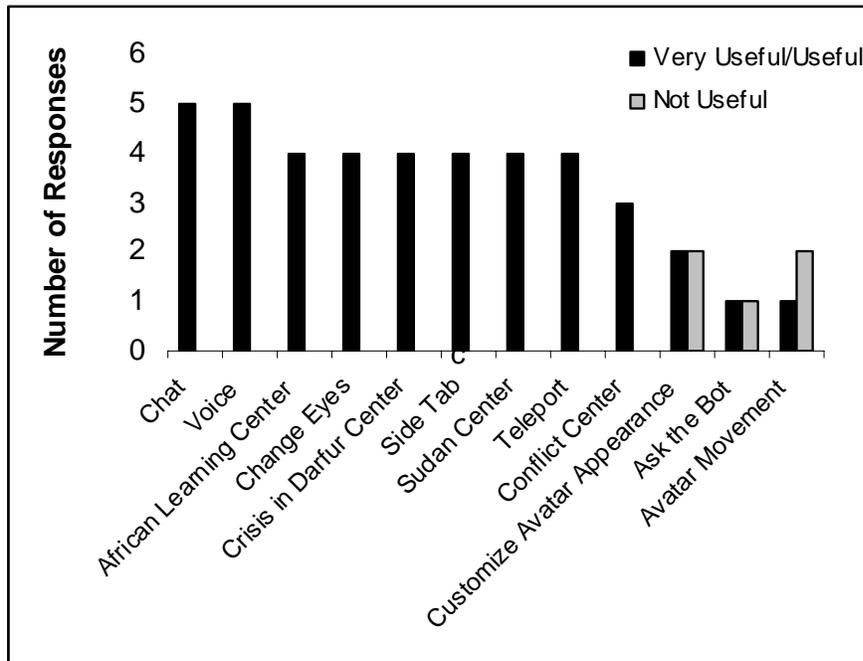


Figure 12. Average ratings of usefulness for Active Worlds.

Forum. Nine students in the Fall 2008 class and 4 students in the Spring 2009 class completed the mid-course survey evaluating the Forum. All four students in the Spring 2009 class used the forum every few days. One student noted that he/she did not like distance learning courses and preferred face-to-face. The overwhelming number of "Disagree" comments came from this single person. All but two students used the Forum at least every few days (See Figure 13 below). Note that two respondents never used the Forum but still responded to the survey items. Due to confidentiality safeguards and the software used, we were unable to eliminate the responses of these two participants from the survey results.

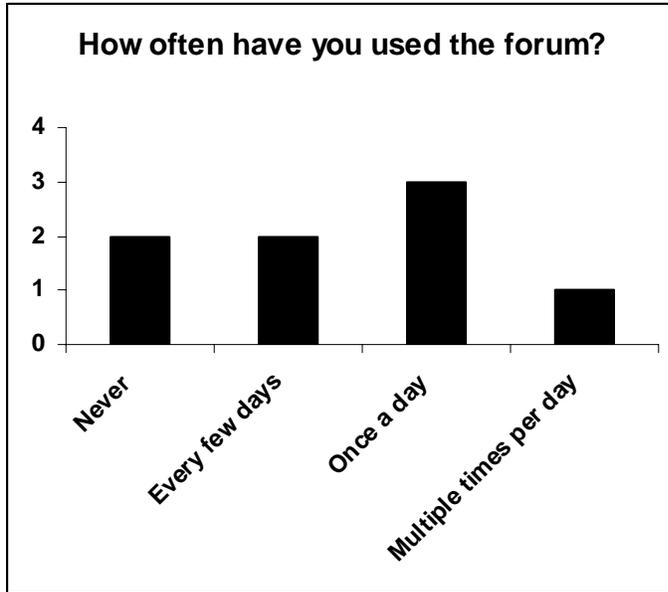


Figure 13. Frequency of student use of the Forum during course A523.

The most frequent uses of the Forum were to read information from the instructor, to find directions for the tutorial, and to complete surveys. Based on the wide range of experiences of the participants, it was disappointing that they did not engage in more on-line discussions as the students had a diverse experience that could have led to interesting exchanges.

Table 18.
Frequency of Different Uses of the Forum

How did you use the forum?	Fall 2008 N=8	Spring 2009 N=4
Read information from the instructor	8	3
Found directions to access tutorial	8	2
Completed feedback surveys	7	3
Downloaded articles to read	6	1
Checked course syllabus for class times or content	5	2
Follow-up on class discussions	3	1
Communicate with the presenters	1	0
Checked course syllabus for class times or content	1	0
Participated in on-line discussions	0	1

Students were then asked what they like best and least about the Forum. In terms of what they liked best about the Forum, the comments included:

Fall 2008

- Updated News
- Documents available from multiple computers
- It enables the fusion of ideas from participants who are in different locations.
- I love the idea of being able to access the best information.
- Little

Spring 2009

- I'd rather talk in person....not a big fan of chatting
- The option to just show the latest articles
- The links in the forum were very informative, you could get all the information you wanted.

Instructors did not rely on it completely to keep students informed

As to what they liked least about the Forum, respondents commented as follows:

Fall 2008

- It took me a few times to easily find all of the information. At first it was a little confusing to figure out how to post a message or find an attachment to a message.
- Just one more thing to log into ...
- None
- Often hard to access from my work computer. No means of informing me when important new things are there to download. Hard to find the items I want on the forum. Information sometimes not yet posted when I check for it, then it gets posted when I am not checking.
- The technical difficulties which were experienced periodically.
- There were times when it was a bit confusing to recall where I have seen specific info

Spring 2009

- Forum seemed redundant when we met in class
- When the connectivity was low

The average ratings to survey items on the usability of the Forum are displayed in Figure 14. Participants responded on a Likert-type scale, with 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, and 5=Strongly Disagree. Therefore, the lower the score, the more in agreement the participants were with the survey item.

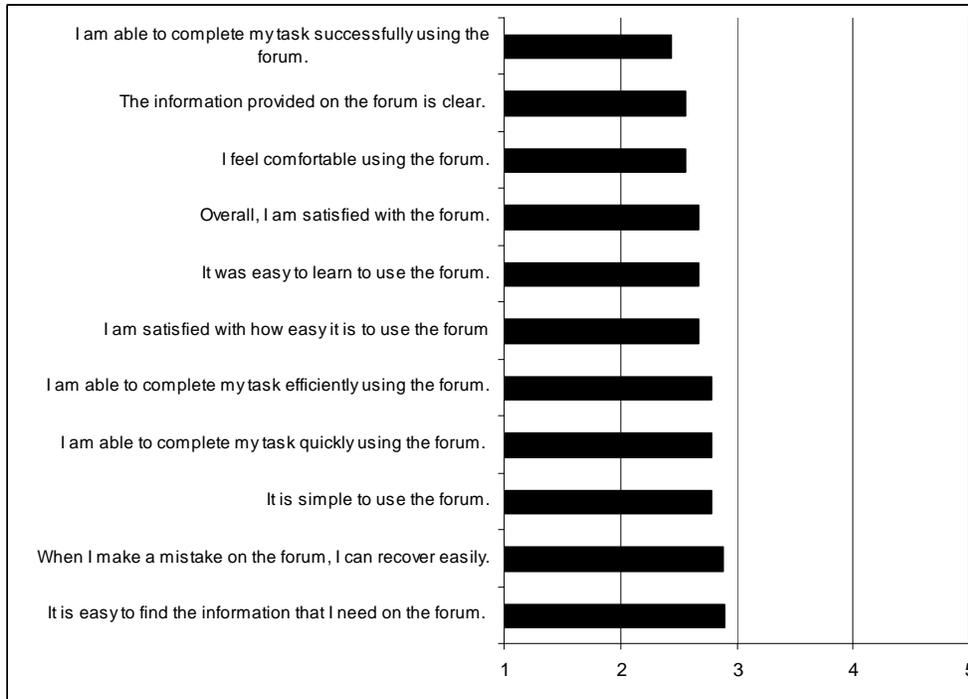


Figure 14. Average usability ratings for the Forum.

Overall, participants found the Forum easy to use. This is evident from their comments, as indicated below:

- Once I logged in a couple of times it was very easy to find my way around. However, I have logged into other sites where blogging, posting, chatting etc. is a little bit more user friendly.
- There is no significant difficulty regarding the use of the forum but occasional technical problems could create some discomfort.
- Relatively simple, except for the occasional technical problems.
- Relatively easy.
- The information is understandable.

Not all users were comfortable with the Forum, however. The majority of the negative comments came from a single user who was participating in a distance learning course for the first time.

- Considering the minor problems I have encountered while attempting to use the forum there is need for improvement.
- It easier to have class in a classroom
- Nothing about this is efficient
- For me, there was nothing special about the forum that couldn't have been accomplished on e-mail.

The questions in Figure 15 were asked of students' observations of Forum use to determine if these issues were common to a majority of the students. Again, participants responded on a

Likert-type scale, with 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, and 5=Strongly Disagree. Thus, a lower average rating indicates a closer agreement with the question.

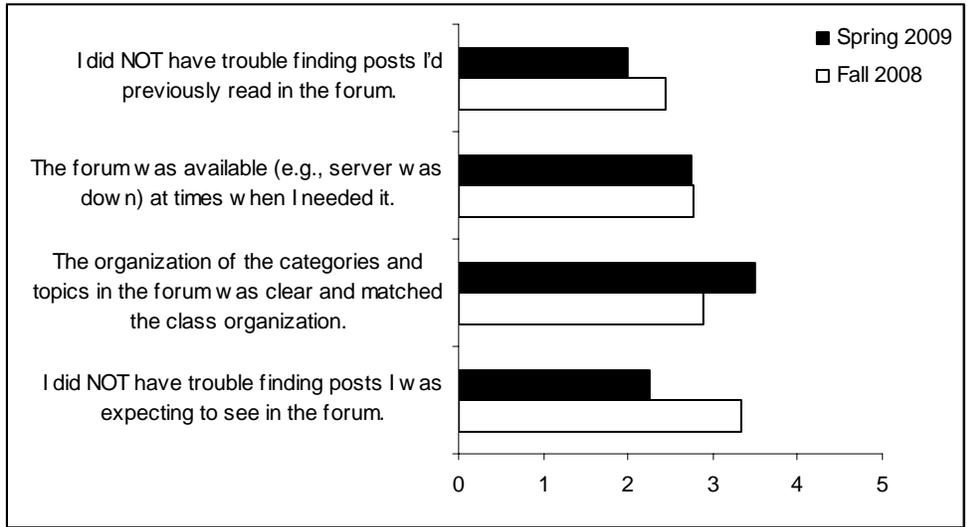


Figure 15. Average rating concerning problems with Forum use.

A final item asked participants if they would have preferred email to the Forum. In general, they responded that they found both useful. They are more familiar with email, but some of the material found on the Forum would be difficult to send via email due to size and the configuration of participants' computer requiring the information. The Forum was used more extensively during the Fall 2008 class than during the Spring 2009 course. During the Spring 2009 session, the instructor used email in combination with the Forum. Differing emphasis on the Forum in the two sessions make it difficult to compare findings between the two sessions.

eBooks. A subset of the students received an eBook for use during the Fall 2008 class. Since electronic books were not used in the Spring 2009 course, the data are from the Fall 2008 session only. Three students responded to the survey. Responses to survey items on the usability of the eBook are presented in Figures 16-18. As with the other surveys, participants responded on a Likert-type scale, with 1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, and 5=Strongly Disagree. Low average ratings therefore indicate greater agreement with the statement in the survey. The items are arrayed in ascending order of average rating, corresponding to decreasing agreement with the survey statement.

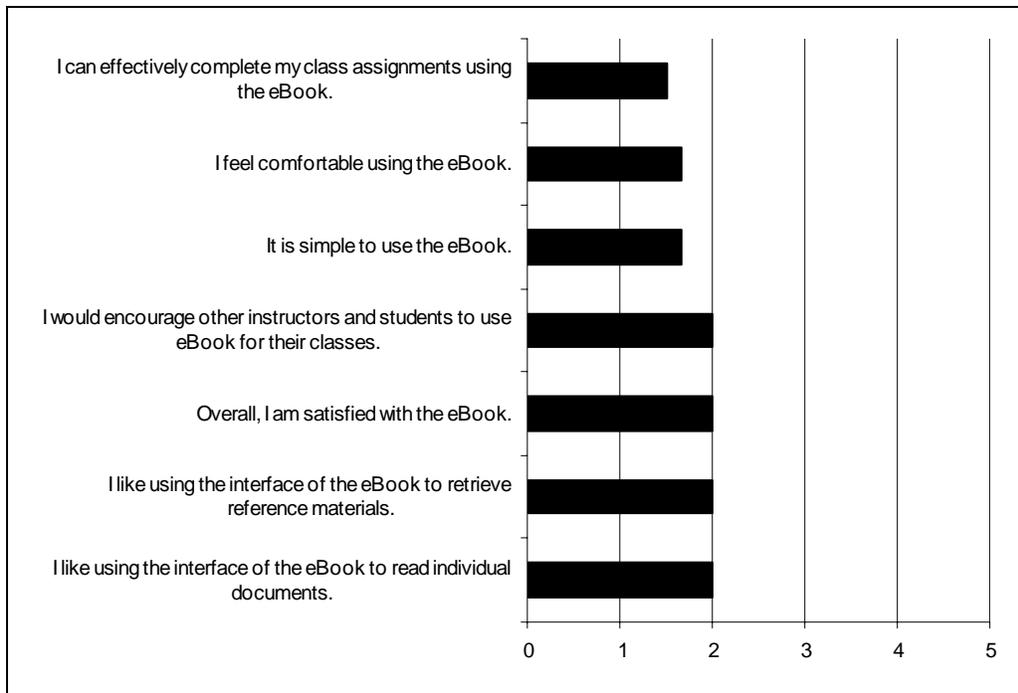


Figure 16. Average usability rating of the eBook (Part 1).

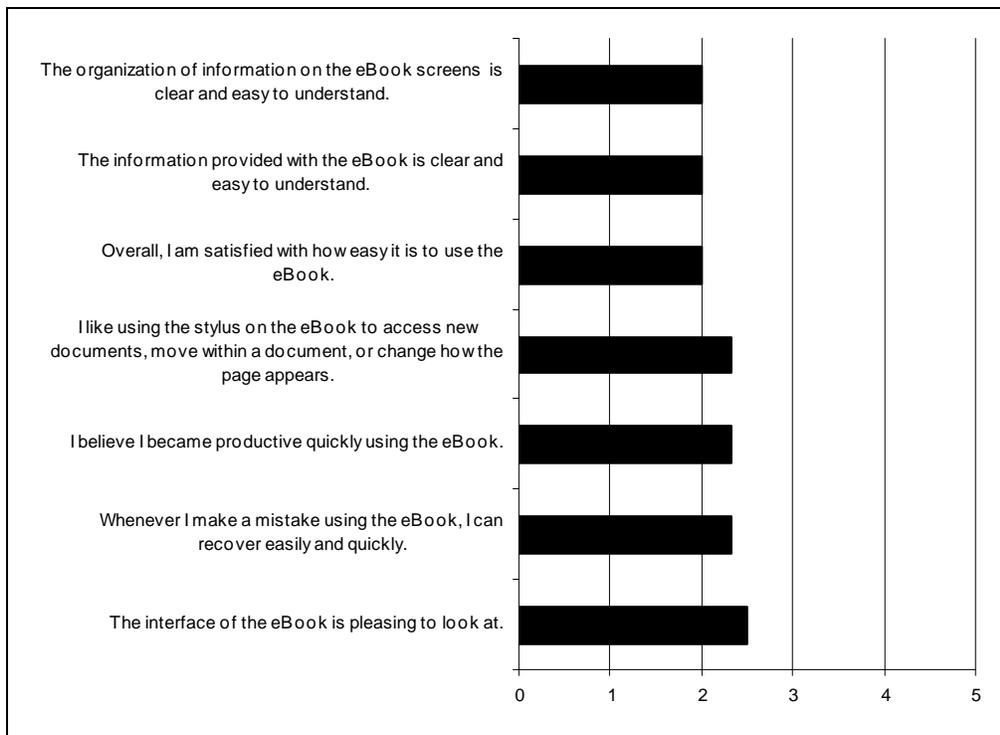


Figure 17. Average usability rating of the eBook (Part 2).

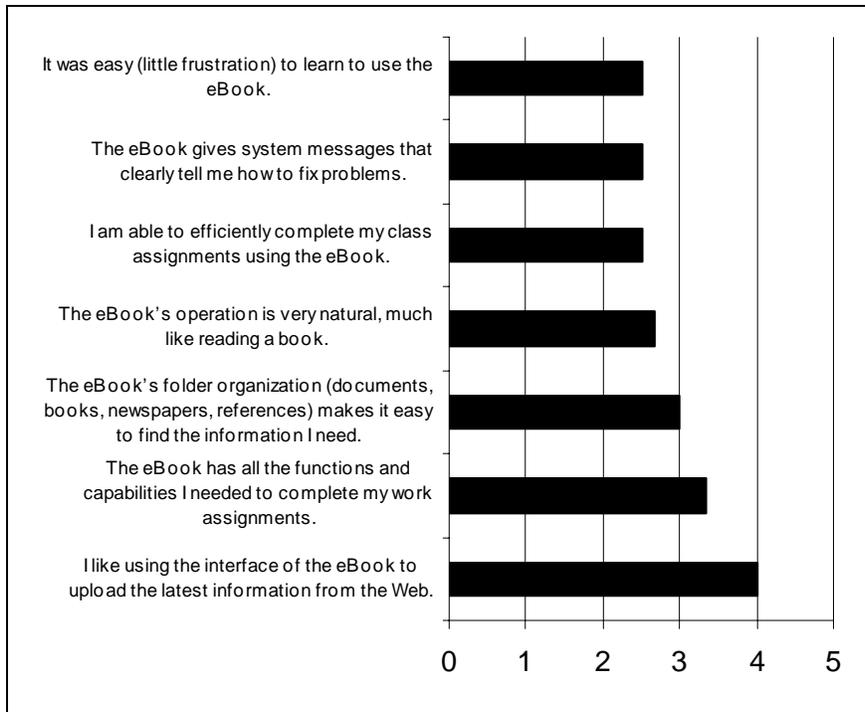


Figure 18. Average usability rating of the eBook (Part 3).

Overall, these students found the eBook very easy to use and saw it as a valuable addition to the class. There are additional features that they would like to see included in the device. The student comments are as follows:

- I used it in other electives to take notes and access stored manuals
- I used the eBook several times to review documents.
- Very useful for reviewing reference material.
- It would be great if it were preloaded with all of the FM's and JP's
- It would have been nice to have Web access and email.
- Sometimes the font is small and the zoom is not that easy to use
- It took a while though to find out that some of the advertised functionality is not yet available (e.g., downloading the news)
- Hard to search
- Difficult to upload information from the Web.
- Sometimes it would have been easier to use your finger rather than the stylus.
- The eBook is pleasing to look at. Response-It is a little boring.

Final Course Survey

Due to hectic scheduling and heavy workload demands, only four students in the Fall 2008 session and three in the Spring 2009 session completed a final course survey that compared the four digital learning technologies on a variety of usability, usefulness, and learning impact

criteria. Nevertheless, there are some major points that can be taken from the final course survey, as discussed below.

Of the four students who responded to the final survey, two had had no previous experience with DCO, eBooks, or forums, and three no prior experience with AW. While all four technologies received relatively high marks for ease of learning, the Forum was viewed as the easiest of the new technologies to learn and use. There was unanimous agreement that AW had a negative impact on learning. They all agreed that technical issues with the Forum did not negatively impact learning, an opinion that was not shared with DCO or AW, both of which had much lower assessments. As a learning tool, DCO received a more favorable rating among the respondents than AW. Students who used the eBook found it easy to use and beneficial for the class.

Regarding the Forum, respondents liked having all the information in one place and the ability to access posted material from the instructor and other students. One feature of the Forum that was not used was on-line discussions; they did not use the Forum to socialize with one another.

Conclusions

In this final section, we first summarize the major findings regarding each of the four digital learning technologies, in some cases providing details not addressed previously. We then offer six lessons learned from our evaluation of the blended learning course. We close by presenting several recommendations for what could be done in future blended learning courses to improve efficiency, effectiveness, and learning impact. In each section, we consider both the technical aspects of the technologies as well as the behavioral implications for the users.

Major Findings for the Four Digital Learning Technologies

Below, we summarize our findings from the in-class observations and online surveys that were conducted during the Fall 08 and Spring 09 offerings of the A523 course.

Defense Connect Online

Set up and Interfacing with non-military computers. Gaining access to DOD certificates to allow users with non-military computers to go through the DCO portal was a major obstacle in the Fall 08 class. While CAC card holders can go straight through, the process is more cumbersome on the non-military side. Only an extensive search by a highly IT-savvy team member revealed the needed certificates so that non-military users were able to start the blended course on the first day. On the other hand, once the root certificates have been obtained, non-military access to DCO was quite easy, as we saw in the Spring 09 class. As we saw in Fall 08, even once the certificate issue was solved, the technology checks needed to ensure that all the diverse, remote participants could link in were stymied by the multiple time zones covered collectively, preventing a “full dress rehearsal” until the first class was held. Set-up with the highly remote participants (Iraq, Africa) and DOS personnel was especially involved (audio calibration, connectivity checks), and not surprisingly, consumed the bulk of the start-up time.

Bandwidth and Connectivity. The problems with dropped audio plagued use of DCO throughout the Fall 08 class, although the severity was greater earlier in the course with the frequency and intensity dropping off somewhat in the later sessions. The time lost for actual education and training was obviously quite severe, as it required retransmission, greater reliance on chat, new start-up procedures, repeated connectivity checks, and the like. This is, of course, accompanied by lost meaning, loss of comprehensibility, and less information being conveyed

that was originally intended. With the number of participants (18 max) about double the number of official students (9), we learned that DCO bandwidth limits are notable, indicating that restrictions must be placed on the number of outside observers who can participate. On the other hand, the severity of the audio problems was greatly reduced in the Spring 09 course, to the point that audio issues had only a minor impact on learning impact and student participation.

Bandwidth and connectivity hurdles precluded effective use of video throughout the Fall 08 course and prevented a number of guest speakers from participating directly through DCO, where they instead had to call in through speaker phone and use the “hot mic” for their presentation. The extreme reliance on audio for information sharing placed greater demands on speaking clarity and use of text supplements, including both chat and PowerPoint. Both elements were viewed favorably in DCO as learning aids, however, although PowerPoint was not always available due to technical problems.

On the other hand, the Spring 09 class had far fewer problems. In fact, all guest speakers were able to give their presentations within DCO. Audio quality varied somewhat, depending on the guest speaker’s location, but by and large the major technical problems observed in Fall 08 were not an issue for the Spring 09 course.

Interface Issues. For the present application, the user’s DCO interface (chat window, camera & video window, participant list, whiteboard) was primarily controlled by the session moderator. At times, this involved some unpredictable changes in size and shapes of the screens. However, the survey results indicated that users were not put off by such shifts and learned to adjust to them without problem.

Integration of Learning Materials. By design, DCO was to serve as for the academic, first-half part of the Fall 08 course, with AW serving as the medium for the hands-on planning exercises in the second half of the class. As an academic collaborative environment, a key element for DCO is to flexibly allow PowerPoint and other impromptu whiteboard materials to be available to support lectures, group discussion, or student presentations. Based on our observations and participant comments, material to supplement audio presentations was severely underutilized in DCO. This was due to a combination of factors, including difficulty of use, lack of training, and in some cases, the absence of advance planning.

In the Spring 09 course, DCO was the primary instructional medium for all 12 sessions, including the practical planning exercises in Sessions 7-12. The lack of material supplement to the audio was still an issue, though the use of PowerPoint for lectures and presentations worked quite well.

Active Worlds

Role call and voice check. Though time-consuming, this process was essential to registering participants and determining the type of communication ability each possesses. In the future, one should consider whether observers, or any non-students, need to be comm.-checked based on their expected level of contribution. In this regard, it would be helpful to free the instructor from this duty to give him/her time for pre-class preparation and trouble shooting, either by assigning the task to someone on site or possibly automating it through one of the AW bots. The disadvantage of the latter approach is that with automation, we lose the ability to witness (hear or see) who is on-line in the virtual world, a form of familiar intimacy that is not available through chat.

It was clear from the observations and the survey that future classes need to consider steps to reduce the time required for the startup checks. These should, of course, include thorough tests of the system on every computer that will be involved, both resident and remote. This will be especially true for organizations with known compatibility issues, such as DOS. As a general rule, it would make sense to test AW on the least capable systems as a way to assess how difficult it would be to achieve interoperability.

Holding startup checks or roll calls in general, and especially with a voice response or video confirmation, also adds some security by establishing the actual identity of the person controlling the avatar, since one cannot assume the actual person is the one being named. Indeed, AW seats are expensive and bandwidth is limited in many settings, so it is to be expected that participants may be sharing seats. Also, we know that some participants will be connecting from home computers where spouses and other family members have access. It would thus be useful in, say, holding a pre-course tutorial on AW, to reinforce the advisability of confirming the identity with one's first communiqué in AW before discussing anything personal or sensitive. In this regard, it would be a good general rule to have some sort of introductory exchange when first meeting in a virtual world.

Teleports or accelerators. Our first-hand observations and surveys both established the desirability of having teleports to facilitate navigation and reduce wasted time in the virtual environment. In the TRADOC AW, participants routinely used teleporting to the CGSC class room, topic rooms, Africa Learning Center, Crisis in Darfur Center, Conflict Center, and Pirate Information Center. They also liked using other aids to speed up navigation, such as clicking on a seat to sit down. This was preferred to the psychomotor burden involved in moving an avatar upstairs or having to elevate over different areas to determine where one is located. Since the goal of the class is learning stability operation and not AW, all of these accelerators were much appreciated. In this regard, participants would have benefited from some guidance on the existence of these "helpers," since it was not clear to the novice that clicking on the seat is how one sits down or that one can click on the "you are here" map to teleport. The AW User's Guide was deficient in providing this information. For a structured course such as A523, the instructors know in advance the specific behaviors and places they want the students to use. There was no content anywhere else, so free-exploring the world would be of little value. These points apply equally to the use of AW as the primary instructional medium, as it was for Sessions 7-12 in the Fall 08 course and as an optional self-study medium, as it was for the Spring 09 course.

Maintain text record of class interactions and materials. With choppy audio and intermittent connectivity, it is especially important to maintain records of chat and other interactions to support presentations, discussions, brainstorming, and breakout room exercises. One option is a PowerPoint briefing that is prepared in advance and then displayed on the AW classroom presentation screen. This would provide a common reference point during class discussion and while brainstorming. In Fall 08, the presentation screen was becoming utilized more near the end of the course, when familiarity with the environment was higher and technical support available. Early in a virtual course, there is a greater need to prepare materials in advance; after familiarity increases, it becomes easier to load other presentations "on the fly" as the need arises to support class discussion.

Another option is the white board in the AW classroom: This was used only once during the Fall 08 course and not at all in Spring 09, but it has apparent potential. Because a name and password are required (which we did not have), we were not able to check out its functionality.

However, it would seem to be ideal for brainstorming items like courses of action, items falling under a sector, root causes of a problem, and so forth as a means to collect and organize people's ideas. An additional capability that would be useful would be to capture the product of the whiteboard as a text or at least a .jpg file, and then be able to load it in another room in the World, such as another breakout room for follow-on discussions and amplifying points.

Ideally, a combination of these two options could be used, where a presentation could be annotated in real time to facilitate class discussions. This would provide for the best of both worlds, as a reference to begin discussion and a living document to add new ideas to.

Finally, the chat box can, and did, serve as a rudimentary form of permanent text record. The discussion can be logged and later reviewed for key themes, content, and questions. Participants can also use the chat record as an overview/preview of what they will contribute during the verbal discussion. From our experience, it was much easier to follow and comprehend free-flowing discussions when they directly followed, or were related to, one of the ongoing chat questions, particularly given the choppy audio and intermittent connectivity problems.

Research Functionality. As a larger layout and organization issue, the design and functionality of the Information Centers in AW should be reconsidered. For the Sudan Center, the teleport lands one's avatar at the stairs in front of the building. This location is difficult for a novice to navigate since one has to fly or just walk right through them; it is then easy to become disorientated once inside the building because it is hard to reach and climb up on the center pulpit. If there is a best viewing spot for seeing all the information, the participant should simply be able to teleport there. This would be the functional equivalent of the "center up" button that one cannot see until they are basically already centered and whose actual meaning is not necessarily clear. The Crisis in Darfur Center is easier to navigate, however, and does not suffer the same disorientation problem.

The organizational logic of the "links" or clickable research items in the Information Centers is also not apparent to the AW user. Within the major areas, the links appear to be fairly random, with no obvious association between adjacent sets of links. Imposing some type of pseudo-organization, such as by sector or, more broadly, by military versus humanitarian, would have been helpful. As it is, the panorama of web sites that greets the visitor is fairly overwhelming. Granted, some links, like the one labeled "the indictment of the president," are more clear than ones such as "Sudan (the Republic of the)".

One way to help in this area would be to have a roll-over annotation that gives a preview of what one will find in the link without having to actually open it. In some cases, there are links that are highly similar, such as Darfur Details and Darfur Background. It would be nice to know the difference between the two, or at least the source. These two links were on opposite walls, which again speaks to the organizational problems with the centers.

There are also teleporting capabilities within the centers, as some of the square box-like targets are actually teleporting links that take the user to other centers or elsewhere. These targets are designed to look slightly different, which is helpful, but they should include a cue such as "to," so its function is clear. Organizing all the teleports into a "teleport to" section would also reduce navigational confusion.

As a research tool, the functionality of the web pages within AW has a negative impact on productivity. The default arrangement is a pop-up mini window on the right side of the AW

screen. However, the small size of the resultant web page is a detriment to Internet searching, especially when maps or other wide items are involved. It is possible to detach the window and expand it, but this also may not be intuitive for a novice user. It is not clear what advantage is gained by conducting the web research in AW versus working in a normal web browser, other than that the links are gathered in one place. But without a good organization, as discussed above, the present format is actually inferior to simply being sent to a single web site that has all the relevant links listed in tabular form.

Another limitation of the web-related functionality in AW is that it is cumbersome to highlight and copy material to a blank Word document in order to save the results or products of one's research. The goal of research is to gather and collate knowledge, and a researcher cannot be expected to remember everything. There are at least two options for retaining work, either of which might be useful depending on the user's needs. One possibility is to save the results – be it pdfs, maps, cut and pasted information, useful web links, etc. -- to one's own computer for later use. These documents could then be shared with the rest of the team via email, the Forum, or some other means.

The other option would be to add a workspace to the site where one could save, annotate, and otherwise store information within AW. This could be in the form of a shared “workspace” or an individual's workspace or virtual office. Importantly, this should not be just for file storage, but would also allow for creating new content (PowerPoint, Word documents, etc.) and assimilating information into “new” products for the team. This would be especially important if it were being used to support planning exercises.

Another useful capability would be to allow two-way navigation between selected web sites that share common information or functionality. This would include the web site where the PIF/CAI Forum is hosted as well as others, such as Anacapa's SameSide. An offshoot of the annotation idea that might reduce redundancy (and increase efficiency) in search efforts would be having a log (or bookmarks) of what sites other team members have already visited. If the World's search function and links are expected to have repeat users or repeat use by new team members on the same or similar exercises, then it would enhance productivity if these persons could also be allowed to annotate or rate sites based on their usefulness, applicability to certain matters, or other selection criteria. In essence, this would provide a way to store “corporate knowledge” during class research activities.

Several other aspects of the web search sites in AW are admittedly minor points, but they were somewhat annoying. First, several of the web links resulted in pop-up ads on the user's screen; this is something that should certainly be avoided and sites should be screened for this. Second, a number of the links (at least five by our count) were also not working or caused script errors so they would not run. These problems might be even more severe on State department or other government computers. Regarding the Sudan SME, it is recognized that all of the SMEs' inputs must be pre-scripted since they are bots and not a live person. To make the most of this feature, the SME needs to be updated frequently and programmed to provide inputs relevant to the course or other intended use. In the present case, it was not clear what topics the SME knew about, as only certain key words would trigger a useful response. The user needs some type of cue to know how to start the query. For example, perhaps the SME could provide a list of topics the user could ask them about, or, AW could provide an SME profile when the user clicks on the bot. Either technique would help alleviate non-productive, frustrating queries.

A great addition to the blended learning environment would be to supplement the bot SME with access to living SMEs, as it is impossible to pre-script all information needs. To be sure, real-time access to live SMEs could be done as well through the Forum, yet it would be nice to have the ability to ask or post questions that teammates or other SMEs could then see and respond to in some manner. This feature would likely require a time delay in responding, yet it might also be possible to post an alert when a real-world SME is available for discussion. Also, times could be posted when various real-life SMEs are available for discussions on select topics that could be listed in AW, the Forum, or even DCO. In effect, this would correspond to a valuable reachback capability that could be built up through a large-scale Community of Practice. In this regard, PIF, an international NGO, has developed such a community that could be made available for serving as in-country SMEs for future blended learning classes at the College.

Breakout Rooms. Breakout rooms were only used in the Fall 08 class. Although students could upload and do some cursory editing of presentations (e.g., delete slide) on the screen, no one ever did. The instructor was solely responsible for these activities, which only added to his already very high workload. Moreover, the interface for using the white board was not very user friendly either. While we could figure out how to edit or delete an existing presentation, as well as add a new one, we were not able to determine how to show the presentation.

From our understanding of the screen functionality, the user has a choice of .jpg or .ppt file format, where each slide is then converted to a .jpg file. The bot in the room provides a list of commands when the user whispers help to it (the bot also responds this way when he is clicked on), but we did not have the password to take control of the bot, which we suspect is required to show a presentation. Basically, the entire process needs to be made more efficient, especially if students/users are bringing items from the main classroom to discuss in a breakout room. Also, the Army should consider introducing a tool kit or something similar where users can clone or use other resources already created in the World (i.e., whiteboards) as needed in the breakout room.

Forum

The primary uses of the Forum for the course were to read posted information from the instructor (e.g., session start times, reading assignments, and log-in procedures), directions for accessing special material (e.g., tutorials, guest speaker presentations), articles to download, and feedback surveys to complete. As noted previously, the Forum received far more extensive use in the Fall 08 course than in Spring 09. Regarding the former class, students liked the Forum as a way to have all course-related information in one location, although its internal organization was viewed by some as confusing. Despite some occasional technical difficulties with accessing the information, most respondents were comfortable with this method for obtaining information and liked having updated information about the course. While email can provide some comparable capabilities, respondents liked the ability to see other students' posts and thought the organizational structure was beneficial. Despite its utility as an information source, the Forum was not used as a means for socializing, communicating with the presenters, following-up on class discussions, or participating in on-line discussions. These are all prospective benefits of the Forum, and might be exploited in future course offerings.

eBook

Only students officially enrolled in the A523 Fall 08 course used the eBook (it was not available in Spring 09) and, unfortunately, we were not able to obtain any independent observation of their

use during the course. Hence, our information is restricted to reports from those respondents who completed the mid-course and final course surveys. Students overall found the eBook very easy to use and considered it valuable for the class. They particularly viewed it as useful for reviewing reference material, but noted that it would have been more valuable had additional field manuals (FMs) and joint publications (JPs) been pre-loaded on the device. The interface with the Internet did not appear to be enabled for this course, so its ability to receive updated information (via the iRex web site) was not utilized. However, it appears to have considerable potential for providing access to large-volume material that would simply be too daunting if obtained via the Web or some other means. Also, its capability to receive the latest updates in doctrinal publications would seem to hold considerable promise for future applications. It will also be advisable to include some first-hand observations of student use with the device in future classes to identify any notable human factors or other usability issues.

Lessons Learned

Based on our observations of the course and analysis of the survey data, we offer the following six lessons learned about blended learning. First, *voice is the primary medium for information exchange*, so that preservation of its quality and continuity is critical to the learning process. As we saw with DCO, when audio was lost or connectivity degraded, the class was maintained through innovative use of speaker phone and “hot mics.” Assessments of voice quality, so that all participants can hear as much of the speaking as possible, un-degraded and unbroken, must receive the highest priority. Other media, including video, chat, e-mail, or PowerPoint presentations should be considered as only supplements to the primary voice modality.

Second, *determine the most effective technology to meet the needs of the course objectives and use the simplest technology that will get the job done*. Most students favored more traditional instructional methods and means of information sharing. For example, most students reported that they favored reading information from a hard copy rather than from a computer screen; preferred face-to-face meeting vice electronic meetings; and were not comfortable using virtual environments. When asked to identify means of information sharing that they found comfortable, most identified those involving no technology (face-to-face or hard copies) or frequently used technology (email and telephone). Telephone and email again were the most frequently used means of exchanging information when distributed. Even when developing shared-situational awareness, respondents preferred email, telephone and video conferencing. Based on the survey responses, it is clear that students expressed a strong pre-course tendency to favor familiar technologies, such as the telephone and email, for sharing information, distributing information, and developing SSA.

Bandwidth limitations will continue to place obstacles on who can and cannot participate, so that planning should be done in advance of any class or exercise. Connectivity is the rate limiting factor, both across sites and between organizations. Some of the problem is software-related, such as having the proper certificates to run DCO. Other problems reflect a combination of hardware and software. Importantly, each participating site needs to be internally reviewed by its IT cadre to see what its bandwidth can tolerate. As a related point, since BW will typically be a rate-limiting factor of participation, it will be necessary to limit the number of non-student participants to keep BW demand manageable. While it is possible to have non-participants use less BW (such as by turning their video stream off), their presence on the network will consume BW even in voice-only mode. Hence, there is a need to be frugal in granting permission for participation and/observation.

Because of the large number of complex technical issues that must be addressed in any blended learning application, *high levels of IT support will be needed* and should be made available. From our experience, it will be difficult for a new “site” to participate in the blended learning application unless they have their own internal IT support group that can troubleshoot connectivity and BW issues, explore server limitations, and in general, identify all the troubling hardware/software restrictions that remote participants will be faced with.

Blended learning is a much slower process than face to face instruction. With the inevitable technology “checks,” calibrations, request for repeat transmissions, and the like, everything takes much longer than expected in a blended learning setting. Hence, one must plan for this slower pace such as by starting sooner, having more things completed in advance, allocating additional time for activities, and restricting the scope of what is expected to accomplish within a blended learning session.

Finally, it should be recognized that *exploratory environments are not the same as learning environments.* Hence, while AW has extensive avatar functionality for exploring interesting visual “environments,” this capability worked at cross-purposes for the classroom learning setting that was modeled. Indeed, a learning environment, where the primary focus is on information sharing and communication, is quite different from a three-dimensional setting where free-form navigation, exploration, and visualization are promoted. While operation of avatars within AW can be considered “fun” in this context, it was clear that the heavier burden on the user to manipulate avatars and navigate had negative consequences on students’ learning experience during the class.

Recommendations for Future Blended Learning Classes

Finally, we close by offering some recommendations for conducting future blended learning classes based on what we have observed from the A523 course. These include:

1. Recognize that connecting students from distributed locations using a variety of systems will result in delays in beginning a class. Also consider the inevitable consequence of the technical delays and communication glitches that result in a slower pace of blended learning relative to face to face instruction.
2. Consider having a dedicated helper to the course instructor whose job would be to respond to chat messages and e-mail, and conduct communication checks. Because the instructor is handling both in-class and remote participant communications, he/she is extremely busy during a given blended learning class, and thus is the focus of multiple interruptions. It would both alleviate the instructor’s workload and increase class efficiency to have a dedicated individual, preferably someone with IT expertise, to be available in the class to monitor students’ chat messages, conduct all connectivity checks, and address any other technological issues, freeing the instructor up for conveying class content.
3. Prior to class start-up, the Army could hold a short tutorial on optimal methods of presenting material within a blended learning environment. The idea here would be to initiate a mindset change, that blended learning is fundamentally different than face to face settings, in which voice quality is important, slide content must supplement potential lost audio, pace of delivery must be slower, and so forth. In essence, the tutorial would be designed for both students and participants to help them consider how to speak, use video, and create supplemental content (chat, PowerPoint, e-mail) in ways that promote learning and enhance information sharing.

4. As part of the course preparation, it would be advisable to create an IT steering group or subgroup whose responsibility would be to support troubleshooting technology problems at the various participant sites. The subgroup would take the lead on any overarching connectivity or bandwidth wrinkle that has surfaced and would offload the demands on the resident instructors and their staff.

5. Finally, the Army should consider holding a brief, one-hour tutorial on the skills and procedures needed to access DCO (including using its interface) and navigate with AW (including avatar manipulation). Even a short, hands-on session with these collaborative environments would help overcome some of the problems experienced by students and other participants during the course.

Glossary of Acronyms

AFRICOM	U.S. Africa Command
AOR	Area of responsibility
ARI	U.S. Army Research Institute
AW	Active Worlds
CAI	Center for Applied Innovation
CENTCOM	Central Command
CGSC	Command and General Staff College
COA	Course of action
COTS	Commercial off-the-shelf
DCO	Defense Connect Online
DOD	Department of Defense
DOS	Department of State
FM	Field manual
GOTS	Government off the shelf
HA	Humanitarian Assistance
HOA	Horn of Africa
IPC	Integration Planning Cell
IT	Instructional technology
IWS	Info Work Station
LNO	Liaison officer
NGO	Non-governmental organization
JP	Joint publication
JIPOE	Joint Intelligence Preparation of the Operational Environment
PIF	Partners International Foundation
PKSOI	Peacekeeping and Stability Operations Institute
PPT	PowerPoint
S/CRS	Department of Coordination for Reconstruction and Stabilization
SME	Subject matter expert
SO	Stability operations
SPT	Sudan Planning Team
SSA	Shared situational awareness
TRADOC	Training and Doctrine Command
UN	United Nations
USAID	U.S. Agency for International Development
USG	U.S. government
USIP	U.S. Institute of Peace

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