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Requirements for Knowledge Repositories: A Case Study

Millie Kwan
University of Hong Kong

P. Balasubramanian
Boston University

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M. Millie Kwan
University of Hong Kong
mmkwan@business.hku.hk

P. R. Balasubramanian
Boston University
bala@bu.edu

Abstract

This research explores how knowledge of semi-structured processes, which emphasizes learning from past experiences, can be structured in knowledge repositories to facilitate memory and sharing. According to dynamic memory theory, a structure called a memory organization packet (MOP) is designed to share experiences. This case study uses case teaching in a Business School as a semi-structured process. By gathering instructors' experiences, analyzing them and applying the MOP structure, we found that the functional context, situational context, initial context, and language context are key elements for supporting knowledge sharing through knowledge repositories. A prototype was also constructed.

Introduction

Knowledge workers often need to learn from each others' experience to cope, to keep up-to-date and to innovate. Knowledge management aims to externalize the experiential knowledge gained by individuals who perform organizational activities, store it in knowledge repositories and make it widely accessible across the organization via the corporate intranet. Knowledge repositories typically store documents containing knowledge used in organizational processes, such as memos, reports, presentations, or they may be discussion databases in which participants record their own experiences on an issue and react to others' comments (Davenport, et al., 1998). Through knowledge repositories, knowledge sharing is enabled across space and time while knowledge becomes an organizational asset which stays within the organization even after the individuals who created the knowledge had left.

Most knowledge repositories are built around informational objects classified by subject area (March and Garvin, 1997). For example, Arthur Andersen's Global Best Practices knowledge base is a repository of highly distilled research concerning the most effective ways of performing particular processes. The content of this knowledge base is organized using a process classification scheme which categorizes an enterprise's activities into seven broad operating processes and six broad management processes. These broad processes are then broken down into a hierarchy of subprocesses. Materials under each process are grouped in ten categories, such as descriptions of best practices, world class performance metrics, presentations, diagnostic tools, etc. The source materials are usually stripped of their context to make them more general and then placed into distinct categories within the classification scheme. These repositories assume that processes are structured and practiced according to design.

This research explores how knowledge of semi-structured processes can be organized in knowledge repositories to facilitate memory and sharing. Knowledge repositories allow communities to pass on their traditions, record their experiences and provide introductions to their new members. Whereas structured processes emphasize learning in process design and task execution, semi-structured processes – processes that require problem solving – emphasize learning from past experiences. This learning is created through story-telling and sense-making by members of a community of practice (Boland and Tenkasi, 1995; Brown and Duguid, 1991). The After Action Review (AAR) process, for example, provides a technique for communities to derive lessons from experience (Henderson, et al., 1998).

To share knowledge of semi-structured processes using knowledge repositories, we need to organize this knowledge in a flexible structure so that it can be readily captured and retrieved. Dynamic memory theory (Kolodner, 1993) proposes a structure called a memory organization packet (MOP) that promises to organize experiential knowledge based on a storytelling approach. A MOP describes an experience (an episode) as a sequence of scenes. A scene organizes a set of scripts which describe particular sequences of activities that are pursued in difference contexts in order to achieve the goals associated with the scene. Indexing

of goals and contexts provides access to specific experiences and scenes. MOPs can be created by combining scenes that operate under different contexts. With this flexible structure, we believe that a MOP-based structure is suitable for a knowledge repository for sharing knowledge of semi-structured processes.

In the case study reported here, we use a prototyping approach (Pressman, 1996) to investigate the requirements for a knowledge repository that supports case teaching in a Business School. Case teaching is considered a semi-structured process because there are conventional principles about how to teach cases both in general and in particular, but detailed teaching plans and experiences vary depending on the goals and contexts. We employ a prototyping approach to discover the contexts that are crucial for the indexing and retrieval of the experiences. Results indicated that the functional context, situational context, initial context, and language context are key elements for supporting knowledge sharing through knowledge repositories.

Research Method

This research was performed within a larger project of designing a knowledge management system to support the instructors of an introductory MBA course labeled CD710 in a major Business School. At the time of the study there were 7 sections with about 40 students each. Each section was taught by a team of three instructors, representing the Information Systems (IS), Organizational Behavior (OB), and Management Policy (MP) departments respectively. The sections were coordinated by coordinators representing each teaching team. Each department also had a coordinator who coordinates the activities of the department's instructor in each teaching team, e.g., an OB coordinator coordinates the activities of all OB instructors across the sections. Coordinators are experienced teachers, both in general and in teaching the CD710 course. Some of the instructors are part-time adjunct professors. Each semester, new instructors are brought in or former instructors may return after a lapse of a few semesters. Bringing newcomers and returning instructors into the current practice has been a challenge for the coordinators. In particular, instructors indicated that knowledge of teaching cases, including methods and materials such as teaching notes and supplementary materials such as news, slides, videos, and war stories was most valued. Case teaching, a semi-structured process, has therefore been chosen as the focus of this research.

We interviewed instructors to ask about their teaching plans[1] for the case. The instructors described each step in the plan, detailing their rationale, observations, expectations, and other thoughts. At the interview, we also collected the associated teaching materials, such as handouts, teaching note, news clippings, board plans, assignment questions, video, presentations, notes on student feedback and lessons learned. Then we attended the case discussion in class and recorded the experience according to the plan. Finally, we held a facilitated group session in which experienced instructors discussed and produced lessons learned from teaching a case.

Given that the instructors are working within the context of the CD710 course, we also made use of data collected for the larger project, i.e., material involved in the process of teaching the course, including the syllabi, reading lists, assignments and their grading guidelines, cases and their supplementary teaching materials, home pages of instructors, student course evaluations, and instructors' after-action reviews.

Instructors were informed of the purpose of our data collection efforts and were asked to focus on those aspects of knowledge sharing that they consider to be necessary and most important for them to adopt case teaching knowledge from a knowledge repository.

We analyzed the case teaching data as follows. First, we took each interview transcript and organized the plan into scenes based on the steps described by the instructor. A change of scene may be triggered by a lead question, application of a theoretical framework, a presentation, or other means. We identified parts of the description where special conditions were made to qualify the activity being described. The content of these parts were categorized into different types of contexts that govern the conduct of the teaching plan. Next we constructed a prototype to demonstrate to our users the form and function of a case teaching knowledge object.[2] In the following, we will first use an example to show the organization of a teaching plan. Then we will present the four categories of context from our content analysis. Finally, we will present the prototype.

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[1]We use the term 'teaching plan' here, but the instructors' descriptions were really a summary of their past experiences, which includes the plans as well as the actual outcomes.

[2]We use the term 'knowledge object' to refer to a unit of knowledge as structured in a knowledge repository.

Results

In this section, we use as an example "The College Textbook Marketplace" case (Venkatraman, 1996) to show how we defined the scenes and identify the contexts. In one interview transcript, the instructor started with:

> *"It's about BPR. Can also lead to a discussion of strategic alignment."*

In the instructor's mind, the most important point is the objective of teaching the case. He identified two key objectives: business process redesign and strategic alignment. From the point of view of knowledge sharing, this means that it is important to state up front the key function of the knowledge object. (We later refer to this as functional context.)

Analysis of the transcript produced a teaching plan as shown in Fig. 1. In the first scene, the instructor starts with the lead question "What should Lynch do?" and gets four or five recommendations from the class. The next scene, he does a quick five-forces analysis with the class. Here, the instructor gave the rationale as follows:

> *"By this point of the semester, we've done 2 or 3 other five-forces analyses. It's getting boring to do it but it helps to get the backstage discussion going because some of the recommendations may be unreasonable."*

This comment indicates that depending on the prior coverage of the course, the instructor might adjust the pace or level of detail of this step accordingly. (We later put this in the situational context category.)

The third scene focuses on developing a value chain for the company, which is McGraw-Hill, before and after its IT transformation. Here, the instructor showed some of the value chains developed in class, and explained that

> *"different classes come out different ways but there is clearly a dramatic reconfiguration of the value chain. So now we're really at the third level - this is real re-reengineering, real revolutionary."*

Here, when he talked about 'the third level', the instructor is implicitly quoting from Venkatraman's five levels of IT-enabled business transformation (Venkatraman, 1994). To record this for knowledge sharing, it is necessary to provide references for this terminology. (We later refer to this as language context.)

The fourth scene focuses on apply the strategic alignment model to this case. Again, references for the model is needed.

The fifth scene is wrap-up time when the instructor presents a summary of the learning points.

Having identified the contextual elements from the transcript, we then categorized them into four types: functional, situational, initial and language contexts. We describe these in detail below.

Functional Context

The functional context describes the objectives of the activity being presented in the knowledge object. From the user's standpoint, it is used to evaluate the extent to which the knowledge object is relevant to the problem at hand, or to focus on those aspects of the object that are relevant. The user also expect to see these objectives being as a measure to show how successful the experience described in the knowledge object is. Thus, both relevance and performance were criteria used by the user in evaluating the functional context. In CD710, course objectives are described in themes. Themes are further decomposed into topics which are then accomplished by teaching class sessions. A case may be part of a
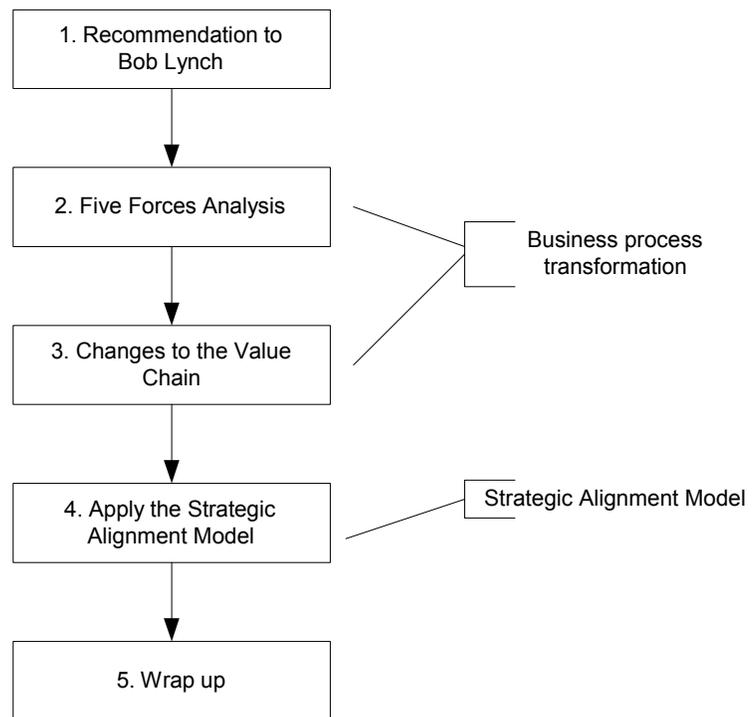
Figure 1. Scenes in 'The College Textbook Marketplace' Teaching Plan

teaching session that includes lectures and assignments. For example, a theme in CD710 is " Aligning the organization for total quality management and continuous improvement". The topics "strategic alignment" and "Business process redesign and business scope redefinition" are under that theme, and the "McGraw-Hill" case teaches these two topics. An instructor may have taught the "McGraw-Hill" case in a different course for different teaching objectives, thus, knowing the functional context enables a user to understand the relevance of the experience being described in the knowledge object.

Situational Context

The situational context describes occasional variables that impact on the experience presented in the knowledge object. These variables include physical locations, tools, people involved, time and timing variables, etc. During the after action reviews and the facilitated group sessions, we noted that instructors who contributed to the teaching tips often qualified their responses with respect to the situational context in which the case is taught. This includes who the students are (undergraduates, MBAs, Executive MBAs, Executive workshop participants), how much time is available for teaching the case, whether videos and other visual aids can be used, and so on. These variables were used to determine the scope and procedure flow of the case discussion in class.

Instructors were able to articulate how to modularize the parts of a case discussion and organize the flow of the parts according to the situational context. Thus, a case discussion can be organized as a collection of discussion steps, each of which addresses different concepts. These steps may be triggered by specific session times (e.g., 30 minutes into the discussion) or by the end of a discussion step (i.e., sequentially). At each step, teaching materials, such as videos, and any tools needed to use the teaching materials are brought in by the instructor to deliver the concept to the students. This suggests that knowledge of a semi-structured process can be 'structured' by breaking it down into parts and then labeled with the situational context for that part. A user may then compose his own process flow from the parts according to his situation and needs. Organizing semi-structured process flows based on the situational context enhances the usability of the knowledge object.

Initial Context

The initial context of a knowledge object refers to the source or process in which the knowledge was created. During the AAR session, novice instructors raised the concern that they did not know who best to ask for teaching tips. From their point of view, tips from successful and experienced instructors would perhaps be preferred. Hence, questions were raised as to how one can assess the credibility of teaching tips if retrieved from a repository. Two solutions were proposed, one based on the background of the contributor and another based on the process from which the tip generated. A tip from a contributor will include the contributor's background (rank, years of experience, number of times taught the case and the CD710 course, teaching evaluation). A tip generated from an After Action Review would quote the source(s) as well as the arguments used during the AAR. The initial context thus addresses the credibility of the knowledge source as a critical element for information adoption.

Language Context

During an AAR discussion, instructors agreed that terminology used within the local community of instructors may need to be defined so that new comers, as well as returnees may keep up with the evolving "language" of the CD710 instructor community. This language includes the local definitions of terms and concepts in the course content, as well as definitions for terms and concepts used to describe their teaching processes. For example, the definition of "strategic alignment" may be varied according to different business researchers, professors and practitioners, but in the CD710 community, its definition is based on Henderson and Venkatraman's strategic alignment model (Henderson and Venkatraman, 1993). An example of a term created to describe teaching processes is "enabling concepts" which refer to concepts that are employed in teaching a case, but are not a teaching objective of the case. In the "McGraw-Hill" case, Porter's value chain framework is used to analyze the case, but students are expected to already know how to use the framework.

Interface Design Considerations

Instructors felt that the repository should use the metaphor of a teaching note as the basic knowledge object. The steps in a discussion flow should be displayed as sections in a document. To reflect its supplementary nature, contextual information should be displayed in pop-up windows. Shortcuts should be provided for knowledge that is frequently accessed. For example, a shortcut to current updates allows experienced instructors to zoom into the new knowledge for last minute class preparation and a shortcut to lessons learned from after action reviews allows users to review the tips without viewing the details of the process.

The button-bar at the bottom provides shortcuts to key access points to the case. The Objectives button leads to the functional context which describes the teaching objectives of the case. The Materials button provides a shortcut to all the supplementary materials for teaching the case: the case text, a Web-based version of the case, supplementary readings, case assignment, board plans, presentation slides, and a digital video. The Lessons Learned button leads to tips contributed by individual instructors as well as excerpts from AAR sessions of instructors about their experiences in teaching the case. The initial context of how this knowledge came about, such as through an after action review discussion or personal experience, are provided in pop-up windows. The Update button leads to late-breaking update information relevant to the case. It is intended to be used by instructors just before class as a last-minute preparation.

Discussion

We have investigated the requirements for building knowledge repositories for semi-structured processes, using in particular case teaching as a case study. The results suggest that knowledge of such processes may be shared in the form of recipes, such as a teaching note. Should such recipes be stored in a repository, the instructors indicated that four contextual elements are key for adoption: functional context, situational context, initial context and language context. These recipes could be broken down into parts which, together with the situational context, could be used by another use to compose his own process flow. We developed a prototype from these findings to verify our understanding of the requirements with the instructors.   While we obtained these findings from a single case, we posit that semi-structured processes of a similar nature, i.e., decomposable by defined situational variables, existence of community of practice which has its own language and knowledge creation processes such as AAR, and well-defined goals would be able to use our approach.

Future work is directed toward building a knowledge repository that provides tools for users of a community to contribute their experiences in performing semi-structured processes in the form of process steps supplemented by the four contextual elements. To facilitate capture and reuse of knowledge, we plan to implement a capability wherein instructors can activate a teaching note in class to support teaching, so that all supplementary materials are available as needed. Thus, a new experience can be captured real time, and if desired, an instructor can also pull up an existing teaching note and follow it as is. Alternatively, an instructor may compose a new case discussion process for the situational context at hand using the relevant parts of the teaching notes in the repository. Having tried it, he can then record his experience as a teaching note in the repository. These additional features will result in more complete support for knowledge sharing using repositories.

Acknowledgements

References

Boland, R.J. and Tenkasi, R.V. "Perspective making and perspective taking in communities of knowing," *Organization Science* (6:4), 1995, pp. 350-372.

Brown, J.S. and Duguid, P. "Organizational learning and communities of practice: Towards a unified view of working, learning and organization.," *Organization Science* (2:1), 1991, pp. 40-57.

Davenport, T.H., De Long, D.W. and Beers, M.C. "Successful knowledge management projects," *Sloan Management Review* (Winter), 1998, pp. 43-58.

Henderson, J.C., Sussman, S.W. and Thomas, J.B. "Creating and exploiting knowledge for fast-cycle organizational response: The Center for Army Lessons Learned," *Advances in Applied Business Strategy* (5), 1998, pp. 103-128.

Henderson, J.C. and Venkatraman, N. "Strategic alignment: Leveraging information technology for transforming organizations," *IBM Systems Journal* (32:1), 1993, pp. 239-252.

Kolodner, J. *Case-based Reasoning*. San Mateo, CA: Morgan Kaufmann Publishers, 1993.

March, A., and Garvin, D.A. *A note on knowledge management*. 1997, Harvard Business School Publication #9-398-031.

Pressman, R. Software Engineering: A Practitioner's Approach, 5th Edition. New York, NY: McGraw-Hill, 1996.

Venkatraman, N. *The College Textbook Marketplace in the 1990s: McGraw-Hill's Launch of Primis*. Boston University School of Management Teaching Case *#97-35*, 1997.

Venkatraman, N. "IT-enabled business transformation: From automation to business scope redefinition," *Sloan Management Review*, Winter 1994, pp. 73-88.