SMALL GROUP INSTRUCTION IN REAL-TIME OVER THE WEB

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Abstract:

In 1998, the U.S. Army Armor School launched a major distance learning effort to convert an eighteen-week officer professional development course to an instructional strategy that could be delivered over the Internet. Two major challenges had to be met and overcome. The first was to redesign all content, developing the knowledge and comprehension levels into interactive asynchronous lessons deliverable over the Internet. The second was to implement, at a distance, the small group exercises essential for students to develop higher level thinking skills needed for problem solving. From August 1998 until March 2000, the Armor School developed and implemented the asynchronous courseware that delivered the knowledge/comprehension levels of learning. Feedback from students and data analyses indicated that the courseware was effective. During that same timeframe, the Armor School also developed a learning environment called the Virtual Tactical Operations Center (VTOC), which enabled the students to apply the knowledge gained in the asynchronous courseware. The development of the VTOC was unique in that the features of the collaborative environment were actually developed using the basic collaborative environment itself. The development was conducted among contractors in Munich, Illinois, and Texas and government content experts at Fort Knox. Features include a 3D Tactical Operations Center that can be exchanged for 3D terrain, reference access, test production, a map overlay editor, a map display with movement matched by the 3D world, a text chat function and voice conferencing, and display of the participants' names. Implementation occurred between April and October 2000 with 16 students meeting on a monthly basis. Feedback from the students was extremely positive. Students were each assigned roles to play in monthly scenarios provided to them by their instructor via an on-line student syllabus/homework site within the VTOC. During each weekend session, which lasted 8 hours on Saturday and 3 hours on Sunday, the students worked on developing products that were a direct result of the combat scenarios they were assigned. The VTOC allows collaboration of groups of 15 and splitting up of that group into as many as 6 groups. All students have learning tools within the VTOC that allow production of text products, development of map overlays, and presentation of oral briefings. The instructor and students have the capability of attaching others to them as they move their avatars through either of the virtual 3D environments, causing those attached to see what the leader sees. In addition, a 2D terrain display shows students how their decisions on the battlefield are then reflected in the 3D world displayed right beside it. Working through the issues of group dynamics, grading group work, maintaining group cohesiveness, motivating students to stay up with the group has demonstrated that learning effectiveness in cognitive and constructivist terms is doable over the Web, that the Web is not just for simplistic learning, and that group work is not limited to chat rooms and bulletin boards. The Web is capable of supporting interactive, truly collaborative, real-time learning environments, where peer exchange and instructor facilitation allow the light bulb to go on.

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INTRODUCTION

In 1998, the U.S. Army Armor School began a major distance learning course conversion effort that would result in sixteen weeks of an eighteen-week officer professional development course being deliverable over the Internet. This project, the Armor Captains Career Course - Distance Learning (AC3-DL), demonstrated that the Internet can deliver highly interactive asynchronous instructional materials that use graphics, animations, drag-and- drop functions, audio, and even virtual materials. More importantly, this project created a virtual learning environment that allows for group work in real-time and thus peer interaction, instructor facilitation, and practical application of the knowledge gained asynchronously. This latter breakthrough in technology allowed the course to replicate the small group instruction in the resident course where the student gained higher level critical thinking and problem solving skills.

BACKGROUND TO THE ARMOR CAPTAINS CAREER COURSE (DL)

The Armor Captains Career Course (DL) prepares students to be company commanders and battalion and brigade staff officers. A company commander or staff officer is the equivalent of a civilian mid-level manager with at least a bachelor's degree who supervises an organization composed of 60 to 100 subordinates with assets of $30 to $50 million dollars. These leadership roles require advanced skills in planning combat missions against an adaptive enemy force and leading a complex organization made up of maneuver, supply, maintenance, and information assets.

Students traditionally complete the resident AC3 in 18 weeks. Class time for these students totals 719 hours. However, most officers in the Army National Guard, which contains 52% of the Army's armored forces, cannot attend the 18-week resident course due to having only 39 active duty training days per year. In the past these officers completed a reduced course consisting of approximately 150 hours worth of text-based training and two weeks of resident training. The difficulty in reaching these National Guard officers along with the importance of training to the same standard as the Active Component made them ideal candidates for a distance learning version of AC3.

COURSE DESIGN

Phase 1a

The first phase of the AC3 (DL) is a knowledge-based, "crawl" stage of content delivery. This phase is delivered entirely asynchronously via the Internet. The courseware is delivered using a learning management system that logs the students on and tracks their progress. The instructor has the ability to observe the students' movement through the materials, provide them feedback, and also control their advancement. This phase of the course is broken into modules, each with a number of lessons, each with a test. Five of eight modules have culminating exams. Most tests are computer-graded; however, the complexity of the module tests, or gates, requires instructor grading to address complex, experience-based, problem-solving scenarios. This instructor involvement in the asynchronous courseware has made a difference in attrition rates, which started at 60% and now has dropped to less than 30%. The students have one year to complete this phase.

Phase 1b

The second phase of the course is also delivered via the Internet, this time in small group *synchronous* remote sessions. Following specific asynchronous modules, students attend small group sessions to develop combat-related products that reinforce the concepts and principles taught in the asynchronous content. Students are given assignments (specific roles to play within a combat scenario) and then work collaboratively using a virtual learning environment called the Virtual Tactical Operations Center (VTOC). Students and instructor may be anywhere there is Internet access. After a brief review of the material from the asynchronous phase, the instructor provides further instructions for the practical exercise

and the students break into their various smaller groups (as many as six groups can work separately in the VTOC). At the end of the designated time, the instructor checks back with the group in the main room to see if the groups have completed their products or need more time. When ready, each of the smaller groups reports out to the larger group of 15 and receives feedback from both peers and the instructor. Reports are presented in two ways--- through a text function in one window of the VTOC and through an audioconference function built into the VTOC. All students and the instructor can use these functions in the large group and in the smaller group work. The students can also use a chat function in the VTOC to "talk" to other students and the instructor, and they have access to the instructor through a 1-800 phone line and through email. Private conversations among students and between student and instructor are also doable.

This phase is integrated with the asynchronous courseware so that the practical exercises within the VTOC reinforce the learning gained from the asynchronous lessons. An introductory group session is held the first weekend. After that, the weekend sessions follow the same order as the asynchronous content. The students finish the module on the military decision making process (MDMP) and their next weekend session practices using the MDMP. With the integration of the weekend session into the asynchronous courseware sequence, a student can finish the content in less than a year. One student finished in nine months. The usual length of time to finish is 12 or more months.

Phase 2

This final phase brings all the students who have completed Phase 1 (a & b) to a resident environment for two weeks. During these two weeks, students experience or "run" with the content during live, virtual, and constructive simulations that increase each student's decision- making skills. Now they get to experience combat tasks on real terrain and in fully interactive constructive and virtual simulations instead of just as an individual or as a small group member. Now the same small group instructor who taught them over the Internet can assess their abilities to perform in the "real" world, face-to-face. This becomes the capstone exercise that allows the students to analyze, synthesize, and evaluate the depth of their understanding of the tasks taught in the course. Their after action review of their efforts at the end of the course indicate that they are well aware of their strengths and weaknesses and how much the course has taught them.

THE VIRTUAL COLLABORATIVE ENVIRONMENT

Development

The development of the AC3 (DL) collaborative learning environment, the VTOC mentioned above, provided a unique experience for the subject matter expert and the technical advisor for this project. The VTOC concept and parts were developed at a distance in a communal work environment set up by the contractor doing the programming of the VTOC. The programmer was located in Munich, Germany, other technical developers were located in Illinois and Texas, while the government SME and the project technical expert were at Fort Knox, Kentucky. The basic collaborative environment was put on-line by the Munich programmer, and each week the group came up in the virtual "room" together to talk via a phone conference and to work through an agenda of issues and questions written in the VTOC text box. This on-line collaboration allowed more frequent review of the learning environment and ensured that the contractor had immediate clarification of tools the government wanted incorporated into the virtual "classroom." No project would have been able to afford that level of coordination if travel had been involved. The SME was key to this project in identifying all the behaviors and tools required to duplicate the collaboration and creation of tools required in the resident small group practical exercises.

Features that became a part of the VTOC that would allow the duplication of the resident small group work included a 3D tactical operations center with a main room and six side rooms that could represent each of six different roles students might play. This 3D room can be exchanged for 3D terrain that matches a 2D map depicting the same terrain in a second frame on the monitor. Movement in the 3D world is matched by movement of objects displayed on the 2D map. A map overlay editor allows any participant to edit objects on the 2D map. At the bottom of these two frames are a text chat function, a display of participants names (who has signed in), and an audio function that allows up to 15 participants at one time. In addition, the 2D map can be replaced with a reference library or a whiteboard-like function that allows student and instructor to input text and display it to others.

Implementation

The first class entered the VTOC in April 2000. Sixteen students were divided into two weekend groups to allow for more interaction and lessen the

complications of implementing a new technology. All sixteen students finished the weekend sessions in October 2000. A second group of nine students finished in May 2001. Three more classes will complete this phase of the course by the end of 2001.

Each weekend session lasts 12 hours, usually 8:30 to 5:00 on Saturdays and 8:30 to 12:00 on Sundays. Students have a homework assignment provided the week before and each student does a technology check either Thursday or Friday prior to entering the class on Saturday morning. The first half-hour of each weekend day is spent conducting technology checks ensuring that students have few or no problems throughout the sessions.

A Comparison

The vast majority of collaborative e-learning environments today fit the pattern of having a bulletin board, a threaded discussion capability, and email. These work very well to enhance student involvement, allow reflective thinking, engage the student in deeper, critical thinking, and even identify students' personalities for the instructor. These not-in-real-time features work extremely well for academic subjects that are broad, abstract, and foundational in knowledge.

For this military audience of mid-level officers just beginning to develop and hone their decision-making skills, much more engagement was essential to allow them to practice those skills with a facilitator / mentor for immediate feedback. In addition, the foundational content for this course is extremely long and intense, requiring 20 hours a month for a year to complete all self-paced lessons. The VTOC serves as a practice arena to reinforce the facts, concepts, principles, and processes taught in seven of the eight modules in Phase 1a and as soon after the students finish a given module as possible. In that sense, the VTOC serves almost as a laboratory where the students can practice with various scenarios (substitute formulas or strategies) to determine how to develop staff products that would be used in a combat environment. The weekend sessions have served as motivators to encourage the students to stay consistently active in the course in order to complete within a year. This seeing the light at the end of the proverbial tunnel has kept students moving through difficult content in order to stay up with their group and graduate with them after the two-week resident phase.

This same real-time capability would be invaluable for training such subjects as physics and chemistry. Experiments could be conducted first in the 2D environment and then observed as they played out in the 3D. Students could collaborate / partner on difficult experiments and then present them to a larger group with comments by the instructor for further applications. The instructor could provide mini-lectures, text, references, and demonstrations so that students would not get lost in very complex content, and then conduct their own experiments in a safe, virtual world.

The key element that appears to drive the requirement for real-time collaboration is complex content which has some real solutions or end-states that the instructor wants every student to master. More abstract content that requires the building of higher level thinking skills can be adequately handled via non-real-time collaboration.

LESSONS LEARNED FOR SUCCESSFUL REAL-TIME COLLABORATION OVER THE INTERNET

Many instructors and other educators still express concern about the learning efficacy of distance learning. With the advent of new capabilities like real-time collaboration over the Web, some of these concerns will disappear as more and more institutions---academic, industry, and government—find inventive ways to replicate the learning that occurs in face-to-face classrooms, ostensibly because an instructor can see when students are lost or not comprehending difficult content and can provide one-on-one remediation, or spend more time in class on that particular problem area. In fact, because of greater individual learner accountability in on-line courses and now the ability of the instructor to observe students in group situations, future research might well identify that greater learning will ultimately occur in well-designed DL courses.

Following are a few of the lessons learned over the past two years using real-time collaboration that indicate, at least in an anecdotal fashion, that learning is becoming effective over the Web. That said, these lessons also indicate that the challenges of teaching at a distance are there; more intensive planning and preparation, better lesson and course design, and back-up plans for the technology must be in place to increase learning effectiveness and learning efficiency.

Technology Lessons Learned

Key to successful collaboration at a distance, particularly in real-time, is the hardware and software programs for both the students and instructor. Prior to the collaborative sessions, all technical issues need to have been coordinated with each student, a technical check made for each student's computer and all functions being used during a session, such as audio. Normally, students in AC3 (DL) call in on a 1-800 number one to two days prior to each weekend session. The instructor or a technical assistant walks each student through a series of checks to ensure that his computer supports the weekend session and to ensure that all functions in the VTOC work on his computer. These pre-checks have been extremely important to efficient use of weekend time since students have been required to use different computers on different weekends because of work requirements. Some students have linked in from home, others have had to attend at a unit armory on some weekends, others have moved from one state to another.

All of these changes require constant vigilance to ensure that some change in the computer and connections does not cause problems. Setting up the protocol to pre-test computers prior to each weekend session and then also requiring that the first 30 minutes of each weekend be spent crosschecking and de-bugging any technology glitches have allowed AC3 (DL) instructors to concentrate the sessions on the students' learning rather than on the technology.

To assist in that effort, a technical support person is always available to students even while the rest of the group and the instructor are working through a group product. Solving a student's technical problem quickly keeps him from missing the interaction within the VTOC. Having this additional support also keeps the instructor from stopping the entire group due to one computer problem. The individual can be brought back into the process either by the instructor in an off-line discussion or by his fellow small group members.

In addition, the instructor must ensure that external factors do not interfere with collaborative sessions. For example, system support on routers and system upgrades often occur on weekends. Coordination on schedules ensures that an organization's external support system does not wreak havoc with the collaborative sessions.

One other backup will assist students' access to the weekend sessions. Occasionally students cannot connect through their Internet service provider (ISP), or in some cases, students do not have an ISP. We provide the students with a 1-800 number and allow them to connect using a terminal access server. Most students prefer to use their own ISP because it is faster; however, this back-up plan works, especially if a large provider like AOL goes down.

Group Dynamics Lessons Learned

One concern that the small group instructors had prior to the VTOC sessions was the replication of the interaction that students have in the regular small group classroom, both the informal and the formal. Without that interaction, the instructors felt the DL learning would not be equal to the resident classroom learning.

By the second weekend session (the first weekend concentrates on learning the technology and reviewing some basic foundational material), we began to observe the students behaving very similarly to what they did within a regular classroom. The technology became just a means to communicate, only in a different way.

The students began to have side chats complimenting one another on answers given in discussion. This can be done very quickly without losing focus on what else is happening within the group. Just as in a real group, some of the side comments took on sharp jabs and jokes to get students to straighten up or be part of the group. This camaraderie and peer pressure that frequently build within a group tasked with producing something concrete were clearly evident even in this virtual learning environment.

Often, in a face-to-face classroom, groups are dominated by two or three extroverts while the rest of the group follows along tacitly or with mild input. Only the instructor can ensure that this does not happen, or occasionally a student will take this stance and insist on fair participation. What happens in DL is that the technology actually assists and encourages the full participation of all students. For example, the extroverts could not leap in every time and dominate every second in the VTOC. The delays in transmission, although minuscule, still allowed others and the instructor to keep just one or two from dominating. The extroverts seemed to prefer the audio, but used the text chat function as well. The fact that they were slowed down a bit allowed them to be more thoughtful in their responses. The introverts appeared to prefer the chat function because they could mull over their answers for a few extra seconds and become comfortable with their

answers. In addition, the delay in the audio allowed them that extra time to think through their answers, which made them more comfortable in that medium as well. Broader and more intimate involvement is what we saw come out of the virtual learning environment in real time.

In addition, some students began to experiment with the technology functions, making the VTOC do things we hadn't even thought of, and then sharing that with the rest of the group. Just as with most groups, some were more comfortable with the technology than others, but all were willing to help and ask for help when needed. There is no evidence that technology engenders empathy; in fact, many would say the opposite. What we observed was a great deal of consideration and concern for other members of the group when technology problems precluded someone from continuing in the group.

Part of what evolved out of the group work was a greater individual desire to remain with his group. Even at a distance, students developed identification with the group and a comfort level with the group that caused them to want to remain. As a result, once group work began, we saw less and less attrition from the Phase 1a and a more consistent movement through the foundational content in order for the student to remain in his original group during the weekend group work. This motivational factor alone says volumes about the importance of replicating an authentic learning environment at a distance that provides instructor and peer interaction in a meaningful way.

Grading Group Work Lessons Learned

Grading group work over the Internet proved to be a challenge for the instructor, but feedback is feedback whether over the Internet or in a classroom. Instead of formally grading each student or each group, the instructor used a checklist to all the areas that he was expecting to be covered in whatever the product the group was developing. Each subgroup of two to three students would brief the information that they had developed and placed in the VTOC posting section (a text function that acts much like a whiteboard in a classroom). The instructor and the rest of the subgroups would listen and then provide feedback, usually orally, but also in chat. At the end of the subgroup presentations, the instructor would spend ten to fifteen minutes summing up the learning elements in that day's work and addressing any weaknesses that the students needed to work on for the next day or for the next weekend session.

Finally, the instructor would conduct a student evaluation session at the end of each weekend. Each student was encouraged to discuss what he had learned or what he had found difficult during the session. Students were also encouraged to critique any weakness in any session so that improvements could be made. Participation and feedback from these forums allowed the instructor to assess what the students still needed to work on for the next session and what he needed to improve in order to better facilitate the students' learning. These feedback sessions also allowed the students to reflect on their own learning and determine where they were still weak. Prior to the next session, they could choose to return to the on-line materials on a particular subject and review areas where they needed work.

CONCLUSIONS

The technology issues, the group dynamics including maintaining group cohesiveness and motivating students to remain part of a group, and the feedback required for group work, all demonstrate that learning effectiveness, in cognitive and constructivist terms, is doable over the Web. In fact, the Web has now been demonstrated to be capable of more than just simplistic, text-based learning for groups. It can support more than just chat rooms and bulletin boards. The Web is capable of supporting interactive, truly collaborative, real-time learning environments, where peer exchange and instructor facilitation allow the light bulb to go on.

Perhaps, it is just as important to remember one of the key reasons for DL: to provide access to learning to audiences that might not have access otherwise. The Web can do this anywhere, anytime. One AC3 (DL) student expressed the importance of DL and the Web as a delivery mechanism during the student feedback at the conclusion of one of the weekend sessions. He said, "I was moved to Alaska from Texas during the last month. There is a gas station, a small grocery store, and one other building in this small town. But I'm still in the course because I have access to the Internet. I can still participate from way up here. This is great!!" Now that DL is Web-deliverable and collaborative in real-time, that says it all for us too.