COLLABORATIONS ACROSS KNOWLEDGE BOUNDARY:  
AN E-LEARNING CASE

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Abstract

Collaboration within interdisciplinary team is a challenge even with the presence of frequently communications. Barriers of effective knowledge delivery among team members exist because of knowledge boundary. Despite the use of common terminologies for communication, team members may create different interpretations toward a same cluster of terminologies when they hold different understandings, assumptions and values schemes embedded in their individual disciplines. In addition, interest conflicts among team members may also prohibit the effective collaboration. Such kind of barriers caused by knowledge itself usually result in an ineffective knowledge delivery in interdisciplinary collaboration. This research-in-progress study attempts to understand knowledge boundary problems and knowledge boundary spanning strategies to facilitate an effective collaboration between e-learning content developers and subject matter experts. Anchored on a case study of e-learning development project, this study explores two research questions: (1) what are knowledge boundary problems which can be found in the E-learning development process? (2) How to solve the knowledge boundary problems? Based on Carlile (2004)’s framework, we explore the difficulties that are risen by syntactic, semantic and pragmatic knowledge boundaries when the developers interact with SMEs. The expected findings would describe the scenarios of knowledge boundary problems during the development of E-learning projects, and illustrate solutions to cope with these problems. This study would contribute to academy and practice by revealing knowledge boundary spanning in e-learning development context.

Keywords: E-learning content development, Knowledge boundary, Knowledge boundary spanning, Boundary objects, Case study.
1. INTRODUCTION

Collaboration across disciplines has become more common in organizations for leveraging multiple disciplines and knowledge bases to innovation design. Research has paid particular attention to the challenges of interdisciplinary collaboration, such as long communications (Oborn & Dawson, 2010), the lack of incentives and poor previous experience (Daley 2009), goals and professional value differences (Garman, et al. 2006). These studies collectively address the important problem of multidisciplinary collaboration, aligning with what has been denoted as “knowledge boundary” by Carlile (2002; 2004).

The perspective of “knowledge boundary” suggests that knowledge can be a barrier to innovation, and challenges effective knowledge delivery across functional and professional boundaries (Brown & Duguid 2001; Carlile 2004). Though knowledge is critical to drive innovative problem solving within a function, it may actually hinder problem solving and knowledge creation across functions due to its localized, tacit, and embedded nature (Carlile 2004; Szulanski 1996). In practice, the variation of local knowing among functions makes it difficult to collaborate across functional boundaries, and accommodate the knowledge developed in another practices ( Carlile 2002; Yanow 2004). Since most organizational innovation happens at the boundaries between disciplines or specializations (Leonard-Barton, 1995), working across boundaries is a key for organization’s competitive advantage (Carlile, 2004).

Developing an e-learning content can be an interdisciplinary task because it requires the developers to receive knowledge from subject-matter experts (SMEs) and convert it with appropriate instructional design and media presentations. This process involves intensive knowledge works that developers transform and represent SME’s knowledge in order to prompt a better learning. As the developers and SMEs come from different disciplines, knowledge boundary problems become critical to e-learning project quality. Anchored on a case study of e-learning development project, this study explores, this research-in-progress study applies Carlile’s (2004) framework to explore two research questions: (1) what are knowledge boundary problems which can be found in the E-learning development process? (2) How to solve knowledge boundary problems?

The rest of this paper is organized as follows. Firstly, we review related literatures, including knowledge boundary, boundary spanning and boundary objects. Then, we briefly describe research method and case background in Section 3. Finally, we propose a short conclusion of expected findings of this study.
2. **LITERATURE REVIEW**

2.1 **Knowledge Boundary**

Knowledge boundary refers to the gap of knowledge delivery across the functions and professions (Brown & Duguid 2001; Carlile 2002; 2004). Due to its tacit and sticky nature, knowledge is critical to drive innovative problem solving within a function, but may actually hinder problem solving and knowledge creation across functions (Szulanski 1996; Carlile 2004). Knowledge is localized, embedded in practice thus knowledge from one function may not properly fit into another “lived world” (Yanow 2004). This specialization of knowledge in practice makes it difficult for interdisciplinary collaborations and to accommodate the knowledge developed in another practices (Carlile 2002).

Carlile (2004) proposed a framework to integrate the three perspectives of past knowledge boundary studies, including information processing, cultural and political perspectives (Brown & Duguid 2001; Bechky 2003; Carlile 2002, 2004). The *information processing* perspective assumes that knowledge should be firstly encoded, captured, stored and retrieved, thereafter it can be effectively transferred through establishing shared lexicons (Kellogg, et al. 2006). The *cultural* perspective considers knowledge embedded in practice, and puts emphasis on how to establish a shared meaning to eliminate the interpretive conflicts between different parties (Brown & Duguid 1991; Bechky 2003; Kellogg, et al. 2006). The political perspective proposes that knowledge is rooted in the interactions for interest consolidation. It also focuses on knowledge transformation by establishing mutual relationships and coordinating interests (Bechky 2003; Carlile 2002; Kellogg et al. 2006).

In Carlile’s (2004) framework (Figure 1), knowledge boundaries involved with syntactic, semantic and pragmatic boundaries, each of which differs in terms of the degree of novelty, dependence and specialization. When the degree of novelty, dependence and specialization happens to be low, it would cause the difficulty in knowledge delivery which comes from incompatible terminologies.
which form **syntactic boundary** (Carlile 2004). It is important to establish a common lexicon for actors to *transfer* accurate communications and solve information processing problems (Davenport and Prusak 1998; Carlile 2002). The increasing of the degree of novelty, dependence and specialization would result in **semantic boundary** because actors from different disciplines may have different interpretations to common terminologies (Carlile 2002; Dougherty, 1992). *Translating* interpretations for establishing shared meanings can work through these semantic differences (Carlile 2002, 2004). On the other hand, when the degree of novelty, dependence and specialization is high, goal conflicts of knowledge delivery would show up and result in **pragmatic boundary** (Carlile 2002; Feng, et al. 2011). To resolve the possible negative consequences of goal conflicts, individuals have to become capable of *transforming* the knowledge for establishing a common interest of the project (Carlile 2002).

### 2.2 Boundary Spanning, Boundary Spanner and Boundary Object

Boundary spanning refers to behaviors to establish relationships and interactions with external actors to assist team in meeting its overall objectives (Marrone, et al. 2007). Two concepts are widely cited as possible channels for boundary spanning: boundary spanner and boundary object.

#### 2.2.1 Boundary Spanner

Boundary spanners are the individuals, who operate at boundaries of an organization and engage in significant interactions with external agents (Leifer & Delbecq 1978). Boundary spanners are vital to transfer information and to facilitate the sharing of expertise among boundaries (Aundhe et al. 2011; Cross & Parker 2004). A competent boundary spanner would have to acquire a good understanding of contextually languages and perspectives on each side of different boundaries (Kim & Jarvenpaa 2008). Hence they are able to seek for and identify whether the information is relevant to what or whom in their groups (Kim & Jarvenpaa 2008).

#### 2.2.2 Boundary Object

The concept of boundary object was introduced by Star and Griesemer (1989). Boundary object refers to a broad range of artifacts which “ are plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites” (Star, 1989, p.393). Examples of boundary objects include physical prototypes, design drawings, use scenarios, engineering sketches, accounting ledgers, and standardized reporting forms (Levina & Vaast, 2005).
3. RESEARCH METHODS

3.1 Case Selection

This research adopted a case study to explore knowledge boundary problems and boundary spanning in an e-learning content development context. The research was anchored in a project that developed e-learning materials for employee training of a DIY wholesales company. Based on theoretical sampling, the case was selected regarding three reasons: firstly, this case involved interdisciplinary collaborations of which the developers and the SMEs of the company had to work together for developing the e-learning contents. Secondly, the developers’ knowledge was quite different from that of the SMEs. Thirdly, the observed phenomenon of this case aligned with our research issues.

3.2 Data Collection and Analysis

The data collection in this study was through archives and interviews. We collected project documents such as e-mails and design documents in order to know the project development details and results. In addition, we interviewed the developers and SMEs for understanding their experience and thoughts on knowledge boundary. There were two stages of data collection. In the first stage, we seek to understand the story of the project development, which included the background, scope, and the expected outcome of the project. In the second stage, we focus on the problems caused by knowledge boundary and their solutions. There were five interviews, each of which listed about 1 to 2 hours of length, and was recorded and transcribed.

For data analysis, an open coding was firstly conducted. The researchers read the transcripts sentence by sentence, and divided the sentences into meaningful phases, and then gave each phase an appropriate label to represent the concepts. In this stage, total 282 labels were identified. Next, we included the 282 labels into eleven categories which collected from the previous literatures to represent the concepts regarding to knowledge nature (i.e., novelty, specification, dependency), knowledge boundary (i.e. syntax, semantic, pragmatic), boundary spanning activity (i.e. transfer, translate, transformation), boundary objects, and boundary spanner. This process was performed by two independent coders with 82% consistency, indicating an acceptable reliability (Kassarjian, 1977). Then, the researcher repeatedly contrasted the data with theory to emerge themes. Finally, we developed three scenarios to present our findings.
3.3 Case Background

The objective of the e-learning project was to develop an e-learning material for employee training in a Taiwanese DIY wholesale company which ran business in Taiwan and mainland China. The project continued for seventeen months and developed two online courses with animations: one presented 16 notes of Labor Safety, and the other was general notes of Safety and Health.

In the beginning, the developer regarded this project as an easy task due to this project present lower novelty and specification. Although the developers had no wholesale experience, they felt confident to this project because all the texts were structurally written and the SME was highly involved. To developer’s expectation, what they should do was to convert the written texts into animations with the aids of the SME. Soon after, however, the developers found that the unsuccessful knowledge delivery made the project far from an easy task.

Despite SME were highly available on and involved in collaboration, the developers found their communications with SME would not on the same page. They expanded much of time on clarifying terminologies, rather than working on the contents. Although the SME continuously explained terminologies, the developers were getting more and more confused. For example, one developer noted a typical situation as an example:

We did not know the difference between a forklift truck and a reclaimer. … SME explained that a forklift truck helped lift loads of product with pallet and put them on the top shelf. … On the other hand, the reclaimer could lift the service person to a top shelf for taking few products. … Despite these discussions made much clearer about the function of the machines, it rose another question: what is “top shelf”?

When they finally got the phase of the terminologies, the project blocked again due to the developer’s incorrect interpretation of those terminologies. The developers couldn’t understand SME’s explanation, and SME couldn’t understand why the developer failed to catch those terms which were easy and intuitional to him. One developer recalled a typical situation:

We have learnt that products were stored in top shelves, but still it seemed meaningless to us…. SME couldn’t understand our confusion, either. To SME, the idea of top shelf was just an instinct. Isn’t it an instinct that top shelves are the racking on the top where products could be stored? But to us, it was nonsense. To our understanding, products should be stored in a warehouse.

The misunderstandings and wrong interpretation caused much time and effort to redo the project again and again. For example, the developers’ interpretation of protection equipments was far different from the real objects which were used in the wholesales context. One developer recalled:

For instance, we must redo our work because we found that the fire sprinklers we drew would be too big to fit the actual size. … We were told that fire sprinklers in stores would be smaller and more delicate, so that female employees were able to use the fire extinguisher system as well.
Moreover, the developers were asked to make learning materials vivid and interesting in order to attract the learners. However, the developers found the SME’s expectation was totally different from theirs. One developer gave a typical example of “trying to be vivid”:

Initially, SME told us that because the learners were young people so the style of animations would have to be, preferably, vivid. But when we turned in to him a template, SME was frightened due to the too many realistic details we draw to depict the character such as wrinkles and nostrils. He then asked us to change the style to a cute one.

The incongruent expectations delayed the schedule of the project. The developers had to figure out the conflict and to negotiate a consensus between two parties. With continuously communication via a spanner and with appropriate boundary objects, the developer and SME finally reached the consensus of the outcomes for the project. Although it was behind schedule, the project finally finished, and the SME was satisfied with the output that the project delivered.

4. CONCLUSIONS

This research explores the boundaries caused by different knowledge backgrounds in interdisciplinary collaborations and tries to illustrate solutions for spanning knowledge boundaries in e-learning content development context. Our expected findings will describe knowledge problem scenarios in syntactic, semantic and pragmatics boundaries, followed by demonstrating boundary spanning activities and boundary objects for solving the problems brought by knowledge. This study might contribute to both academy and practice by bringing attention to the problems caused by knowledge in multidisciplinary collaboration.

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