Discovering the Invisible: Using Tacit Knowledge to Develop Agile and Adaptive Leaders

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ABSTRACT

More than ever, the ability to share tacit knowledge and expertise is integral to today's military. The asymmetric nature of our enemies is such that their tactics are ever changing, making it imperative that Soldiers adapt their tactics, techniques, and procedures (TTPs) by exploiting recent observations, insights, and lessons learned from theater to apply to relevant tailored training in order to become agile and adaptive leaders. Without effective knowledge management, these valuable lessons learned, TTPs, and best practices can go to waste, potentially putting lives at higher risk. One of the main problems is that tacit knowledge is difficult to capture. Tacit knowledge often involves skills so well learned and familiar that an expert may not even be consciously aware of using them in the course of performing difficult tasks or reacting to stressful situations requiring near instantaneous decisions. This knowledge is often so deeply embedded that it requires specially trained interviewers to get at the processes that Soldiers have difficulty articulating. Because this technique is costly and time-consuming, many organizations have tried to acquire tacit knowledge through other more affordable, yet less effective means. This study took an in-depth look at the challenges faced by over 50 Soldiers ranging from Squad Leaders to Corps Commanders during recent deployments to either Iraq or Afghanistan. These Cognitive Task Analysis interviews gave us insights about how to harness tacit knowledge in the field more effectively and efficiently. Soldiers and units can then take that knowledge and adapt, adopt, or discard knowledge within the context of their mission, location, and training requirements. Using the facilitated professional forums, collaborative tools, and storage and retrieval capabilities of the Battle Command Knowledge System (BCKS) empowers leaders to retrieve that knowledge in a way that promotes effective learning through development and use of high quality vignettes.

ABOUT THE AUTHORS

Holly C. Baxter, Ph.D., is a Senior Scientist at Klein Associates, a Division of Applied Research Associates, specializing in Instructional Design, Evaluation Metrics, Organizational Development, and Training. Her research interests include Knowledge Management and all phases of cognitively based training including cognitive needs analysis, design, development, implementation, and developing cognitive metrics for evaluating training initiatives ranging from classroom training to simulations. As a member of Klein Associates she has served as the project manager and technical lead on projects including developing effective training for enhancing situation awareness, designing embedded training solutions for damage control personnel, developing evaluation metrics for simulation based training, identifying cognitive training requirements for Future Force environments, and developing and using knowledge management tools to capture tacit knowledge in the field and turn that knowledge into effective just-in-time training. Dr. Baxter holds a BA in Communication from the University of Dayton, a MA in Organizational Communication and Training from Indiana University, and a Ph.D. from Indiana University in Organizational Communication and Management with a focus on Training, Instructional Design, and Organizational Development.

LTC Joseph Koskey, U.S. Army Signal Corps, is currently the Deputy Director of the Battle Command Knowledge System (BCKS) at Fort Leavenworth, Kansas. He entered the Army in December 1985, and his military assignments have included a variety of positions from platoon to brigade level in conventional, joint and special operations units. He has expertise in communications planning in joint, special operations and the modular force. He was the first Signal Officer assigned to the Stryker Brigade Combat Team (SBCT) at Fort Lewis and subsequently as the Chief of C4 Plans, Exercises, and Contingency Operations within the J6 Directorate at the United States Pacific Command. He has been involved with knowledge management with the modular force, the Standing Joint Force Headquarters (SJFHQ), and now with BCKS. BCKS serves as the connecting layer between the Operating and Generating Forces through facilitated professional forums, KM training, and its advanced query capability fostering and enabling leader development, doctrine development, lessons learned dissemination, and battle command enhancement. His military education includes the Infantry Officer Basic, Signal Officer Advance Course, Basic Airborne, Ranger, Jumpmaster, Survival, Evasion, Resistance, and Escape (SERE) School, and Command and General Staff College.

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Lisa M. Stevens is a Staff Scientist at Klein Associates Division of Applied Research Associates. Her interests include studying the skilled performance and expertise of individuals and teams. Ms. Stevens is currently doing research for the U.S. Air Force to develop an intelligent mentoring system for future JFACCs. This system is envisioned as one that will efficiently organize resources such as research and training materials, doctrinal documents and manuals, and Joint Lessons Learned. It will be a trusted source for counsel and feedback for future JFACCs. She is also involved in a project sponsored by the U.S. Navy to develop a tool to assist Human Factors Engineers (HFEs) evaluate Navy systems. This tool will help HFEs identify elements within early system design artifacts that enhance or impede naturalistic decision making and expertise. She also contributed to this project sponsored by the U.S. Army to develop recommendations for capturing tacit knowledge in the battlefield. These recommendations will enable Soldiers to obtain the elusive tacit knowledge that renders decision making exercises effective. This research will give Soldiers the ability to extract important cues and factors in order to develop their own cognitively authentic vignettes for just-in-time training. Ms. Stevens holds a B.A. degree in Psychology from Yale University, New Haven, CT.

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INTRODUCTION

The ability to share tacit knowledge and expertise is integral to today's military. The asymmetric nature of our enemy is such that their tactics are ever changing, making it imperative that U.S. Soldiers take the lessons learned from theatre and use them for just-in-time training to become agile and adaptive leaders. Without effective knowledge management (KM) in this combat environment, valuable lessons learned can go to waste and lives can be put at higher risk.

The concept of KM emerged in the private sector in the 1990s as a result of organizations beginning to understand the importance and value of the intellectual capital of their employees (Heath, 2003). Knowledge management is especially important when an experienced employee leaves an organization, or in the case of the military, when a Soldier leaves a current assignment or deployment. The military has always recognized that human capital is its most valuable asset. It was involved in KM before it became vogue, through flank unit coordination and operations such as relief in place and passage of lines. Without effective KM, all of a Soldier's knowledge and experience can leave with him or her. However, KM is not only about managing knowledge; it also involves the ability to elicit that knowledge from a Soldier effectively so it can be shared and used to transfer learning.

The goal of this effort was to understand how to capture and use the tacit knowledge being created during deployment in the Contemporary Operating Environment. If this knowledge is successfully drawn from experiences of those Soldiers who are currently deployed and transmitted effectively, the Battle Command Knowledge System (BCKS) can use the knowledge to support the development of tactical thinking expertise throughout the Army. To meet this goal, we examined the nature of knowledge available to BCKS from the field experiences of deployed leaders, both officers and NCOs. We specifically elicited and analyzed performance challenges and tacit knowledge embedded in critical decisions in the operational environment by conducting 54 Cognitive Task Analysis (CTA) interviews. This tacit knowledge, along with explicit knowledge, supports the development of Recognition-Primed Decision (RPD) making (G. A. Klein, 1989)—that is, decision making expertise. We then examined the requirements for processes to return that knowledge to the field so that deployed Soldiers can access it before and during deployments for just-in-time training.

To illustrate how the BCKS is seeking to fill this need for the U.S. Army, this paper will explore what is meant by tacit knowledge, how to capture it, and how to store and transfer that knowledge as vignettes to build the adaptive leaders so vital to today's military.

What is Tacit Knowledge?

Knowledge exists in both explicit and tacit forms. Explicit knowledge is codified and widely shared. Explicit knowledge is easy to disseminate and represent in manuals, procedures, and rules. Tacit knowledge, on the other hand, is experiential knowledge, which although it can manifest itself through actions, is most often stored in the heads of experts and is difficult to elicit and share (Stenmark, 2000). The difficulty in eliciting tacit knowledge is that experts can exhibit it, but they find it difficult to describe what they are doing. Tacit knowledge is not usually verbally encoded and easily retrievable consciously. It is stored in complex mental models that the expert uses to manipulate the external world, often without conscious thought, and with ideas and assessments springing forth in response to situations almost instantly and nearly fully formed. Tacit knowledge is a key component of expertise and enables intuitive decision making.

How Do We Capture Tacit Knowledge?

A problematic issue with tacit knowledge is that it is difficult to capture. For one thing, experience-based knowledge is challenging for a proficient performer to access or articulate; sometimes people are not even fully aware of their own tacit knowledge. Tacit knowledge often involves skills so well learned and familiar that the expert may not be consciously aware of using them in the course of performing some task (Stenmark, 2000). It is so deeply embedded that it usually requires trained interviewers to get at the processes that the experts have difficulty articulating (G. Klein, 1998; Stenmark, 2000). Because this technique is costly, time-consuming, and requires trained interviewers, many organizations have tried to acquire tacit knowledge through other more practical, yet less effective, means. Key issues around tacit knowledge involve not only how it can be efficiently extracted and captured, but also how it can be expressed concretely, communicated effectively, and codified for reuse and retrieval in subsequent learning situations (Collis & Winnips, 2002).

Many organizations have undergone KM efforts to capture and reuse tacit knowledge. Organizations, including the military, are creating knowledge networks in virtual environments because these networks provide opportunities for interaction among Soldiers (Clarke & Rollo, 2001). In turn, the networks serve as electronic forums in which tacit knowledge can be transferred, such as chat rooms, team websites, and professional forums. One key way many Soldiers currently share knowledge is through web logs (blogs) or through sites such as Company Command, Platoon Leader, LOGNet, NCONet, or CavNet. Such efforts open up an environment that allows communication among distributed workers, increasing the chances of tacit knowledge transfer. However, there is a shortfall to these websites, forums, and Soldier blogs. The type of information actually being captured is not tacit knowledge, but rather snippets of decontextualized experience. These forms of knowledge capture are missing the expertise of the Soldiers by focusing on out of context highlights rather than the critical cues and factors of a situation.

Danjel Bout, aka Thunder 6, captured the problem perfectly in his miliblog when he noted:

> Americans are raised on a steady diet of action films and sound bites that slip from one supercharged scene to another, leaving out all the confusing decisions and subtle details where most people actually spend their lives. While that makes for a great story, it doesn't reveal anything of lasting value. For people to really understand our day-to-day experience here, they need more than the highlights reel. They need to see the world through our eyes for a few minutes (Hockenberry, 2005, p. 135).

What Types of Knowledge are Important to Capture?

Simply harvesting knowledge for the sake of collecting as much information as possible is not effective knowledge management. As the Army continues to transform to meet the needs of the 21st century, it must take an information age approach to KM to meet the needs of the future force and foster a culture change to inculcate KM practices and technologies into Operating and Generating Forces. The military recognizes that it must shift its focus from simply capturing large quantities of information to capturing the key tacit knowledge and experience that Soldiers are gaining in the field. By capturing this tacit knowledge, Soldiers preparing to deploy will have a strategic advantage that they have not previously had.

Simply gathering stories from Soldiers with experience is not enough. In order to build an experience base the Soldiers need an in-depth understanding of the key decisions and assessments that are being made in the field. Knowing that an improvised explosive device (IED) was found in cement alongside a road teaches a Soldier *what* to look for in an identical situation, but not how to look for IEDs in different circumstances. Thus, not only do Soldiers need to know the decisions or assessments being made, but they also need to understand the cognitive processes behind those decisions.

The cognitive processes behind a decision include understanding the factors, cues, strategies, novice errors, and information sources that were critical to making that decision. Factors include any information the Soldier knew from past experience that went into making the decision. This could include lessons learned in classrooms, personal experiences, history of the area or enemy, stories they had heard from fellow Soldiers, etc. For example, a soldier may have heard that the enemy was placing IEDs along roads and burying them. Cues refer to what the Soldier was seeing, hearing, or smelling in the current environment. For example, the Soldier noticed that there was a cement patch that looked new along this

road. Strategies refer to how the Soldier went about making the decision in that given situation, such as not driving by that particular patch of cement. Novice errors are mistakes a less experienced Soldier might have made given the same situation. This is additional information to aid a leader in a new situation. Finally, information sources are where the Soldier got his information from and how he judged the credibility of that information.

While this level of information is vital to understanding cognitive processes, it is not effective to simply break down decisions and pass this information along. To effectively transfer this type of tacit knowledge and build more adaptive and agile leaders, we found using vignettes to be highly effective.

How Do We Store and Transfer This Knowledge as Vignettes?

Vignettes are low-fidelity, context-rich, written descriptions that require a student to respond to a dilemma under friction (time pressure, uncertainty, ill-defined goals, ambiguous or conflicting information). Vignette-based training has been used in a variety of domains from training integrated emergency response teams to training military personnel (Peluso et al., 2004; Schmitt, 1994, 1996; W. Smith, Dowell, & Ortega-Lafuente, 1999). The purpose of using vignette-based training is to provide the opportunity for students to deliberately practice assessing and responding to a situation in order to improve decision-making skills. Not only do vignettes allow students to become more comfortable in uncertain conditions, but they also afford students the opportunity to improve their pattern recognition skills and provide practice communicating with others under difficult circumstances (Phillips et al., 2001). Additionally, vignette-based training provides an experiential basis for students to learn from each other's responses and to receive direct feedback from an experienced facilitator (Peluso et al., 2004; Phillips et al., 2001; Schmitt, 1994, 1996; W. Smith et al., 1999).

There are many different names used to describe vignette-based training, including Tactical Decision Games (TDGs), Decision Making Games (DMGs) and/or Decision Making Exercises (DMXs). The concept of TDGs was conceived by MAJ John Schmitt (USMC) with the aim of improving tactics and decision-making skills (Schmitt, 1994). The concept of DMGs and DMXs was based on TDGs. All of these vignette-based approaches involve a low-fidelity, context-rich situation that requires students to make pressured assessments and decisions. Vignette-based training in no way attempts to replace real-life training, but it does try to increase the rate of skill development by providing situations that require students to decipher important cues and factors in order to improve their recognitional decision-making abilities (G. Klein, 2003; Phillips et al., 2001). This is done not only through putting the student on the "hot seat" but also through discussion with other students and feedback from an experienced facilitator (Harris-Thompson et al., 2004).

While vignettes have been used by the military for training, they have not been previously used as a method to store and transfer tacit knowledge, especially in electronic professional forums. One way to offer an environment that is conducive to tacit knowledge transfer is to have a skilled facilitator sponsoring online vignettes or stories. Research has found that narrative serves as a bridge between tacit and explicit knowledge, allowing tacit knowledge to be demonstrated and learned (Linde, 2001). Using stories is one of the most powerful methods for both eliciting and enabling the transfer of tacit knowledge (G. Klein, 1998; E. A. Smith, 2001). This is because they allow the transfer of complex ideas in a basic, yet memorable form (Snowden, 2000).

What Makes a Good Vignette?

Simply telling a good story neither guarantees that tacit knowledge is captured nor does it ensure effective learning. So what makes a good vignette? Schmitt describes vignettes as "short action stories" that build to a climax. A good story allows the student to understand the factors involved in the situation—eventually allowing them to recognize causal relationships (G. Klein, 1998). Good vignettes include a graphic or map, and they provide general information to set the stage and transition into a specific situation by providing a variety of information that culminates in a dilemma or challenge (Harris-Thompson et al., 2004; Peluso et al., 2004; Phillips et al., 2001; Schmitt, 1994). All good vignettes need to have "fog and friction." In other words, there should be a certain amount of uncertainty contained within the vignette that can be the result of a lack of information, ambiguous or conflicting information, and/or unanticipated events (Schmitt, 1994, 1996). In addition to the elements already listed, good vignettes must also be interesting, challenging, plausible, accurate, have no single correct solution, contain the right amount of detail and the right type of detail, and

have a reasonable time limit to address the challenge (Schmitt, 1994, 1996)

Vignette-based training can help decision makers become more adaptive thinkers. Adaptive thinking in the military is described as "the cognitive behavior of an officer who is confronted by unanticipated circumstances during the execution of a planned military operation" (Lussier, Ross, & Mayes, 2000, p. 1). In today's world, Soldiers are forced to be more adaptable as they face a decentralized combat environment, which has only increased the ambiguity associated with the battlefield. Junior level officers are being asked to take on roles they never imagined they would have to fill, and this has forced them to learn how to adapt and apply their mental models rapidly. Young officers must learn how to deal with an unpredictable environment because the enemy is constantly adapting to their reactions. One officer captured it perfectly when he spoke about his Operation Iraqi Freedom experience by saying, "To prepare any officer for this, to prepare anyone for this, you need to just constantly test him, put him in very challenging situations, and allow them to sort of think and act under pressure and stress. That is essentially what you do here"(Wong, 2004, p.19).

To produce good adaptive thinkers, training needs to address "a thinking performance" that can be practiced in the same way as other skills (Shadrick, 2003). Using vignette-based training can be an inexpensive replacement to full-scale exercises or simulations, allowing situations to unfold based on the trainees' responses in a time pressured and realistic environment (W. Smith et al., 1999). For jobs that require an individual to make pressured decisions, vignette-based training can be a great way to help those involved in such jobs to learn to become more adaptable. However, a common misconception is that practice makes perfect. If students are not experiencing cognitive behaviors and practicing the cognitive skills of an expert facing a similar situation, then they are not improving their battlefield decision-making skills. It is essential that when practicing, the learning process produces authentic cognitive experiences, uses an effective facilitator, and delivers quality feedback.

An important component to creating "good" vignette-based training is to make sure it is cognitively authentic (Ross, Halterman, Pierce, & Ross, 1998; Ross & Pierce, 2000). By cognitively authentic we mean that the training accurately captures the elements that exist in the natural environment—those challenges and indicators that activate an expert's tacit knowledge. This design allows for the critical cues and factors to be present so the appropriate problem-solving and decision-making processes are like the processes that might be experienced by an expert in the same situation. (As learning progresses, "noise" should also be present in the experience to reflect the ability of the expert to "tune out" information irrelevant to performance.)

How Do We Use Key Information to Create a Vignette?

The foundation for developing cognitively authentic vignettes as the basis for the learning process is Cognitive Task Analysis (CTA). Cognitive Task Analysis allows a vignette developer to go beyond the procedural knowledge and behavioral aspects of expert performance and get "inside the head" of an expert to understand his or her decision making (G. Klein, 1998). The analysis portion of CTA then organizes the salient information in a way so that it can easily be incorporated into the vignette. It is essential that CTA techniques be used when developing vignette-based training in order to ensure cognitive authenticity. The problem that developers encounter is that CTA techniques are very laborious and require a certain amount of expertise. Because of this, many vignette developers struggle to create a cognitively authentic decision environment (Harris-Thompson et al., 2004). Again, practice only makes perfect as long as the decision space that a student is being placed in accurately represents the situation from an expert's perspective.

In order to help vignette developers create more authentic vignettes, several attempts have been made to simplify and improve the development process (Harris-Thompson et al., 2004; Phillips et al., 2001; W. Smith et al., 1999). These tools range from articles that provide guidance about how to design good vignettes (Schmitt & Klein, 1996) to authoring tools that help improve knowledge capture (Harris-Thompson et al., 2004; Phillips et al., 2001; W. Smith et al., 1999). Although all of these tools provide beneficial advice and guidance, it should be noted that the reason why vignette development can be so challenging is because there is no one best process (Harris-Thompson et al., 2004; Peluso et al., 2004). The vignette development process is a very iterative and cognitively complex process that varies for each person, and it is constantly changing based on the circumstances for which the vignette is being developed.

Using the key information from CTA interviews (factors, cues, strategies, novice errors, and information sources), new vignettes can be created. While explaining the creation of a vignette is a far more complicated process, we offer a general overview.

A vignette has several key components. The learning objectives set out the learning goal you are attempting to accomplish. These learning objectives are based on the decisions and assessments that were identified during the CTA. The general situation sets up the background information and provides a brief history of the situation. Here is where you can incorporate in the factors, some of the information sources, and some of the typical novice errors. The specific situation describes what is happening right now, and the dilemma the participant faces. It includes a description of the environment, assets, other resources available and the current scene. In this section, you can incorporate in the remainder of the information sources, along with the cues, and the remainder of the novice errors. The requirement instructs participants to do something specific, such as determine what action you will take and who you will communicate with. This often stems from a challenge that has been identified. Finally, an appropriate visual representation adds an additional element of cognitive authenticity to the vignette. Here you can incorporate cues or things the person saw on a map or a diagram rather than verbalizing them in the text of the vignette.

A key factor to keep in mind is that a vignette should never be created from a single experience or incident. You want to learn about a situation from multiple experts and use all of that information to create a vignette that is more challenging and stretches the leader to become more adaptive.

The underlying motivation in creating vignettes is to help improve tacit knowledge capture and transfer so that it can be passed along to individuals with less experience. Although the value of a CTA practitioner can never fully be replaced, finding a way to streamline and improve the knowledge elicitation process can significantly increase the chances to improve tacit knowledge capture, thus allowing for more cognitively authentic training to be developed.

Are Vignettes Effective for the Transfer of Tacit Knowledge?

Three studies have been done that illustrate the effectiveness of cognitively authentic vignettes in transferring tacit knowledge in a variety of environments. Baxter, Harris, & Phillips (2004) found that using vignettes for training produced a statistically significant improvement in situation awareness and sensemaking skills. In addition, vignettes have been found effective in improving mental simulation and planning skills (Baxter, Ross, Phillips, Shafer, & Fowlkes, 2004). BCKS is a low-cost and broad reaching delivery means for these vignettes through introduction into the professional forums. Company Command uses this effectively through its Command Challenge and Rally Point posts.

Finally, an evaluation of vignette-based training used for Operations Other Than War (OOTW) revealed that vignettes were effective in conveying the appropriate themes for OOTW missions. The evaluation results revealed that 75% of the students recognized the teaching points in each scenario. Of the 75%, 44% better realized the importance of the teaching points and 16% felt like they were better prepared to handle these issues. The evaluation also revealed that using a skilled facilitator can improve the success of engaging students and communicating the teaching points (Miller et al., 2003).

CONCLUSION

Tacit knowledge is created from the context in which experience is situated. How then, can knowledge that is literally part of the dynamic cognitive processes of individuals in particular situations be transmitted to others? We assert that capturing stories and then transmitting those stories, especially in the form of vignettes to enhance and foster leader development, professional education, and training, is the preferred knowledge transmission method. We believe stories and vignettes can also work to support professional forums that are not as literal as “training events,” and can measurably tap into the mental processes that define how our experiential patterns trigger into actionable responses.

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