

Online Learning of Complex Skills

The Army, as do many large training organizations, envisions that future training will rely more on Web-based, online approaches than on paper-based methods for geographically dispersed learners. In addition, the Army has a keen interest in the establishment of sound designs for the online training of complex skills along with leadership adaptability and flexibility. This particularly is important with the recognized change in the threat environment and the calls to transform military training, e.g., 2001 Quadrennial Defense Review. Skills that should benefit from online training include tactical thinking, interpersonal intuitions, and problem solving, often in collaboration with others. Most distributed learning today is asynchronous where students learn at anytime but not usually with any real-time contact with other learners or the instructor. In contrast, the two research examples reported here examined the nature

of synchronous online communications with live interactions or with interactions involving software “agents.” In general, the tasks required groups of Army learners to hone complex skills. In the first example, learners engaged in two tacit knowledge exercises about personal skills and tactical knowledge. In the second, Armor officers engaged in collaborative problem-solving tasks. The purpose in synchronous environments was (1) to assess the effectiveness of software “agents” replacing certain instructor functions and (2) to measure the degree and nature of the interactions during collaborative learning over networks.

Leadership Tacit Knowledge - Online

Over the past decade, ARI has developed several powerful measures of the practical knowledge a leader learns during years of growing expertise in the Army (Hedlund, Sternberg and Psotka, 2000). This intuitive knowledge largely lies within the scope of doctrine and standard operating

procedures but usually is too rich and detailed for explicit descriptions in Army FMs and TMs. Yet, this intuitive, or tacit, knowledge is extremely valuable, learned slowly and with great difficulty. In developing an automated environment where the learning of tacit knowledge could be accelerated, ARI created a synchronous discussion system called the Knowledge Post. One of the powerful features of this Knowledge Post is an intelligent agent that assesses the quality of a participant’s text contribution in terms of its relevance to the central topic. It provides advice about other related contributions, and may

provide additional details to help improve thinking (Landauer and Psotka, 2000). The Knowledge Post has potential to improve all aspects of growing tacit knowledge. Therefore, ARI assessed its value over paper-and-pencil answers to complex scenarios involving both tactical and interpersonal issues.

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Sixteen groups of officers at four Army installations participated in the experiment. Data were collected in small groups of 5 to 15 officers, where group members were all of the same rank. A total of 125 officers participated. Each group convened for a three-hour period in an ordinary classroom for the paper and pencil exercises, or a distance learning classroom with web browsers available on each desktop.

The task required officers to respond in writing to a scenario regarding the resolution of a situation in a tactical scenario. The scenario was based on a PowerPoint briefing that gave a detailed description of the tactical situation, opposing forces, and commander’s intent in a fictitious combat zone Centralia that looked a lot like Kansas. In the scenario the officer must assume that she or he is a member of the Command group 2BDE/55th ID/X Corps/ 33 US Army. A sample scenario follows.

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Two research examples examine the nature of synchronous online communications with live interactions.

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You have been briefed about the current situation involving the US, Dakota, Nebraska, and Centralia. You have just held against the Dakotan offense, and been given new mission and intent, with a refueling mission to AA ROSE. Elements of your FSB are moving forward to establish a refueling site for units moving into their defensive positions. Civilians from a nearby refugee camp have blocked the stopped convoy in route. What should you do to resolve this situation?

Again, responses were open-ended essays. Retired military, civilians with more than 20 years of Army experience, and the automatic intelligent agent built into the Knowledge Post assessed the resulting essays and responses. Their assessments (Figure 1) were that solutions proposed by participants in the Knowledge Post resulted in much better resolution of the tactical situation than in paper-and-pencil solutions. Also, there was more thorough and complete discussion of the tacit knowledge that supported the solutions online than in face-to-face discussion. On the paper and pencil task, senior officers (LTCs) performed much better than the CPTs and MAJs. However, this difference was overcome in the contributions provided in Knowledge Post, where officers could critique each other and share their experiences and knowledge. When able to reflect on their

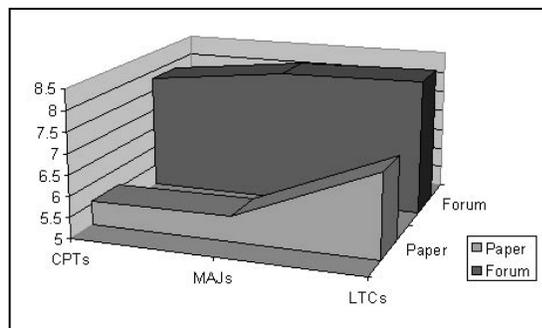


Figure 1. Superior performance by officers on a tactical tacit knowledge scenario within the on-line discussion Knowledge Post.

answers and share their tacit knowledge, lower ranking officers' answers were indistinguishable from the senior officers'. Reflection is particularly important in this environment as a supported critical thinking skill that promotes adaptability and flexibility in officers' thinking.

We found a similar result for interpersonal scenarios such as the following sample:

You are a company commander, and your battalion commander is the type of person who seems always to "shoot the messenger"--he does not like to be surprised by bad news, and he tends to take his anger out on the person who brought him the bad news. You want to build a positive, professional relationship with your battalion commander. What should you do?

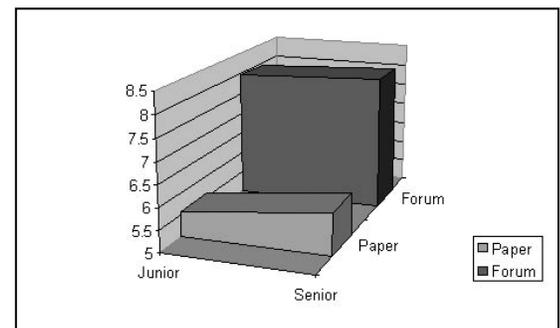


Figure 2. Superior performance by both junior and senior officers within the online Knowledge Post discussion system.

Again, Responses were open-ended essays. Using four variations of the scenario, officers demonstrated a profound superiority in the essays written within the Knowledge Post (Figure 2). Both junior (LTs, CPTs) and senior (MAJs, LTCs) officers were superior in the tacit knowledge tasks that assess interpersonal leadership skills. How much of this difference is due to the effect of the automated intelligent assistant remains to be explored in further research.

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Armor Problem Solving - Online

In this effort, ARI examined the use of chat environments over longer periods of time, to see not only how they may be effective for learning and problem solving, but also how they support social exchanges. The problem-solving activities derive from a course conducted by the U.S. Armor School, Fort Knox, called the “Armor Captain’s Career Course.” As designed by the Armor School, the course has three phases (Wardell and Paschetto, 2001). Research focused on the second phase that centers around a synchronous, Web-based learning environment termed the “Virtual Tactical Operations Center” (VTOC). In this phase, soldiers work collaboratively on problem-solving tasks requiring higher-order thinking skills for mission analyses, decision making, traversing map terrains, and collaborative document writing and review. Since the participants realize that they will work together online over an extended period, prior to meeting face-to-face for the first time, it was anticipated that significant social interactions would occur in this collaborative environment.

Most research supports the notion that online groups are likely to spend the majority of their interactions (i.e., communications between participants) focusing on the task rather than social interactions. While the results are mixed regarding the impact of technology on social exchanges, it is clear that important social exchanges occur in some online environments. Also, one of the recurring criticisms from online learners is that the technology is problematic. At times people struggle much more with the tools than the task, subtracting from potential learning activities. With experience, it is likely that interaction regarding technology would decline. Therefore, we expected that interactions on the mechanics of operating the VTOC would follow a receding pattern. As expressed through online chats, then, our interest was in the relative pattern of on-task, social, and mechanical interactions.

Participants (n=41) were male reservists geographically dispersed across the United States in the Army National Guard. They had never met face-to-face. Text messaging data were drawn from five separate groups, which included three instructors and two technical advisors, during 12 hours on each of seven weekends over a seven-month period (the first session was via video teletraining and the remaining six were in the VTOC). The students “convened” in the online VTOC environment for sessions lasting between four and eight hours on two consecutive weekend days. In the VTOC, they solved problems collectively and generated work products. The VTOC was a visual rendition of an actual operations center. The collaborative tools available were group as well as private chat, shared whiteboard, shared bookshelf, shared text application, and 3-dimensional terrain tools.

Chat Coding. From the 6,601 coded chats, raters determined that 55% of the chats were in the on-task category, 30% were in the social, and 15% were related to the mechanics of the technology.

Changes in the relative frequency of each category were analyzed over the six-month training period. A consolidation of the data is presented in Figure 3 aggregated into three learning periods, each combining two sessions. Here, the category of task chat showed a curvilinear pattern over time, where a lower percentage of time was spent on task communication at the beginning and end of the training period compared to the middle sessions. Juxtaposed with this trend, social chat interaction was more prominent in the beginning and end of the training periods than in the middle. Not surprisingly, the category of mechanics steadily reduced over time, indicating a learning curve for the online technology by the users.

Multiple dimensions of problem-solving behavior materialized frequently in the chats. Critical thinking skills such as reflection, brainstorming, self-criticism, rhetorical argument, humor,

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and social engagement all arose frequently in the online environments. What's more, these problem-solving behaviors were interwoven with a steady stream of social exchange throughout the learning period. Unlike independent asynchronous instruction, in which social exchange is rare, the learners here averaged approximately 45 social chats while solving problems. This research provides evidence that expected patterns of interaction tended to hold. In addition, social interaction not only occurred often in this Army setting, but followed trends often observed in face-to-face groups. When first utilizing the VTOC, learners embedded their problem-solving activities with social exchange, not unlike what may happen in a real tactical operations center.

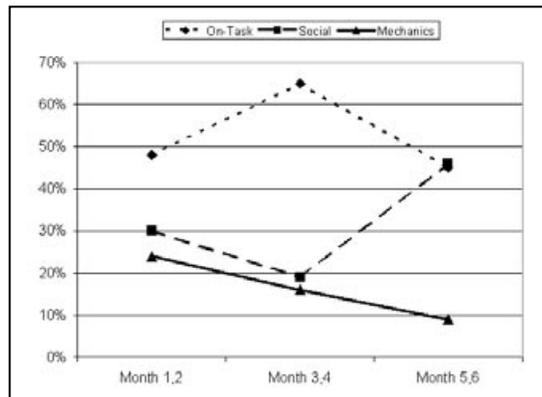


Figure 3. Social, mechanics, and on-task behaviors in the chat interactions over time.

Conclusions

The combined findings from research about synchronous online learning of Leadership Tacit Knowledge and of Armor Problem Solving suggest that social interaction may be a contributing factor to the success of training complex skills.

The Knowledge Post supports performance that is superior to results from using paper-and-pencil. In the case of online chat, no direct comparison

has yet been made between task performance with and without it. However, the data do show that online chat is directed heavily at on-task topics.

So, what next? The reliance on anytime-anywhere, asynchronous delivery of instruction avoids an advantageous feature of synchronous and face-to-face instruction: real-time social interaction between learners. Organizations shifting to distance learning must consider the nature of the tasks and how performance is accomplished in the workplace before developing a complete package of asynchronous instruction. For tasks that require some degree of problem solving, particularly when performed in collaboration, the merits of online synchronous systems featuring a chat function should be considered. What is the role of the instructor in such problem solving situations? What types of chat suggestions from the instructor tend to help learning? Can this be automated to some degree? The evidence from the research on the Knowledge Post suggests that critical elements can be automated, widening the applicability of online collaborative learning to Army training.

For additional information, please contact ARI-Advanced Training Methods Research Unit, DSN 767-5648 or Commercial (703) 617-5648.

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