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IS Challenges in Knowledge Conveyance

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Abstract

Knowledge organizations want to capture and preserve their employee's knowledge. From an epistemological viewpoint, employees contribute propositional and procedural knowledge. Propositional knowledge is easier to archive using traditional knowledge representation and access methods, whereas procedural knowledge presents a greater challenge. This paper will examine the underlying reasons for the challenge posed by procedural knowledge.

Three Types of Knowledge

Epistemology studies the nature of knowledge and "seeks to define the features, substantive conditions, and limits of what we can know and how we justify our knowledge" (Moser, 1995). We encounter the evidence upon which we base our knowledge either directly, through our experience or indirectly, by believing that someone's description of a state of affairs is true (Pappas, 1995). Epistemology posits three types of knowledge: 1). knowledge by acquaintance, 2). procedural knowledge, and 3). propositional knowledge (Baergen, 1995). Thus, when we use the word "knowledge," we must be clear about how we are using the term.

Knowledge by acquaintance refers to our direct awareness of something, as when we "know" someone or something by acquaintance (Russell, 1984). We engage in this type of knowing, for example, when we say that we "know" a particular person, or an area of the country.

Procedural knowledge refers to the type of knowledge we have when we "know how" to do something. We engage in this type of knowing when we say that we "know how" to play the violin, to do the t'ai chi form, or to ski down-hill. Procedural knowers appropriate or embody this kind of knowledge and can exhibit it through demonstration.

Propositional knowledge represents "knowing that," and usually appears as facts; this type of knowledge can be represented by propositional statements. "Knowing that" 2+2=4 and Spain is in Europe are examples of propositional knowledge. Ackoff and Emery (1972) define this type of knowledge to be "information that has been authenticated, validated, and true." Dretske (1981) posits that to know something is to eliminate all relevant alternatives, and that knowledge is categorical: you either know it, or you don't.

We are capable of understanding propositional and procedural knowledge because they are structured against a background of pre-intentional non-intentional capacities and phenomena that allow us to think, perceive, and communicate. The background is that set of non-represented propositions against which our articulated propositions take on meaning (Searle,1992). Heidegger (1962) states that we know something by encountering it while engaged and involved with what we do in our lives. From our engagement with life, we can recognize possibilities and know things. We begin by being engaged in projects and tasks, and from this immersed vantage point, can step back, reflect, make sense and can talk about what we do. (Heidegger, 1962, Ihde, 1990).

Knowledge Conveyance

Knowledge can be conveyed to us using a set of symbols, narrative, images, or notations that translate into something that we "know" or "do." However, the way that knowledge is conveyed and the process that one goes through to "know" it differs depending on whether the knowledge is propositional or procedural. In either case, knowledge requires a background against which it can yield meaning. To exemplify the distinction between propositional and procedural knowledge, let us consider an extreme case of each type of knowledge. As an example of propositional knowledge we will consider someone understanding a mathematical proof. As an example of procedural knowledge, we will consider someone learning to do the t'ai chi form.

Publication of a mathematical proof in a reputable mathematics journal shows how both the process and product of propositional knowledge can be communicated to an audience. Following conventions and standards, and representing knowledge by clear notation, anyone who has the requisite mathematical background can understand the proof. However, although the proof is readily articulated and accessible, the "reader" can do one of the following: 1). She may simply note the result, and integrate it into her existing mathematical framework and "know that" some expression is the result of the proof; 2). She may follow the derivation of the proof, and hence "think with" the logic and go through the articulation process as well as understand the final result; or 3). She may need to build up her background knowledge and understanding in order to comprehend the proof. A proof presents knowledge clearly and parsimoniously in a "pure" language that is accessible to anyone, transcending language barriers. The mathematical background is standardized and externally accessible, and thus can be gained by anyone with sufficient talent and effort.

Procedural or embodied knowledge, on the other hand, requires that the learner idiosyncratically understand and apply "statements or instructions" in a practical setting, and through immersion with the material through physical or intellectual practice, she arrives at a knowledge of how to do something. Completely experiential knowledge can be talked about or explained using propositions, but to gain any understanding about what the propositions mean, the activity or experience must be performed. Take, for example, someone learning how to do the movements of the t'ai chi form. Narrative descriptions, images, and principles that have been passed down for generations to guide practitioners about how to perform the t'ai chi

movements (Lo et al, 1985). One can read these instructions, or look at the images, and yet never approach the kinesthetic awareness necessary to give them meaning. The descriptions initially guide one's focus and attention to search for the possible physical correlatives.

Once these physical sensations have been experienced and mapped, the aspiring t'ai chi practitioner has a new level or depth of understanding (knowledge) that augments and gives new meaning to the description. Thus, the learner must build up a "body" of awareness or sensory (kinesthetic) states to gain entrance into the meaning of the descriptions. One can "know that" the descriptions make certain assertions without "knowing how" to perform the movements. In a kinesthetic activity such as t'ai chi or skiing, one often needs a teacher or coach in order to create a bridge between the description and practical enactment. The teacher acts as an interpreter and facilitator of "physical states" by creating conditions that will structure the student's experience of the activities. The coach knows the procedure very well, and is able to place students in the conditions where they can experience in their body what has been approximately described in images or words. To convey experience-based procedural knowledge, a learning framework must be developed where the procedural learner is placed in a situation that will elicit the appropriate experiential responses as the knowledge acquisition process unfolds. Time is often an important component for such learning, being inherent in the requisite repetition or in the requisite introspection and reflection. Physical, mental, or emotional changes might occur during a learning process. In these cases, the learner embarks upon a path to development where the role of the teacher is to manage the learner through the time that it takes to learn the material.

IS Challenges in Knowledge Conveyance

Organizations are faced with representing and retaining both types of knowledge. The different characteristics of procedural and propositional knowledge require different ways of encountering them. Whereas many aspects of a knower's knowledge can be expressed as standard rules and exemplars, other aspects cannot be codified or expressed easily at all. If we take accounting or engineering as an example, we see that many of the rules and practices can be articulated in externally accessible ways. If someone lacks a background to understand these concepts there exist standard methods to remedy this. Other aspects of these disciplines fall into the procedural knowledge category. Activities such as interpreting the tax ramifications of new legislation or arriving at a creative engineering design require an experiential, or internally built framework. This type of knowledge is difficult to represent in an organization's knowledge base. Although it is often easy to document *what* an engineer or accountant has done, it is more difficult to document *how* it was done. The exemplar engineer or accountant often is unable to document her processes as they occur because she must "shift gears" to generate documentation of her knowledge process. Not only has she broken her engagement with the problem at hand, and come to another level of awareness, she is now engaged in another type of activity -- that of reporting what she has done. This demonstrates the paradox of expertise (Dreyfus and Dreyfus, 1986), wherein a practitioner finds it difficult to accurately report what she does. When reporting what she did, the knower often describes in a pedestrian, procedural way the standardized knowledge that comprises the framework that she transcended to innovate.

Whereas propositional knowledge can be expressed and shared in an objective and standardized way, procedural knowledge must be experienced or reproduced in a more subjective way. Reproducing procedural knowledge from a repository requires a mechanism capable of structuring and presenting knowledge in a multiplicity of ways. A learner can acquire this type of knowledge through time by going through the process of finding knowledge and developing a working order for it that occurs as the result of reflecting on the process while engaged in it.

Organizations can retain their knowledge and practices by creating various knowledge artifacts, such as: videotaped demonstrations, narrative descriptions, knowledge bases, simulations, and exemplars, to name a few. If one has a structure or framework in which to fit the "values" of the knowledge, then obtaining and using propositional knowledge is relatively straightforward. Procedural knowledge can be modeled on a continuum: Descriptions can range from objective and externally verifiable to subjective and intuitively understandable. What determines the IS requirements in conveying procedural knowledge depends on its audience. When knowledge recipients share a common experiential background with the knowledge originator, then standard descriptions and mechanisms are sufficient to convey knowledge. However, when recipients lack background experience in the knowledge domain, then systems must assist recipients in contextualizing and interpreting knowledge. Such systems, in addition to delivering knowledge, must be designed to structure, evoke, or simulate conditions for the procedures to be practiced and mastered. They must provide feedback cues and thus train the recipient to identify and interpret contextual clues. The complexity of these system components will depend on whether the procedure requires intellectual or behavioral mastery of the knowledge. Conveying praxis requires interpretation and translation of embodied states into a format that is understandable, accessible, and useable by someone trying to reproduce that ability.

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