Externalization of Tacit Knowledge in Online Environments

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Knowledge, especially tacit knowledge, has gained more and more attention in recent years. The author claims that, with the development of information technology, more knowledge sharing takes place online rather than face-to-face. The purpose of this study is to explore how tacit knowledge is externalized in online environments. To answer this question, the author did a qualitative case study with an online course management system to collect and analyze the data. The results showed that in an online environment, sharing one's own experience is the most effective way for people to share their tacit knowledge. Further suggestions can help support the design and development of effective online environments to facilitate online externalization of tacit knowledge.

PURPOSES OF THE STUDY

Knowledge is increasingly regarded as the critical resource of firms and economies (Quinn, 1992). Knowledge is not only an intellectual object accumulated by experience and learning activities but also a process of structuring, interpreting, and contextualizing information which allows it to be used later in interpretation, action, and decision making for specific purposes (Blackler, 1995). Therefore, knowledge is structured information, while information is organized data.

Picture yourself driving a car, riding a bicycle, typing on a keyboard: you know how to do those things so well that you do not actually have to know how to do them; you just do them (Durrance, 1998). It is tacit knowledge that lives in our bodies, muscles, intuition, emotions, values, and beliefs. Recent attention has been focused on the importance of tacit knowledge for sustaining firms' competitiveness (Hall, 1993), for its role in technological

innovation and organizational learning (Nonaka, 1991), and on the question of how to externalize tacit knowledge to be explicit to others within the organization (Nonaka, 1991, 1994; Durrance, 1998).

With the development of information technology and the emergence of intranet, more and more interactions are online rather than face-to-face. Thus we need to understand the importance of using knowledge and information through the use of online networks. In online environments, how might tacit knowledge be externalized? The purpose of this study is to explore this question.

RESEARCH QUESTIONS

This study is guided by the following research question: *How is tacit knowledge externalized in online environments?*

"Externalize" here means to make tacit knowledge, explicit. "Online" means the Internet and World Wide Web computer technology. "Tacit knowledge" is the most important concept in this study. However, it is a fuzzy concept and cannot be expressed very clearly. From the earlier brief literature review description, we could also know that there is no exact same definition for tacit knowledge.

In this study, I set up the criteria to differentiate tacit knowledge from explicit knowledge in online environments. Tacit knowledge is defined as:

- personal;
- difficult to communicate to others;
- problematic; and
- contextual.

SIGNIFICANCE OF THE STUDY

On one hand, the growing interest around externalization of tacit knowledge has not been matched yet by an equivalent effort to provide empirical evidence supporting the theoretical research hypotheses. On the other hand, most of the attention to this topic has been captured by discussing the transfer of tacit knowledge through face-to-face communication (Nonaka, 1994; Durrance, 1998; Leonard & Sensiper, 1998; Lam, 2000). Up to now, little effort has been put forward towards developing methods for online tacit knowledge externalization.

This study helps to fill the gap by generating empirical data on tacit knowledge externalization in online environments. The results could help support the design and development of effective online learning environments to facilitate online externalization of tacit knowledge.

LITERATURE REVIEW

Tacit Knowledge

The philosopher Michael Polanyi (1996) stated that we know more than we can tell. In the early 1960s, the term *tacit knowledge* appeared. A large amount of the knowledge within an organization may not be codified: it may be personal, context-specific, and difficult to write down. Such knowledge is referred to as tacit knowledge (Polanyi, 1966). Wagner and Sternberg (1986) defined tacit knowledge as work-related practical knowledge learned informally on the job. Durrance (1998) stated that western culture loved explicit knowledge – the quantifiable, definable information that makes up the reports, memos, manuals, and instructional materials. Tacit knowledge existed in more eastern-culture environment. It is more mysterious and harder to talk about. It can be the result when a training program works. Or it can be the reason another fails. It underlies what we actually do.

The starting point of Nonaka's (1991) innovation model was a kind of knowledge that was not so easily expressible: "tacit" knowledge is highly personal, hard to formalize and, therefore, difficult to communicate to others. Tacit knowledge is also deeply rooted in action and in an individual's commitment to a specific context – a craft or profession, a particular technology or product market, or the activities of a work group or team. Tacit knowledge consists partly of technical skills – the kind of informal skills captured in the term "know-how." Furthermore, Nonaka stated that tacit knowledge had an important cognitive dimension. It consisted of mental models, beliefs, and perspectives so ingrained that we could not easily articulate them.

One major strand of the theory of knowledge and organizational learning is notably the work of Nonaka (1991; 1994). He sought to understand the nature of knowledge and organizational learning from a pluralistic epistemological perspective. His work distinguished between explicit knowledge and tacit knowledge and he argued that the interaction between these two modes of knowing is vital for the creation of new knowledge. Nonaka emphasized tacit knowing as the origin of human knowledge.

The critical differences between tacit knowledge and explicit knowledge lie in three major areas (Lam, 2000). The first area is the codifiability and mechanisms for transferring knowledge. Explicit knowledge can be codified, understood, and shared without a "knowing subject." Ease of communication and transfer is its fundamental property. Tacit knowledge is intuitive and unarticulated. It cannot be communicated, used, or understood without the "knowing subject." Knowledge of this type is action-oriented. It needs close interaction and the build up of shared understanding and trust. The second area is the main method for acquisition and accumulation of knowledge. Explicit knowledge can be generated through logical deduction and acquired by formal study. Tacit

knowledge, in contrast, can only be acquired through practical experience in the relevant context, that is, "learning by doing." The third area is the potential for aggregation and modes of appropriation. Explicit knowledge can be aggregated at a single location, stored in objective forms, and appropriated without the participation of the knowing subject. Tacit knowledge is personal and contextual. It is distributive and cannot be easily aggregated. The realization of its full potential requires the close involvement and cooperation of the knowing subject.

Although it is possible to distinguish conceptually between explicit and tacit knowledge, they are not separate and discrete in practice. Nonaka and Takeuch (1995) argued that new knowledge was generated through the dynamic interaction and combination of these two types.

Externalization of Tacit Knowledge

There are some research papers on how to externalize tacit knowledge within organizations. Nonaka (1994) stated that organizational knowledge was created through a continuous dialogue between tacit knowledge and explicit knowledge. He identified four types of knowledge conversion: (a) socialization, (b) externalization, (c) combination, and (d) internalization (Figure 1). From the four modes of the knowledge creation, we know that externalization refers to the knowledge conversion process from tacit knowledge to explicit knowledge.

There are some papers researching how to externalize tacit knowledge in organizations. Leonard and Sensiper (1998) stated that apprenticeships were a time-honored way of building shared specific tacit knowledge. Tacit knowledge grows through shared observation and from mimicking behavior, even without knowing why. The most common application of tacit knowledge is problem solving. The challenge of capturing tacit knowledge is getting employees to contribute their knowledge to the collective base and to reply on
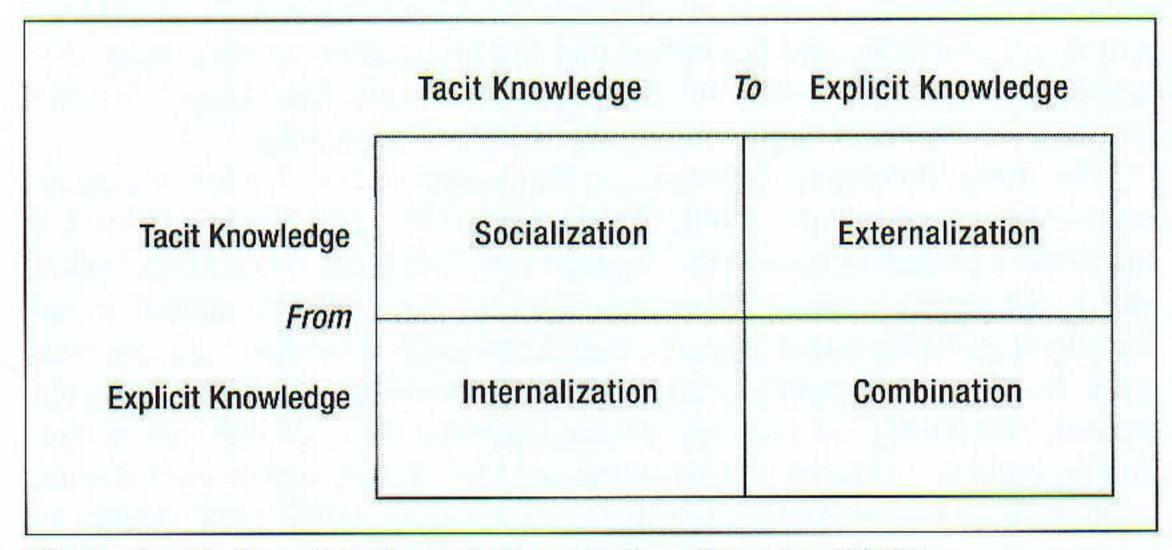
	Tacit Knowledge	*To*	Explicit Knowledge
Tacit Knowledge	Socialization		Externalization
From			
Explicit Knowledge	Internalization		Combination

Figure 1. Modes of the knowledge creation (Nonaka, 1994)

the knowledge of others. Incentives, motivation, and, most importantly, a "cultural foundation for knowledge management" are the critical success factor (Casonato & Harris, 1999). Lam (2000) stated that tacit knowledge was experience-based: it can only be revealed through practice in a particular context and transmitted through social networks. There is a Chinese proverb: "What I hear, I forget. What I see, I remember. What I do, I understand." Durrance (1998) summarized four points of how to cultivate the sharing of tacit knowledge among people in the organization: (a) watch, (b) create an environment of trust, respect, and commitment, (c) let people learn by doing, (d) in any training exercise, allow time for reflection and interpersonal exchange.

Davenport's (2001) Communities of Practice refers to a flexible group of professionals, informally bound by common interests, who interact through interdependent tasks guided by a common purpose thereby embodying a store of common knowledge. Brown and Duguid (1991) argued that employees learned the work in "communities of practice" that de-emphasized canonical practices and used noncanonical practices. Attempts to solve practical problems often generates links between individuals who can provide useful information. The exchange and development of information within these evolving communities facilitates knowledge creation by linking the routine dimensions of day-to-day work to active learning and innovation. The properties of informal organizational memory are storytelling, collaboration, and social construction.

Nonaka (1994) mentioned that one effective method of converting tacit knowledge into explicit knowledge was the use of metaphor. The essence of metaphor is understanding and experiencing one kind of thing in terms of another. And the contradictions incorporated in metaphor may be harmonized through the use of analogies. Nonaka also discussed the importance of building a self-organizing team, sharing experience, and conceptualization (through continuous dialogues) in the process of tacit knowledge externalization.

METHODOLOGY

Population and Sample

The sample of this study was from the students who took a core course in the 2001 Fall semester in IST department at Indiana University – Bloomington. All the students in this course are the potential participants of this study. The potential participants represent almost 10 different countries, either master students or PhD students. All of them have basic knowledge of using computers and the Internet.

All the potential participants posted messages on the course Site Scape Forum (SSF) (an online course management system) every week to share their knowledge with others. The final participants were selected according to the students' postings. Since I relied on my own judgments to select participants, it is the purposive (nonprobability) sampling. Therefore, a purpo-

sive, nonrandom sample was used. To be included in the sample, the postings' content should all meet the tacit knowledge criteria: personal, difficult to communicate, problematic, and contextual. Furthermore, more data was collected through the interview answers.

Instrumentation

Two instruments were developed to collect data for this study: (a) A content analysis protocol (the specific explanation of each criterion for tacit knowledge, Appendix A); (b) Face-to-face Interview (Appendix B). These instruments were used to measure the research variable tacit knowledge and answer the two research questions.

Data Collection

First, students' posting content in SSF was read and those appropriate for my study were selected according to the content analysis protocol. Next, six students of the selected postings were contacted for the face-to-face interviews. The purposes of this further interview were, on one hand, to confirm if my content analysis is correct, on the other hand, to get more specific ideas from the participants about tacit knowledge externalization process and the strengths and weaknesses of the online tacit knowledge externalization.

Data Analysis

First, the content of each message in SSF was analyzed and selected for further study according to the tacit knowledge criteria (personal, difficult to communicate to others, problematic, and contextual). Then, all the selected useful messages were summarized to get the original ideas about which ways the participants used to externalize their tacit knowledge.

Secondly, interviews were conducted with six students who posted these selected messages. The answers of the first three questions may confirm if the content analysis in the first stage is correct. The forth question was a critical one to answer subquestion 1: through what kind of ways is tacit knowledge externalized in online environments? The purpose of the last four questions was to get answers for subquestion 2: comparing with face-to-face communication, what are the strengths and weaknesses of online tacit knowledge transferring? The results were reviewed, summarized, and analyzed.

RESULTS AND FINDINGS

Results

First, content analysis was done according to the four criteria set up for the tacit knowledge. Because all the postings in the course SSF were focused on some specific discussion topics the instructor gave, almost all the postings

were problematic and contextual. I judged if the knowledge the students shared was personal according to my own experience. If the knowledge shared was based on people's own understanding and experience, it is regarded as tacit knowledge. If the knowledge shared could also be gotten from other ways such as books and journals, it is regarded as explicit knowledge. For example, a student gave a description of what he read about concept learning from several articles. The knowledge he shared was not personal, so during the knowledge transferring process, what happened was knowledge converted from explicit to explicit, but not from tacit to explicit. As for the second criteria, difficult to communicate with others, it is hard for me to judge it, so I did not consider it during the content analysis stage. It was confirmed later in the interviews. Finally, 16 postings were selected from six students in which tacit knowledge externalization probably happened

Second, interviews were conducted with the six selected students whose postings meet the four criteria set up for tacit knowledge. The following table shows their demographic data. The interviewees use the Internet on average for two to six hours per day. All of them have online communication experience such as e-mail, SSF, and Oncourse. One interviewee also had online conference call experience.

At the beginning of the interview, the participants were asked to read their postings that were selected in the content analysis. From the answers of the first two interview questions, the participants confirmed my judgment – the knowledge they shared (those selected) was personal and difficult to communicate. However, when asked the reason why they felt it difficult to express their ideas, four participants said that was because it was time-consuming to write down everything and not so natural as face-to-face communication. Only two participants said that was because the ideas were not easy to be clearly expressed.

The research question of this study is "How is tacit knowledge externalized in an online environment." It may be discussed further by two subquestions. The first subquestion is: Through what kind of ways is tacit knowledge externalized in online environment? The answer was devised from the qualitative data of the fourth question. All the participants said that they shared their own knowledge mainly through describing their own experiences in life. They told others their previous working and living experience and knowledge

Table 1

Demographic Data

Gender		Current Status		Native Language	
Male	Female	Master	Ph.D.	English	Non-English
50%	50%	50%	50%	50%	50%

and how it related to what the students were learning. They thought that way was effective because sharing a persons' own experience can add something new, and it is very valid, believable, contextual, and grounded. One participant said according to adult learning theory, adults are practical oriented and always relate what they learn to the real-world practice. To be specific, the participants always describe their own experience by telling stories, using metaphors, and sharing mental models. One participant said metaphor was an effective way to express the ideas but was hard to create. Another participant talked about his experience about how to share a mental model with others. He said: "First I might ask some questions to the other to know his or her ideas, then from his or her thoughts and my own knowledge to build a new mental model, and then tell him or her what I know."

The second subquestion is: Comparing with face-to-face communication, what are the strengths and weaknesses of online tacit knowledge transfer? The answer was derived from the qualitative data of questions 5-8. All participants said they received some value from exchanging knowledge with others in SSF, but not a lot. It was helpful to identify people who had similar or different ideas; to solve problems of others; to clarify some of their own thoughts; and to benefit from others with different experiences and backgrounds. However, they did not get a lot of value because the limitation of discussing in SSF. It is explained in Table 2. Three participants said the knowledge received through SSF would help them do the future work and study because of the value they got. The other three participants said no because they thought the knowledge sharing in SSF was still staying on a superficial level because there was no interaction and motivation. One of them thought the potential of the tools of SSF was much greater than what was used. The participants' main incentives to share knowledge in SSF were to finish the requirements and the willingness to help and share knowledge with others.

The participants gave a lot of their opinions on the last question: by which way do you prefer when exchanging your knowledge with others, face-to-face or online? And why? All of them prefer face-to-face communication to online communication when sharing their own knowledge with others. Their opinions are summarized in Table 2.

Findings

From the data analysis results previously explained, there were two findings.

First, we know that within organizations tacit knowledge can be externalized through apprenticeship, mentorship, and observation. In other words, it is learning by doing. Differently, in online environments, *sharing one's own experience* is the most effective way people use when sharing their tacit knowledge with others. Sharing one's original experience is the fundamental source of tacit knowledge. Tacit-to-explicit knowledge conversion often happens in the forms of *storytelling* and *metaphors*. As the tacit knowledge of one individual is

shared in the form of metaphors and stories, the others listen and combine this input with what they already know and understand. Thus, the listener attains new knowledge, of an explicit nature. Individual's mental models are shared and worked into an explicit articulation. The similar ideas can also be found in Nonaka's (1994) knowledge creation model.

Second, from the participants' feedback, I know that they prefer face-to-face to online communication when sharing knowledge with others. From Table 2, it is obvious that both face-to-face and online communication have their strengths and weaknesses. The attention is focused on is the weaknesses of online communication. Some of them can be improved. Here are *my suggestions*.

- Each participant's biography introduction can be read by others in an online community, and its better for people to meet before starting the online talk.

- For the discussion with specific topics, its better to have some facilitators who can organize and keep it on the right track.

- If conditions allow, have the synchronous online conversation.

Table 2
Face-to-Face and Online Knowledge-Sharing Comparison

	Face-to-face	Online
Strengths	• Synchronous, can get immediate feedback; • Easy to express emotional feelings; • Know whom you are talking with; • Natural, real conversation.	• No immediate feedback; • Hard to express emotional things; • Talkers do not know each other, no sense of community; • Artificial, no real conversation.
Weaknesses	• Speak when thinking, so the ideas may be not clear and thoughtful; • Might forget the knowledge learned in later time; • Need to find appropriate time and place; • People who are nervous about talking publicly and non-native language speakers avoid face-to-face talking.	• Have enough time to think organize, and summarize ideas before posting; • Can keep recording of the knowledge shared; • Can express ideas at any time; • Benefit for people who are afraid of talking publicly and people whose native language is not English.

LIMITATIONS AND FURTHER RESEARCH

Limitations

Several limitations are associated with this study. First, for qualitative study, internal validity is high if the results are credible or believable from the perspective of the participants in the study. This research has an inherent subjectivity because I am the data collector, data interpreter, and data analyzer. A certain amount of bias might be unavoidable. However, I considered the possible bias in the analysis process and used different methods to try to eliminate it, such as online discussion observation and interviews. The time of data collection might also be an issue that may influence internal validity. The postings in SSF were not created recently but posted three to five months ago. The participants might not clearly and correctly remember their thoughts at that time. The lucky thing is that, during the interviews, the postings could easily remind the interviewees what happened and what they were thinking at the time they posted the messages.

Second, for qualitative study, external validity refers to the degree to which the results can be generalized to other contexts or settings. In this study, purposive sampling as a necessary sampling method, made it hard for the generalization of the results to the population at large. In addition, because of the limited resources, I could only collect data from SSF that is just one kind of online discussion. Although currently it is one of the most popular and representative tools for online discussion, there are still some other tools with different functions and different interfaces. Hence, the results from this study might not be generalized to all the online environments.

Further Research

To the extent my measures are limited, more extensive measures of externalization of tacit knowledge in online environments may yield stronger effects. For instance, we could use larger sample of interviews to increase the reliability and validity of the measures. And we could consider researching this topic in other online environments such as BBS and online chat rooms to increase the generalizability of the measures.

Based on the findings of this study, further research could also investigate how to design, develop, and manage more effective online learning environments (such as motivation issues in online environments) to facilitate online externalization of tacit knowledge and other types of knowledge conversion.

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Appendix A – Content Analysis Protocol

1. Personal
The realization of the knowledge requires the close involvement of the knowing subject, e.g. a master craftsman after years of experience develops a wealth of expertise *at his fingertips.*

2. Difficult to communicate to others
Knowledge is always acquired through practical experience and has a personal quality that makes it difficult to formalize or communicate, e.g. the master craftsman is often *difficult to articulate* the scientific or technical principles behind what he knows.

3. Problematic
Knowledge is transferred in the light of the problem at hand. The problem is solved through the experience in an individual's mind, e.g. the master craftsman always transfers his expertise to novices through *at-hand problem solving.*

4. Contextual
Knowledge is context specific and can only be acquired through practical experience in the relevant context, e.g. the master craftsman always transfers his expertise to novices through problem solving at a *specific context.*

Appendix B Interview Questions

Personal characteristics

- Name
- Gender   (female, male)
- Current status
- Nationality
- Internet use (hours/day)
- Online communication experience

Questions

1. I read some of your postings in SSF on which I have interests to do some research. According to my judgment, you were trying to let others know what you have known, am I right?

2. When posting your items, you felt it was easy or difficult for you to express your ideas and opinions clearly? Please be specific.

3. In which situations did you share your personal knowledge with other classmates in SSF?

4. By which way did you share your knowledge with others in posting? Please be specific.

5. What value would you get from exchanging your own knowledge online with others?

6. What are your incentives for sharing knowledge with others in SSF?

7. Will or did the knowledge you receive through the SSF help you do the future study and work?

8. By which way do you prefer when exchanging your knowledge with others, face-to-face or online? Why?