INTERACTIVE DISTANCE LEARNING OVER THE INTERNET A HYBRID SOLUTION

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ABSTRACT

Global Information Systems Technology, Inc., under contract with the Air Force Material Command, Armstrong Laboratory, Advanced Training Technologies, at Brooks Air Force Base Texas (Lab), has completed, and placed in service, a Hybrid Internet training solution. The Military Decision-Making Process (MDMP) training was developed for the Armor Officer Advanced Course at the Army Armor Center, Fort Knox, Kentucky.

Evaluation, using 294 students, is underway as of the writing of this report. Results will be presented at the conference, with an updated paper/presentation with these results posted on http://gist-inc.com/intech. Additionally, a short demonstration of the course will be presented in the session.

The MDMP is the decision making process used by Army officers for battle planning. This domain was selected to:

1. Evaluate instructional strategies for automated training over the Internet;
2. Assist the Army in reducing the length of their course while optimizing instructor time, increasing the retention, and increasing the learner's acceptance of the course material; and
3. Provide remote delivery for the MDMP training to personnel not located at Fort Knox.

The tutor allows small groups of students in a collaborative environment to use a menu-driven system to learn the component parts of MDMP. Required reference materials are available on-line to students at all times.

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BACKGROUND AND CURRENT SITUATION

The Armstrong Laboratory at Brooks Air Force Base manages the Modeling Of Automated Instruction (MAIN) Improved Instructional Techniques for Intelligent Training Systems (INTech) contract. Under this contract, Global Information Systems Technology Inc. implemented a hybrid Internet course for the Army.

The INTech project provides technological solutions that satisfy military training needs. It evaluates hardware and software products for prototyping training systems to advance state of the art instructional technologies; and to field and evaluate the courseware developed to document the effectiveness of the instructional strategies and theories.

The topic is the Military Decision Making Process (MDMP), part of a twenty week Armor Officer Advanced Course. This courseware will cover of the 5th week segment of the course. Currently, one instructor leads a typical class consisting of sixteen students broken up into four groups of four students each. Depending on student load, one instructor may have two groups of seven students each.

A primary role of the instructor is to facilitate the military decision making process as students try to formulate an effective Course Of Action (COA). During the decision making process, students are assigned one or two functional roles in which to the analyze the information. A total of seven roles are divided among the students in each group. Students must submit two interim products (COA recommendation, synch matrix and decision matrix) and the final product (Recommended COA briefing). The instructors will evaluate and provide feedback to the group for each submitted product.

The Military Decision Making Process (MDMP) is a systematic approach to decision making, which fosters effective analysis by enhancing application of professional knowledge, logic, and judgment.

The MDMP domain provides a significant courseware development requirement, having a high probability of affecting the methods of future courseware production for similar Army and Air Force domains. The MDMP is initially instructed in the classroom over a four day period, with a contact time of 32 hours. The automated courseware covers the same materials and objectives utilizing computer-based training and Internet technologies.

Front-End Analysis (FEA)

A front-end analysis was performed to ensure the course would meet training objectives that are validated against real job requirements. The approach was eclectic (in following with the ISD process), based on the experiences of the team in doing FEA. Initial contacts with Domain Experts (DEs) was by phone. Requests for documents, and clarifications over the phone, gave the team the first Overview of the training requirements, target population description, and course objectives.

A needs assessment was conducted to gather and evaluate course objectives and environment. The team traveled to Fort Knox and observed an ongoing class. This allowed the team to observe the communication between the seven functional positions that the small groups (SG) of students role play. The team met with representatives of four of the seven positions (ADO, FS, INTEL, ENG) represented when doing the MDMP role play.

The team was able to discussed objectives previously defined with DEs and the Government PM and build a list of information students must reference to support the learning tasks.

The current Armor Officer Advanced Course (AOAC) is a 20 week course composed of large group instruction, small group instruction, the JANUS constructive simulation exercises, SIMNET virtual simulation exercises, and field exercises. An AOAC class is composed of approximately 100 students who hail from the regular Army, the Army Reserves, the U.S. Marine Corps, and from foreign armies. Initially, the students attend large group instruction together. The students disperse into groups of about 14-16 for the small group exercises.

A small group instructor (SGI) is assigned to each group. Each small group further divides into sub-groups; two groups of seven or four groups of four students. The sub-groups use the MDMP process to plan a course of action. The COA is executed in the JANUS simulation at the battalion level, with all students divided into command and support functions.

The SIMNET simulation is run at the company level, with all students operating specific tank operation positions. These exercises are planned and executed against an OPFOR (opposing force) composed of the instructor group. Field exercises are restricted to terrain appreciation and leader's reconnaissance of the battlefield.

From the front-end analysis, the learning activities were described as:

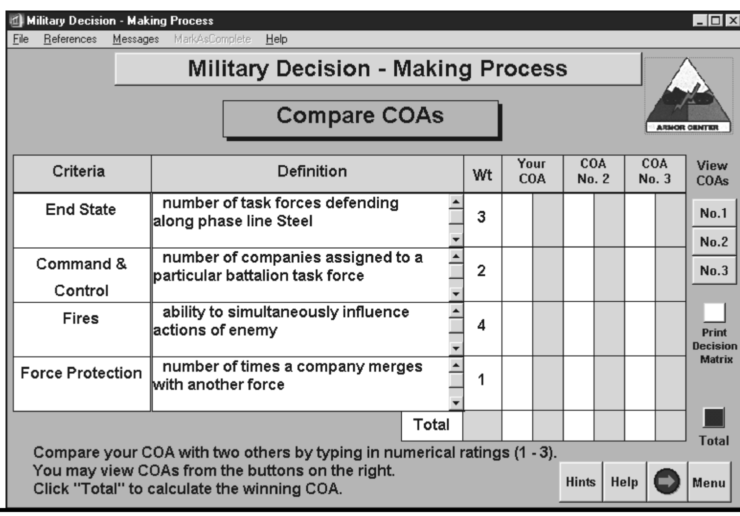
- Gathering facts (current status or conditions);
- Making assumptions (substitutes for facts if information is not known);
- Analyzing higher mission and intent (what tasks are required to accomplish the mission); and
- Receiving commander's guidance (focus for subsequent staff planning).

Also, the courseware architecture for the application of technology to this training requirement was detailed as two major efforts:

1. The implementation of computer-based training (CBT) activities to present mission guidance, provide detailed data for analysis, and to capture small group intermediate and final products. It was noted that to duplicate the hands-on classroom experience, the CBT needed early involvement in active learning exercises and the CBT had to provide learning references, not the learning material; and

2. The implementation of distance learning technology to link the SGI's with the small groups during (for assistance), and after (for product analysis and feedback), the construction of the intermediate and final products.

The first decision was based on the requirement to provide a highly interactive, graphical method to capture the student's strategy design. Response time for the 122 cell synch-matrix, a large matrix used to document the synchronization of actions over time for the battle plan, was desired to be



In this sample lesson segment, students compare COAs against selected evaluation criteria using a Decision Matrix. The student has access to:

- Hints: Provide information that reminds the students what to look for in order to make a good decision.
- Help: Operation instructions.
- MapEdit: for viewing other COA sketches for comparison.
- Print: Allows students to print a matrix.

Figure 1 - Decision Matrix Lesson Segment

less than 3 seconds. The decision-matrix exercise requires similar user interaction (see Figure 1). It was determined by experience that the response time for an Internet solution was insufficient and undependable for such a training exercise.

Additionally, the instructors were adamant about the effectiveness of the current teaching exercises. The goal of the CBT activities were to guide the student group through the activities, capture the end-product of the activities, and initiate the student/instructor asynchronous dialog. Due to the nature of the material, in that there was not one RIGHT answer to the exercises, the instructor was REQUIRED to be in the evaluation loop.

The second decision was how to communicate between a remote student group and the instructors at the schoolhouse. Tests of real-time video proved current Internet technologies unusable for synchronous communications. The decision was to proceed with the asynchronous methods which utilized scripts to send files to an Internet FTP site, notify via e-mail that materials were available for review, and provide messaging between instructor and the CBT module for locking/unlocking modules based on instructor review of the student materials.

Description of the Hybrid Course

The high level architecture showing the grouping of the required functions is shown in Figure 2 . Overlaying the automated instruction and DL technologies to the current course provides an interactive course that covers the same objectives as the current stand-up instruction course. The automated instruction functions provide situation details required for each phase of training. The small group functions are still completed in small groups.

The Distance Learning functions provide the organization and communication methods for the small groups to get help during the small group actions and to receive feedback on the small group products. Gates (hard-coded pause points in the CBT) are closed until the student products are reviewed by the SGI. The SGI evaluates the products, directs the group to correct any deficiencies, and, if appropriate, opens the gate to allow the group to move to the next MDMP phase.

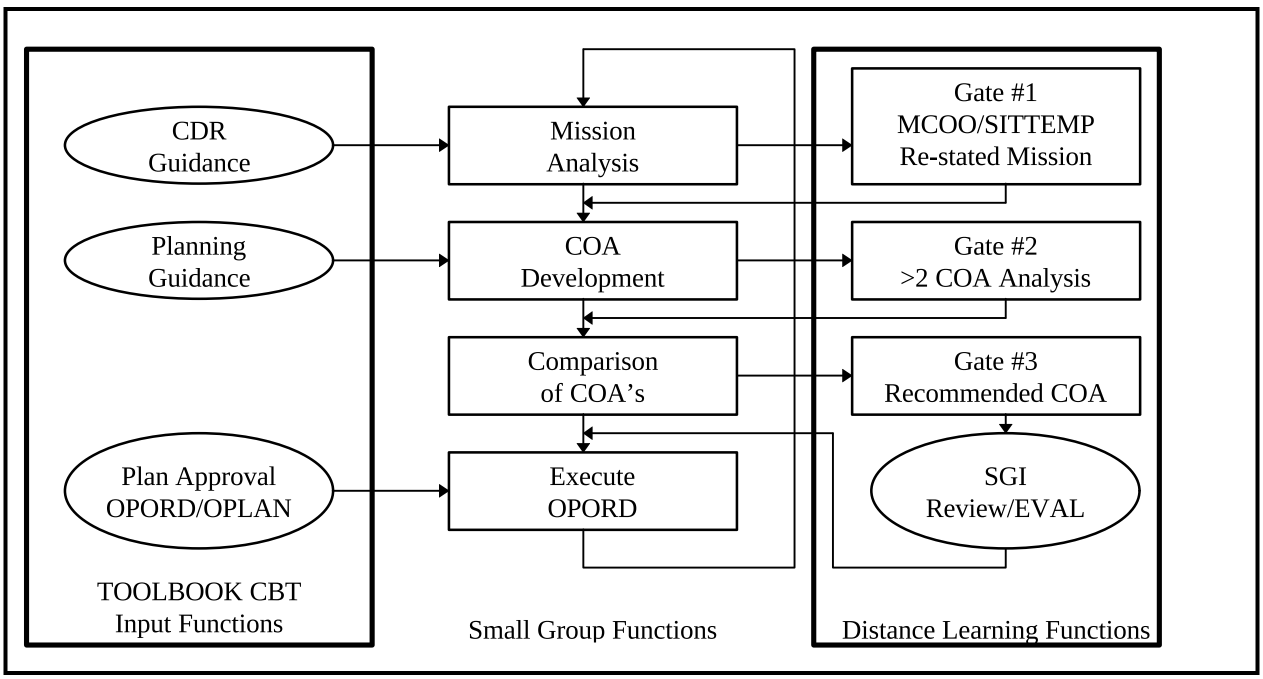


Figure 2 - High Level Course Architecture

The MDMP includes Mission Analysis; Course of Action (COA) development; COA analysis and comparison; decision and execution. The architecture used is depicted below. Note the separation of functions between the CBT, the student group interactions and the Internet communication functions.

HOW IT WORKS

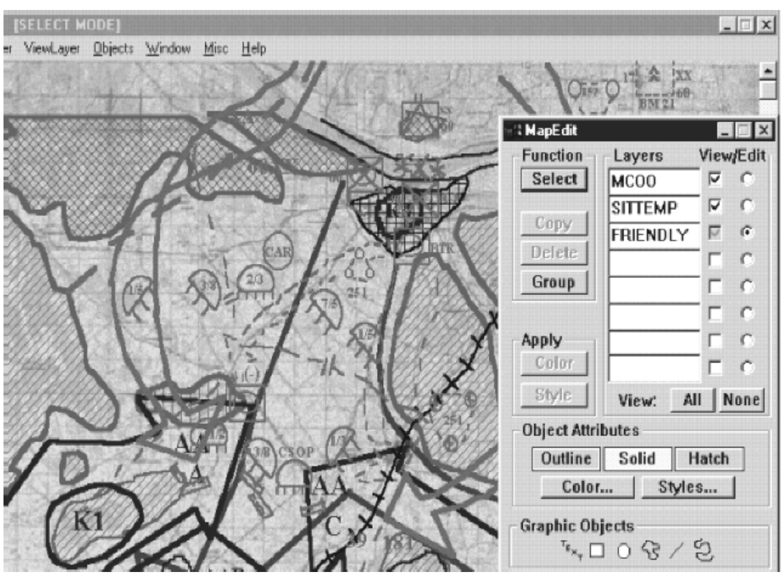
The MDMP Tutor works on an Intranet and the Internet. In the Internet version, a standard SVGA PC is connected to the ATM LAN at Ft. Knox. Students and instructors at Fort Knox access the MDMP Tutor via the LAN. In the Internet version, remote students load courseware on their own machines and send files to the MDMP server at Fort Knox using file transfer protocol.

The courseware was deemed too large and therefore slow to do completely over the Internet, hence the hybrid solution. The TOOLBOOK activity will provide a simulated environment for: the request for information by the small group; the feedback of the information; and the control of simulated time to accomplish the discovery of the information requested.

The instructor will comment on the Word document using the Word annotating features. The instructor will annotate the drawings. Annotations to text and drawings are saved to group folders on the MDMP server.

This small group interaction follows the premise of the cooperative learning situation, which requires a division of actual labor among the students to achieve some task (Shute, Lajoie & Gluck, 1995). The built-in gates provided by the CBT provide the student with the ability to see other students' products after they complete their own. The e-mail functions provide the ability for groups to communicate with each other in their teams and then coordinate with their instructor.

Using a modified version of the TIEPAINT module from the GLOBAL's CBT Authoring System TIE (Training Icon Environment), GLOBAL demonstrated the abilities needed to display and edit the "layered" map scheme needed for the MDMP Tutor. The modified product, called MAPEDIT, consists of the original TIEPAINT and



This shows the MapEdit interface. MapEdit utilizes standard graphic editing tools, such as the ability to create and edit vector objects (lines, circles, polygons, etc.) as well as bitmap objects such as background terrain.

One of the most important features of MapEdit is the ability to draw/place graphic objects in different layers separately, or combined, in order to gain a perspective of the many components in battle planning. Students have the ability to turn the visibility of a layer on, or off to assist the student in editing.

Figure 3 - MAPEDIT COA Tool

A team of four to seven AOAC students will use Microsoft Word to provide written text to communicate the intermediate products in a format for the SGI to review. The Word documents will be filed to a server. Graphics will be drawn using a product called MapEditor embedded in the ToolBook application. Students and instructors use email accounts for messaging.

2 added pop-up menus, labeled ViewLayers and EditLayers. The ViewLayer menu has eight items, numbered 1 through 8. A student can check any or all of these items, and the corresponding layer(s) will be displayed.

The EditLayer menu item allows a student to select which layer they want to currently edit. The editor is basically the standard TIEPAINT "vector" editor. Each vector object has an extra "tag" on it, which indicates the associated layer. When items are displayed, only those items that are part of the active layer(s) are displayed. The graphic produced is stored as one of several standard bit-mapped graphic file formats. As the COA sketch is the principle communications tool to capture the battle strategy, it is important for it to be very user friendly and generate a detailed graphic. Figure 3 shows a typical COA sketch.

EVALUATION

Participants

Subjects will include three classes of 98 students. Thus, a total of 294 subjects will participate in this experiment. The students will be enrolled in the Armor Officer Advanced Course at Ft. Knox. Most, if not all, of the students are expected to be male, of at least Captain's rank and have some experience in the field. Overall, their aptitude is considered to be extremely high and are selected as the top one percent of their career field within the U.S. Army.

The independent variables to be manipulated include instruction (traditional classroom instruction versus computer mediated instruction) and on-line help. The dependent variables that will be measured include:

1. Achievement and efficiency as scored by instructor ratings of the three submitted COA products and the time it took to reach the COA products;
2. Subjective workload;
3. The mental model developed during the military decision making process as measured by paired concepts (Pathfinder) and a diagramming instrument;
4. The rate and quality of communications across teams; and,
5. Affective preferences.

Co-variates will include individual differences in subject matter knowledge as scored on a pretest and prior field experience.

The two interim products and one final product are used as a measure of student achievement. The instructors for the course will evaluate these products. Each instructor will be responsible for evaluating half of the products produced by each treatment group (traditional classroom and distance learning class).

In addition, the products will be submitted to the instructors using codes so that they will be blind as to the source of the product. These methods will be used to prevent bias toward a particular treatment condition.

The amount of time the students took to submit each COA will also be recorded automatically by the system. In the traditional classroom treatments, the instructors will log the time of each lesson taught. Any additional help by the instructor to various students outside the classroom will also be logged.

Instruments Used for Evaluation

Two instruments are linked into a singled automated evaluation session for individual students. The first part is a pairwise comparison of 13 of the key MDMP concepts. Students rate every possible pair of these concepts on a 9-point Likert scale. The second part of the instrument is a diagramming task of the same 13 key concepts. Students are asked to connect the concepts that are related to one another. And finally, an affective survey is administered to the students that measures learner attitude toward distance learning, grouped into four categories:

1. Attitude toward the technology;
2. Attitude toward distance education teaching methods;
3. Attitude toward student and teacher interaction; and
4. Attitude toward being a remote student.

Of the research reviewed, only one affective survey has been found that adequately samples learners on all four of these dimensions. A parallel affective instrument was developed for both the MDMP tutor and the traditional classroom group.

The second instrument is a diagramming task where students are given the same 13 concepts and are asked to indicate how they are related. Using these two instruments will also indicate:

1. Which instrument is more predictive of performance; and
2. If the instructions describing relatedness significantly affect the data produced.

SUMMARY

The Internet has the potential of altering the form, if not the essence, of today's instruction and education. Although early distance learning attempts were limited by technology, relying mainly on print, radio, and one or two-way television, the eruption of the Internet and collaborative software packages promise a more interactive, real-time distance learning experience.

In an attempt to use and evaluate the capabilities of this new medium, this distance learning project attempts to link groups of students and instructors at various Army installations around the United States. The project is unique as it will connect not only students remotely through the use of distance learning technology, but remote instructors will control the pace and quality of the learning experience.

The results of this study will allow conclusions to be drawn as to the effectiveness, efficiency and affect of students toward the use of the distance learning technology as compared to the current classroom instruction. The evaluation of this tutor is planned for 3rd Quarter 1997, with results available for this conference.

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Catherine Connolly is the Training Systems Manager for Evaluation Group of Galaxy Scientific Corporation located San Antonio, Texas. She received her M.S. in Industrial/Organizational Psychology (1993) from St. Mary's University. Currently, she serves as a member of the USAF Armstrong Laboratory's Training Research in Automated INstruction (TRAIN) and INTECH research teams. Her research interests include the evaluation and measurement of individual effectiveness and team processes within automated instruction environments.