DIGITAL SKILL TRAINING:
INFORMATION DEMANDS AND LEARNING BY EXPLORATION

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ABSTRACT

The emergence of computer software in the Army's tactical equipment on a relatively large scale raises the question of how to best train the diverse populations of soldiers on this software. This paper presents the results of an experiment comparing computer-based programs for training the knowledge and "digital" skills required in using a map interface typical of many of these systems. A prototype Land Warrior map interface was modeled. It was used to display and find individuals and units, and to determine the range and azimuth between objects and individuals/units on the map.

First, soldiers learned a coding system for identifying individuals and units displayed on the map. This system combined the Army's standard weapon and unit symbols with the battle roster numbering system. Two training conditions were compared. In one condition, much information was presented before soldiers had an opportunity to apply the knowledge and skills they had acquired. This placed high demands on working memory. In the other condition, the same information was presented in smaller chunks, placing lower demands on working memory.

In the map phase of the experiment, three ways of training map skills were compared. Again, low and high demand conditions were implemented, and an exploratory condition was added. In the exploratory condition, soldiers were informed of the map functions they had to learn, but not how to execute the required steps.

A total of 168 soldiers from four Infantry courses participated: those in initial Infantry training, the Infantry Officer Basic Course, and the Basic and Advanced Noncommissioned Officer Courses. These soldiers represented the soldiers in an Infantry platoon who will use the future Land Warrior system. Within each course, soldiers were randomly assigned to the experimental conditions.

Consistent differences in the soldier populations occurred in both experimental phases, with officers typically achieving the highest scores in the shortest amount of time, and Infantry trainees scoring the lowest, taking the most time. In both training phases, differences in favor of the low demand condition occurred for the instructional segments where the amount of information presented was the most discrepant between the high and low conditions. On the map final exam, soldiers in the exploratory condition had the lowest scores, with those in the low demand condition achieving the highest scores. In sum, the low demand condition was the most effective for code and map skills. Combining this traditional mode of instruction with an exploratory mode might also prove very effective in acquiring the interactive skills and insights required to work with digital interfaces.

AUTHOR BIOGRAPHIES

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The Army is modernizing its force by embedding software in its tactical equipment, e.g., tanks, command and control vehicles, and a wearable computer for the dismounted soldier. Soldiers use the "digital" software to perform tasks that were formerly executed by other means --- by hand, over the radio. In addition, new capabilities such as sending digital images exist. With the large-scale fielding of such technologies, a critical question is how to best train the diverse population of soldiers and officers who employ these systems. One approach is to use computers to deliver training. Much is known about learning and cognition, yet questions remain with regard to computer-assisted instruction. Issues exist about how tasks "should be broken down into practice activities, what activities the student should engage in first, … and so on. Poor instruction often arises from the guesswork in the specification of these details" (Woolf & Regian, 2000. p. 353). Experimental work can address these issues and reduce some of the guesswork.

The experiment described herein incorporated several dimensions that can influence the design of computer-based instruction.

- The type of task: Declarative and procedural knowledge.
- The instructional techniques: The volume of information presented before the user works with the material, and the amount of instructional guidance provided.
- Learner characteristics: Differences in Army experience and knowledge.

Featured in many of the Army's digital systems is a computerized map that displays the battlefield locations of units. A unique feature of the Land Warrior (LW) system for the dismounted soldier is a software interface that must also display individuals. Consequently, soldiers must know the codes or the means by which units and individuals are depicted. A challenge in the instruction described here was to develop a coding scheme that would uniquely and graphically identify individual soldiers, as such a scheme does not currently exist within the Army.

An early prototype of the map functions and layout proposed for the Army's LW system was simulated. This provided insights into that particular interface but also enabled us to examine the generic training issues just mentioned. Participants were soldiers with differing Army backgrounds and experience.

CONCEPTUAL BACKGROUND

Declarative and Procedural Knowledge

Anderson (1980) distinguished between declarative knowledge or knowing that, and procedural knowledge or knowing how. Declarative knowledge reflects the facts, concepts, and principles we know, while procedural reflects the skills we know how to perform, to include problem-solving, reasoning, and means-ends analysis. Both forms of knowledge were included in the experiment.

The first phase of the experiment involved learning a coding system for uniquely identifying individuals and units; that is, facts or declarative knowledge. This system combined standard Army symbols with the battle roster (BR) numbering system. The second phase focused on learning the procedural skills to manipulate a digitized map interface, specifically how to manipulate the software icons and menus to solve tactical problems in locating personnel and ground features, and to determine range and azimuth.

Both phases compared training that placed differing demands on working memory. With the procedural knowledge requirements in the map phase, it was also possible to use an exploratory training mode where there was minimal instructional guidance.

Information Demands

One of the challenges for instructional designers is to present new information so it can be kept in short-term or working memory for a sufficient period of time to be processed and transformed into long-term memory, where it can be retrieved later. We know that if information in short-term memory becomes inactive, it will be lost unless it is also in long-term memory. But our short-term capacity is limited.

When new information exceeds the short-term memory capabilities of learners, they cannot hold it in short-term memory long enough for it to be processed, elaborated upon, and transformed into long-term memory.

Andrews and Bell (2000) made this point when discussing simulation-based military training. "One of the difficulties in designing virtual learning environments is understanding how much new information should be presented at one simulation session before learning overload occurs. Because simulation-based training can present so many new environmental cues at once to the learner, it is important that a solid understanding of the learner's capacities be taken into account during the instructional design phase. If too much information is presented too quickly, the learner's cognitive structures can be overwhelmed to negative effect" (p. 380).

Miller (1956) argued in his classic article on the magical number seven that short-term memory was limited by the number of meaningful chunks. The number of chunks that could be held in short-term memory was postulated to be seven, plus or minus two. This short-term memory span limits the amount of information that individuals can receive, process, and remember. Memory span can be expanded through recoding information into larger chunks that make it more meaningful.

We wanted to know how much information could be presented within a training lesson without overloading the soldier. Within each phase of the experiment, two working memory demand conditions were generated, based, in part, on the concept of Miller's number seven. Miller, himself, acknowledged that it is difficult to define what constitutes a chunk of information. The Low working memory demand condition contained lessons that typically presented what we considered to be 7 or fewer new concepts or facts to learn before the soldiers had a practical exercise of the concepts. The High working memory demand condition had lessons with more than 7 concepts or facts.

Exploratory Learning

There were several reasons for having an exploratory condition for training the map procedural skills. One, it is often stated that soldiers can and will figure things out on their own. If you just give them the opportunity, they will decipher how a software package works. Two, if successful, an exploratory mode would provide more training flexibility and an alternative that might work very well for some soldiers. Three, research on exploratory training has shown both positive and negative aspects, which were important to investigate in the soldier populations of interest.

The map functions did not require great insight or creativity, although it was presumed that soldiers had the basic computer skills required to work with menus and icons. Yet even when a computer environment is relatively simple, the level of complexity can increase significantly if the user makes an error, venturing down an incorrect path. Greif (1994) suggested that the complexity of a computer environment is not a stable characteristic. Instead, level of complexity may be altered by user error, task novelty, and slight modifications in system configuration.

Research on exploratory learning has revealed both advantages and disadvantages over traditional training. One reported advantage is improved transfer of learning (Carroll, 1997; Egan & Greeno, 1973; Kamouri, Kamouri, & Smith, 1986). This improvement in transfer is believed to result from the use of analogical reasoning and hypothesis testing when acquiring procedural knowledge. Exploratory learning can be accomplished in an equal or shorter amount of time as compared to instruction-based training (Carroll, 1997; Kamouri, Kamouri, & Smith, 1986).

The reported drawbacks of exploratory learning include so called "exploration traps" (Payne & Howes, 1992) where learners may select inefficient methods to accomplish a goal, or fail to remember the procedures they used to complete a task. Some research has addressed methods of providing a "supportive" exploratory environment in which potential "traps" are minimized and the benefits of exploratory learning are optimized (DeMul & Van Oostendorp, 1996; Trudel & Payne, 1995, Van Oostendorp & De Mul, 1999). For example, Trudel and Payne improved exploratory learning of a computer-simulated digital watch by restricting the number of keystrokes allowed during a learning session. Individuals may not possess the appropriate information-seeking skills (Wallace, Kupperman, Krajcik, & Soloway, 2000). Those who lack experience with a task may not possess the metaknowledge to recognize what they do not know. In this regard, diversity of experience has been shown to facilitate information-seeking behavior (Briggs, 1990). High-ability individuals may do well in an exploratory environment, but those with lower ability apparently require more learning support (Shute, Lajoie, & Gluck, 2000).

Computer-based Training (CBT)

All training was computer-based as it was envisioned that this form of training will eventually be quite common for the Army's digital systems. Research has shown that CBT is typically more efficient and effective than traditional classroom modes of instruction (Fletcher, 2000). Also it was of interest to know the challenges posed in writing courseware for a digital environment.

EXPERIMENTAL DESIGN

The four conditions in the experimental design are outlined in Table 1. The Low Code condition corresponded to a low working demand training situation where soldiers were given relatively few chunks of new information within a lesson followed by practical exercises where they had to apply and process this information. The High Code condition corresponded to a high working demand condition where soldiers were given more new information before they were exposed to practical exercises. The same content and exercises were used in the Low and High conditions. The differences were in the chunking of the material and when soldiers had an opportunity to apply or process the information. The same concept was applied to the Low Map and High Map conditions.

Table 1
Experimental Design: Blocks of Instruction for High and Low Working Demand and Exploratory Conditions

Experimental Conditions			
Low Code & Low Map	High Code & High Map	Low Code & Exploratory Map	High Code & Exploratory Map
Phase I: Codes			
Two common blocks of instruction			
Six blocks	Three blocks	Six blocks	Three blocks
Final Exam on Codes			
Phase II: Map Functions			
Four blocks	One block	No instruction.	No instruction.
Final Exam on Map Functions			

The Exploratory Map condition was quite different. There was no formal training. Soldiers were simply informed of the 7 map functions they were to learn through exploration on their own. There was no instruction on how these functions or the map interface worked. The Exploratory mode provided minimal support. Soldiers were given 60 minutes to work with the map, but they determined when they were ready to progress to the map exam.

Participants

Soldiers (n = 168) from four U.S. Army Infantry School courses participated: One Station Unit Training (OSUT), Basic Noncommissioned Officer Course (BNCOC), Advanced Noncommissioned Officer Course (ANCOC), and Infantry Officer Basic Course (IOBC). Within each course, soldiers were randomly assigned to one of the four conditions cited in Table 1. The design called for 48 soldiers from each course (12 per condition). There were 48 each from OSUT and BNCOC, and 42 IOBC and 30 ANCOC students.

Code Training

Soldiers were trained on codes that uniquely identified individuals and units. The codes combined a weapon or unit symbol with a battle roster (BR) number. Individuals (squad members, platoon leaders) were identified by a code that combined the symbol for the weapon they carried with a 5-character (letter/number combination) BR that identified their battalion, company, platoon, squad, and individual position. Units (squad, platoon, company) were identified by their unit symbol in conjunction with a truncated BR number. Examples of these codes are in Figure 1.

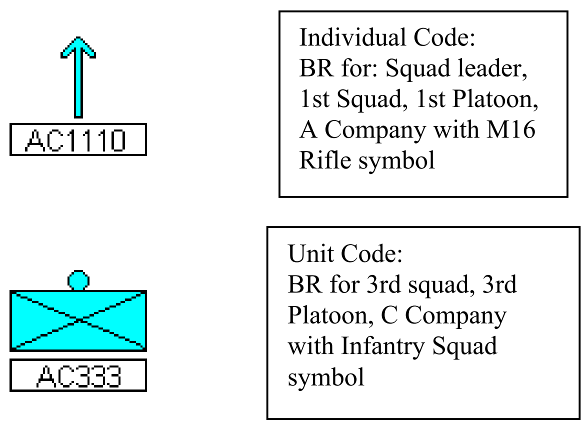

Figure 1. Examples of individual and unit codes.

The lessons and exercises for the Low and High Demand Code conditions are summarized in Table 2. Also displayed is the number of chunks of information associated with each lesson-exercise combination.

Table 2

Low and High Demand Code Conditions

Low Demand		Content	High Demand	
Lesson	# Chunks		Lesson	# Chunks
A	8	Wpn/Unit Symbols	A	8
B	5	BR System	B	5
C	5	Co BR	C & D	13
D	8	Plt-Sqd BR		
E	9	Rifle Sqd Codes	E & F	18
F	9	Wpns Sqd Codes		
G	6	Key Ldr Codes	G & H	9
H	3	Unit Codes		

Note. Content column represents Low Demand. Content of the combined lessons in the High Demand condition can be determined from the center column by using the lesson letters of A through H.

To illustrate the difference in the two training conditions, we will examine Lessons E and F. In terms of demands placed on working memory, the greatest difference between the Low and High conditions was estimated to be in Lessons E and F, which trained the codes for the 9 members of a rifle squad and the 9 members of the weapons squad. In the Low condition, the lesson on the rifle squad was immediately followed by exercises where soldiers had to identify the unique code of the rifle squad members. Then soldiers in the Low condition had a similar lesson and exercises for members of the weapons squad. In contrast, soldiers in the High condition had back-to-back lessons on the rifle and weapons squads, which were then followed by exercises that involved all 18 individual squad member codes. In this illustration, a chunk of information was operationally defined as a code for an individual squad member. Thus there were 9 chunks for each type of squad.

Soldiers had to achieve a score of 80% on the exercises. If not, they had a review of the major concepts in the lesson and then repeated the exercise.

Map Training

Seven map functions were trained: Zoom In; Zoom Out; Pan; Find Me (yourself); Find X (others); Display Others; and Determine Range and Azimuth. Figure 2 shows the map display and highlights the functions.

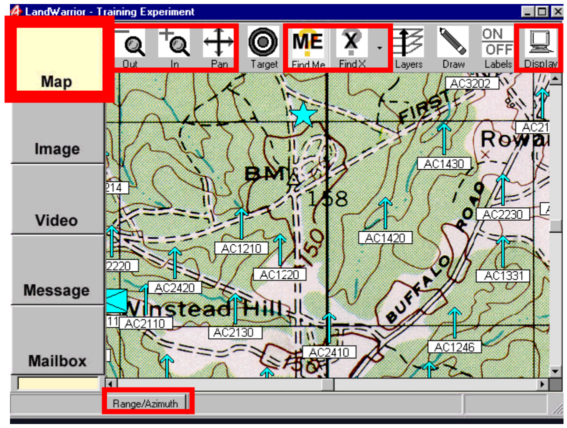

Figure 2. Map display.

The lessons and exercises for the Low and High Demand Map conditions are summarized in Table 3. Also displayed is the number of chunks of information associated with each lesson-exercise combination. Due to time limitations, there was no exercise for the range/azimuth function (cues presented on the map display made this function almost self-explanatory), and no remedial training was required for any lesson. For the map functions, the number of chunks for a function reflected the number of steps required to execute the function, plus the requirement to identify the function button itself. Both Find X and Display Others required a series of menu selections.

Table 3.

Low and High Demand Map Conditions (no formal training in the Exploratory condition)

Low Demand		Content	High Demand	
Lesson	# Chunks		Lesson	# Chunks
I	6	Zoom In & Out, Pan and Find Me	I-M	26
J	6	Find X		
K	9	Display Others		
M	5	Range - Azimuth		

Measures

Criterion measures. Criterion measures were scores on the exercises in the code and map training, code and map final exam scores, number of soldiers who did not reach the 80% criterion on the code exercises, and time to complete the training. The code final exam tested symbols and codes that differed from those in the exercises. The map final exam consisted of situational exercises where soldiers had to locate or find individuals or units using the map functions they had learned.

Pre-experiment measures. Prior to the experiment, soldiers were given a survey on their computer background (Fober, Bredthauer & Dyer, 2000), and a short quiz on map reading, weapon symbols, and unit symbols. They were asked whether they had ever used the Army's BR numbering system. Lastly, in order to identify soldiers who tend to figure things out on their own and therefore might be good in the Exploratory Map condition, an instrument was developed that focused on their tendency to work independently on a variety of tasks (fixing a tire, putting a bike together, changing the setting on a digital watch).

RESULTS

Pre-experiment Measures

In general, the computer backgrounds of the soldiers showed that computer ownership increased with rank (OSUT 58%; ANCOC and IOBC 91%), and more soldiers used computers than owned them. Self-ratings of computer skill and results on an icon quiz showed similar orders for the courses: IOBC highest, then ANCOC, then OSUT, and then BNCOC. In prior research, OSUT was lowest on these indices of expertise.

With regard to military knowledge, all soldiers did best on the map reading (score of 75%), but showed considerable variability on knowledge of symbols. In fact, OSUT soldiers did not answer these questions because they are currently not taught this material. Soldiers in the other courses were weak on weapon symbols (highest average was 29% for IOBC). ANCOC scored highest on unit symbols (73%) followed by IOBC (54%). Only ANCOC soldiers (38%) stated they had used the BR numbering system. In essence, most of the soldiers had relatively little military background with the codes and systems trained in the experiment.

On the tendency to work independently scale, soldiers indicated they would read instructions for 40% of the tasks, put off reading instructions until a problem arose for a similar proportion of the tasks, and would execute 20% of the tasks independently. A cluster analysis was performed to determine the percentage of soldiers who could be considered individuals that typically work independently. About 20% of the soldiers were classified as typically working independently.

Results on Code Training

The initial scores on each of the exercises and the final exam were analyzed with a two-factor analysis of variance (training condition by course). There were main effects for both factors but no significant interactions.

The only score with a difference between the High and Low Code conditions was on the exercises involving the rifle and weapons squads, $F(1, 159) = 23.53$, $p = .00$. In this case, the soldiers in the Low demand group scored better than those in the High demand group. Figure 3 shows the means for both groups on the five exercise scores and the final exam. The graph shows clearly the impact of the High demand condition on performance for the rifle and weapons squad codes. Differences on the final exam were not expected, as all soldiers had an opportunity to repeat content where they did not perform to criterion.

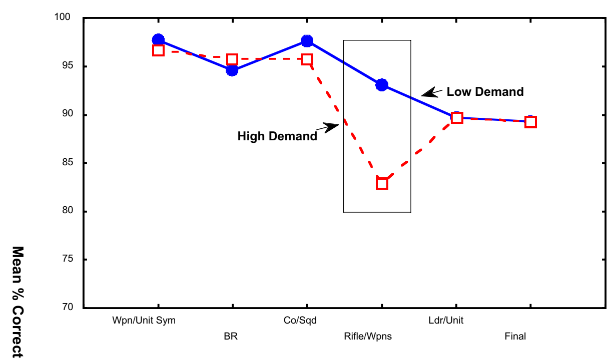

Figure 3. Mean scores for Low and High conditions on code exercises and exam with significant differences highlighted.

Significant differences occurred among the soldier groups on three variables. These were the rifle and weapons squad score [$F(3, 159) = 6.26$. $p < .00$], the key leader and unit score [$F(3, 159) = 5.51$, $p < .00$], and the final exam score [$F(3, 159) = 6.49$, $p < .00$]. For each score, IOBC, ANCOC, and BNCOC soldiers scored higher than OSUT soldiers. In addition, on the final exam, IOBC soldiers scored higher than BNCOC soldiers.

The means for the four soldier groups are in Figure 4. The graph shows clearly the lack of difference between the groups on the first part of the instruction, through the company-squad battle roster instruction. Beyond that point, the lower performance of the OSUT soldiers is illustrated. Of additional interest is the general ordering of the soldier groups from high to low: IOBC, ANCOC, BNCOC, and then OSUT.

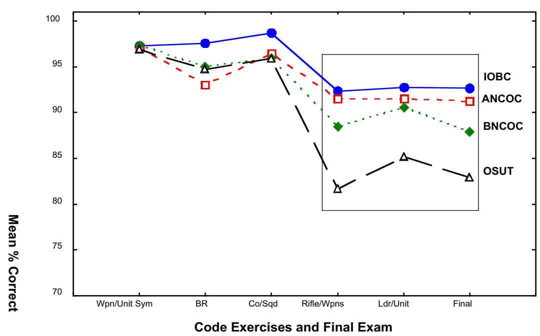

Figure 4. Mean scores for courses on code exercises and exam with significant differences highlighted.

In terms of remediation, proportionately more soldiers achieved the 80% criterion in the Low than the High condition on only one exercise – rifle-weapons squad codes. In the High condition, 16% of the soldiers needed remediation. In the Low condition, 2% repeated on rifle squad and 5% on weapons squad.

Time to complete each coding exercise and the final exam showed significant main effects. On four measures (weapon and unit symbols; company-squad BR, rifle-weapons squad member codes, and key leader and unit codes), there was a significant effect for soldier group ($p < .00$). The respective F values for the four variables were: $F(3, 160) = 17.41$; $F(3, 159) = 10.02$; $F(3, 159) = 12.95$; and $F(3, 159) = 8.87$. On each measure, the soldier group order from fastest to slowest was: IOBC, ANCOC, BNCOC, and OSUT. IOBC was significantly faster than OSUT and BNCOC in each case. ANCOC was consistently faster than OSUT. The impact of these times on the cumulative time to complete the code training is illustrated in Figure 5. The only difference between the Low and High conditions was on the rifle-weapons squad block of instruction, where soldiers in the Low condition completed the training faster than those in the High condition.

Results on Map Training

With the map training, the primary interest was in determining whether there were differences between the High and Low demand conditions on the exercises, and whether there were differences among the High, Low, and Exploratory conditions on the final exam. As with the codes, course differences and interactions with courses were examined.

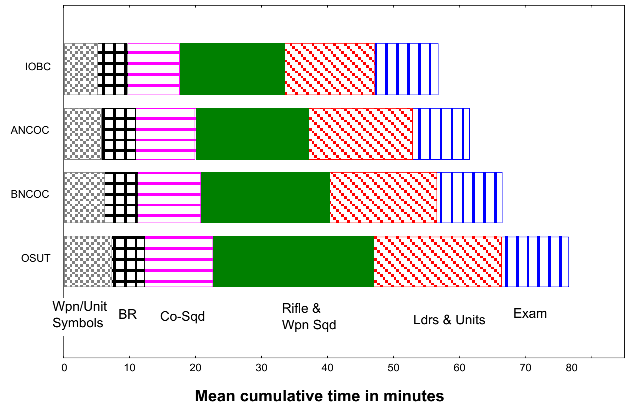

Figure 5. Mean cumulative time to complete training on codes.

Significant differences occurred for the experimental conditions on the Display exercise and the final exam. These are shown graphically in Figure 6. Soldiers in the Low condition scored higher than those in the High condition on the Display exercise, $F(1, 70) = 4.70$, $p < .04$. On the map final exam, clearly, soldiers in the Exploratory condition had the lowest scores, although the difference between Low and High was also significant, $F(2, 142) = 6.84$, $p < .01$.

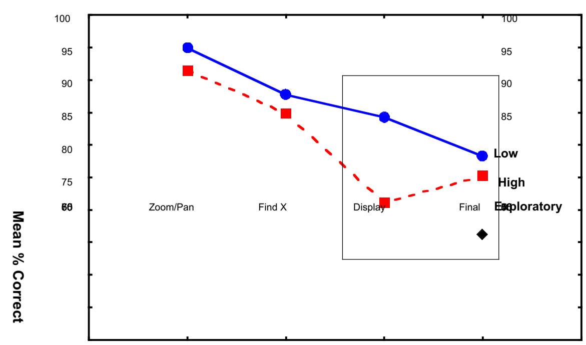

Figure 6. Mean scores for map exercises and map final exam for Low, High, and Exploratory conditions with significant differences highlighted.

Means for the four soldier groups on the map exercises and final exam are in Figure 7. The map exercise means are based on only the Low and High conditions, while the final exam mean includes the Exploratory condition as well. Significant differences among soldier groups occurred on the Find X score [$F(3, 71) = 2.86$, $p < .04$], and the final exam [$F(3, 142) = 3.29$, $p <$

.02]. On each measure, OSUT scored lower than the other groups. With Find X, BNCOC did better than ANCOC and OSUT. On the final exam, IOBC did better than BNCOC and OSUT. On the Display scores, the considerable variability in BNCOC and ANCOC scores probably prevented a significant effect.

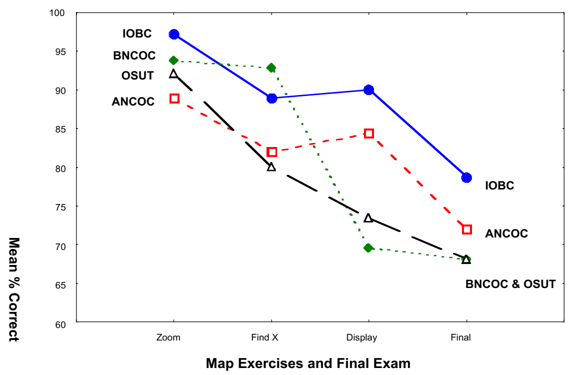

Figure 7. Mean scores for courses on map exercises and map final exam, with significant differences highlighted.

Although soldiers were not required to repeat map training if they scored lower than 80% on an exercise, the percentages of soldiers below this level were tabulated for the Low and High conditions. The results supported the expectation that performance would decrease when individuals were required to learn a large amount of information within a single block of instruction. The percentages of soldiers who failed to reach 80% within the Low condition were: 2% (Zoom and Pan), 19% (Find X), and 26% (Display). For the High condition the percentages were consistently higher: 13% (Zoom and Pan), 24% (Find X) and 44% (Display).

The Exploratory soldiers spent only 15 minutes working with the map on their own, while the soldiers in the Low and High conditions took 55 minutes to complete their training (see Figure 8). Yet, the Exploratory soldiers took more time on the map final exam; 22 minutes, versus 15 minutes for those in the High and Low conditions, $F(2,138) = 46.43$, $p < .00$. If there had been no time limit for questions on the final exam, the map final exam times might have been longer for those in the Exploratory condition. As with the code training, IOBC soldiers finished the lessons and exercises (for both Low and High conditions) faster than OSUT soldiers.

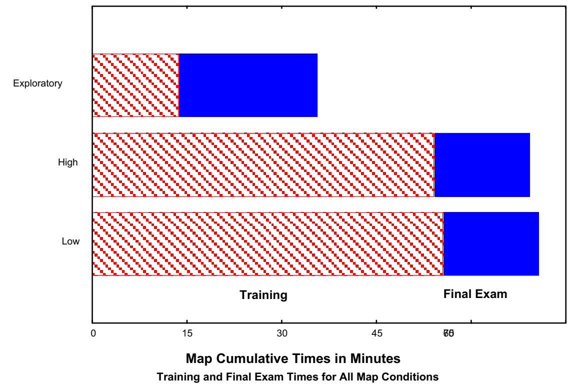

Figure 8. Mean cumulative time to complete training and testing on map functions.

Relationships Among Measures

Within both the code and map phases of training, the following relationships among times and scores were typical. First, the exercise and final exam scores correlated. Second, training times on the blocks of instruction correlated. Third, the exercise and exam times correlated negatively with scores, meaning that higher scores were associated with faster times.

In general, the background variables did not correlate highly with either the code or map final exam scores. The highest correlate within a training condition was between the computer survey icon score and the map final exam scores for the Exploratory map group This may indicate that the more experienced computer users were more comfortable with and/or skilled in working with a computer interface and therefore were able to apply better exploration strategies.

DISCUSSION AND CONCLUSIONS

Despite substantial differences in military knowledge and experience among the soldier groups as well as the minimal knowledge in some areas by all groups, neither of these differences nor the minimal levels of knowledge appeared to greatly hinder performance.

For both the code and map training, the blocks of instruction with the greatest differences in working memory demand were the ones that impacted performance. This was the rifle and weapons squad code block(s) of instruction. In the map, this difference was ultimately reflected in performance on the Display exercises. In each instance, those soldiers in the Low Demand condition performed better.

Another factor that indicates greater effectiveness of the Low Demand condition was the variability in scores. We checked for conditions where the variability of scores for a given group was at least 1.5 times greater than another. For both the company-squad BR and rifle-weapons squad code exercises, the scores for the High condition were at least 2.5 times greater than those for the Low condition. Not only did the Low working demand condition result in a higher level of performance than the High condition, it also resulted in more consistent scores.

Those individuals using the unguided Exploratory means of learning performed more poorly than those with more formal instruction. However, the time devoted to Exploratory learning was reduced by at least 70%. Exploratory times were at least twice as variable as those in the Low and High conditions, and the time required to complete the map final exam was longer. Both findings were additional indications of lower proficiency. In summary, Exploratory learning, with minimal guidance, was not the most effective mode of map training for the diversity of soldiers in the study - the soldiers to receive the Land Warrior system. Although the tendency to work independently scale did seem to identify soldiers who tended to work without guidance, it did not necessarily identify those who were good at employing appropriate information-seeking strategies on their own.

Differences in scores and times for the four soldier groups appeared on many measures. Typically, IOBC soldiers scored the highest, then ANCOC, then BNCOC, and lastly OSUT. That OSUT soldiers scored lowest was not unexpected, given their limited military experience. Times also varied, although the pattern was not as consistent as was the case for the score measures. But in general, IOBC soldiers finished quickest, and OSUT soldiers took the most time. The CBT format adapted well to the differences in learning rate exhibited by the soldiers.

Of interest was the lack of statistical interactions between the experimental conditions and the soldier groups. This was not expected. In particular, it seemed reasonable for the High Demand conditions to have a greater impact on OSUT soldiers than the other groups, given the limited military background of trainees. Instead, when the High Demand condition impacted scores, it had a similar detrimental effect on each group.

A very practical question is whether any of the training conditions resulted in satisfactory levels of performance. For codes, soldiers in both conditions averaged 87% correct on the final exam. The lowest score was 82% for OSUT; the highest, 93% for IOBC. The criterion was 80% correct. A factor that could have contributed to soldiers meeting the code criterion was that they had to repeat a block of instruction if they did not achieve 80% on the exercises the first time.

For the map exam, the final level of performance was not as high, with scores ranging from 66% correct for Exploratory to 78% for Low, and from 68% for OSUT and BNCOC to 79% for IOBC. There was no requirement for soldiers in the Low and High conditions to repeat map exercises when they failed to reach the 80% criterion. If this had been required, it is likely that the final scores in these two conditions would have been higher, resulting in an even greater discrepancy with the Exploratory condition.

Given the relatively short time soldiers spent "exploring" the map interface, this type of training bears further investigation. Combining some elements of formal instruction with an exploratory mode might provide very effective in acquiring the interactive skills and insights required to work with digital interfaces.

Not unexpectedly, you can include too much information in a block of instruction. The concept of the number seven can be used as a rough guide to determine when too much new information may be presented.

The experiments showed how the computer-based training could be designed to incorporate tactical system software as background instruction and demonstration screens, and as interactive screens for performance exercises. High-fidelity training is a positive by-product of this technique.

Multi-media instruction was not found to be a panacea for training digital skills. Challenges lie both in developing good problem-solving scenarios that require soldiers to apply their skills and in developing measurement procedures and techniques that account for the possibility of more than one approach to accomplishing a task.

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