

SPANNING KNOWLEDGE BARRIERS IN E-LEARNING CONTENT DESIGN

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ABSTRACT

E-learning content development can be regarded as an example of knowledge delivery process because the developers have to receive knowledge transferred from subject-matter experts (SMEs), to translate the received knowledge with appropriate instructional design, and to transform the project outcomes to fulfill learner's learning needs. As developers and SMEs may come from different disciplines, using distinct terminologies, having inconsistent interpretations, and holding different values, however, problems of knowledge boundaries may arise and prohibit a successful knowledge delivery process. This study conducts a case study to explore the problems caused by knowledge boundaries between developers and SME in e-learning content development. Our findings illustrated how the syntactic, semantic, and pragmatic knowledge boundaries caused the misunderstanding problems which inhibited the effective knowledge delivery. Our findings also concluded the activities and boundary objects that the developers used to bridge the knowledge boundaries.

KEYWORDS

E-learning content development, knowledge boundary, knowledge boundary spanning, boundary objects, case study.

1. INTRODUCTION

More and more organizations emphasize to leverage knowledge for increasing profits (Brown & Duguid, 2001; Hooff & Ridder, 2004). Therefore E-learning has become one of the mostly used instruments for knowledge deliveries and employee training (Rosenberg, 2006). To develop better e-learning contents, developers have to understand the domain knowledge with the aid of subject-matter experts (SMEs) so that they are able to select appropriate instructional methods and media presentations for developing e-learning contents. Therefore, e-learning content developments can be regarded as the knowledge delivery process between SMEs and developers.

However, knowledge deliveries between SMEs and developers can be ineffective because of knowledge boundaries among professional domains. Since the SMEs and developers come from different professional domains which share inconsistent interpretations and hold different values, their communications may not be on the same page, and misunderstandings may be arisen when they collaborate (Boland & Tenkasi, 1995; Carlile, 2002; Dougherty, 1992). For exploring the knowledge boundary problems, this study adopts a case study in e-learning content development context for seeking answers for two research questions: (1) What are the knowledge boundary problems encountered in an e-learning content development project? (2) How can these knowledge boundaries be spanned and solved?

2. LITERATURE REVIEW

2.1 Knowledge Boundary and Boundary Spanning

Knowledge boundaries challenge effective knowledge deliveries across professional boundaries (Brown & Duguid, 2001; Carlile, 2002, 2004). When Knowledge is localized and embedded in practice (Bourdieu, 1980; Lave, 1988), knowledge of certain functions is not to fit into the “living world” of another (Yanow, 2004). This specialization of knowledge in practice makes it difficult to collaborate across professional boundaries, as well as to accommodate the knowledge developed in other practices (Carlile, 2002).

Carlile (2004) proposed an integrated framework to manage knowledge boundaries (Figure 1). In the framework, knowledge boundaries differ from each other in terms of the degree of difference, dependence, and novelty (Carlile 2004). When the degree of novelty, dependence and specialization are low, the difficulty in knowledge delivery 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). When the degree of novelty, dependence and specialization increase, members from different disciplines may have different interpretations to the common terminologies, thus it results in *semantic boundary* (Carlile, 2002). It is because individuals use a word in different meanings in functional settings (Dougherty, 1992). To establish shared meanings for ensuring accurate interpretations of the knowledge across boundaries can work through these semantic differences (Carlile, 2002, 2004; Dougherty, 1992; Nonaka, 1994). Moreover, when the degree of difference, dependence and novelty are high, conflicts among the actors will show up when the goal of knowledge delivery contradicts with each other and then result in the *pragmatic boundary* (Carlile, 2002; Feng et al, 2010). To resolve the possible negative consequences of goal conflict, individuals have to alter their own knowledge and become capable of *transforming* the knowledge used by other functions for establishing a common interest of the project (Carlile, 2002).

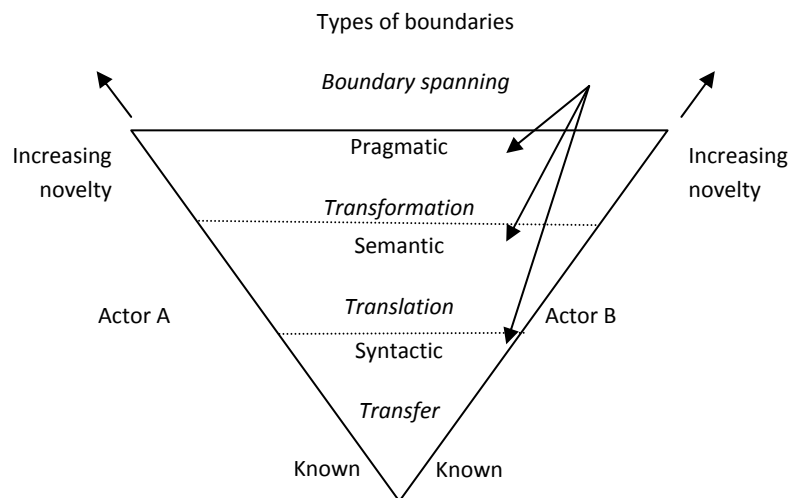


Figure 1. Framework of Knowledge Boundary (Adapted from Carlile (2004))

2.2 Boundary Objects

Boundary objects are artifacts that provide communicative aids for individuals to exchange information with their counterparts (Bechky, 2003; Carlile, 2002; Star & Griesemer, 1989). Examples of the boundary objects can be medical records, product prototypes, engineering drawings, and standard operating procedures (Bechky, 2003; Carlile, 2002; Star & Griesemer, 1989).

Boundary objects are important for spanning the three knowledge boundaries (Carlile, 2004). As for *syntactic boundary*, a common lexicon which sufficiently specifies the differences at the boundary can function as a boundary object to transfer knowledge between senders and receivers (Carlile, 2004). As for *semantic boundary*, translating knowledge is a must for actors to grasp and convey the actual meaning of knowledge delivered from counterparts. Cross-functional team (Ancona and Caldwell, 1992), shared tools or methodologies, boundary spanners (Hargadon and Sutton 1997), and community of practices (Lave and Wenger 1991; Brown and Duguid, 1991) can be ways of developing shared meanings (Carlile, 2004). For spanning the *pragmatic boundary*, common interests have to be developed (Carlile, 2004). Shared artifacts, that act as boundary objects have been proved effective in providing concrete means of representing different interests and facilitating negotiations and transformations (Calile, 2004).

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 Chinese Puppetry. Based on theoretical sampling, the case was selected because of three reasons: Firstly, this case has interdisciplinary collaborations involved where the developers and the SMEs of Chinese Puppetry had to work together for developing the e-learning project. 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 both 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 are seven interviews, each of which listed about 45 minutes to 2 hours of length, and each of them was recorded and transcribed. As for data analysis, we read the transcripts sentence by sentence, and divided them into meaningful phases, and then gave each phase an appropriate label to represent the concepts. Next, the labeled concepts were included into the schema collected from previous literatures and formed the theme of the interpretation. Finally, it came out of three scenarios to explain the research findings.

4. RESEARCH FINDINGS

4.1 Scenario 1: Bridge the Gap of Knowledge Terminology

The knowledge delivery problems between the developers and SMEs were found in the beginning of the project. In order to design a learning content, developers needed to know what Chinese Puppetry was. They had to acquire the knowledge before they were able to design the contents and instructions that might be needed. When they did research on puppetry knowledge, however, they found that puppetry was not as simple as they originally thought. A developer described her surprise:

“We were surprised to find out that roles have five criterion in Chinese Puppetry: male leads ‘Shen’, female leads ‘Dan’, supporting male leads ‘Jing’, an minor supporting roles ‘Mo’ and jesters ‘Chou’. Each role is distinguished with its own posture and paces. ... For example, a scholar walks slower and his movement is relatively small, and a warrior swaggers. These five main characteristics complete the role-plays in Chinese Puppetry.”

What's more complicated was that there had been many factions of Chinese Puppetry, each of them had its unique ways of performing. Thus, the complexity of Chinese Puppetry knowledge was increased. A developer explained that:

"Now, each faction has its own unique performance style, presenting by different accents in aside, as well as story plots."

The developers and SMEs hardly had experiences in each other's expertise fields. The lack of common terms in the beginning of collaboration makes the developers and SMEs spend a lot of time explaining terminologies. For this, SMEs offered books that systematically explained the differences of different puppet criterions in different factions to make better understanding of Chinese Puppetry's history. A developer mentioned that:

"...The books had been organized by Chinese Puppetry experts and we are provided with a clear framework of Chinese Puppetry. There exists Chinese Puppetry terminologies with detailed annotations.

For better team works, SME offered books and hand drawings to help the team acquiring basic terminologies of Chinese Puppetry. This makes a more complete and more efficient way of transferring Chinese Puppetry knowledge, thus a stable and shared lexicon for ensuring the accuracy of their communications was established.

4.2 Scenario 2: Eliminate the Differences of Interpretation

When the developers began to understand more about the terms in puppetry, they found that their "interpretations" of these terms were often incorrect. For example, the developers got to know how Chinese puppet roles were represented by interpreting different gestures and tones in a puppetry show. A developer described her reflection:

"In a show, a role is distinguished through its voices and tones. For example, gentle voices are using to present scholars while deep and suppressed voices are for warriors."

Additionally, since the stage had limited space, a show was usually performed by one or two puppet-masters. That was to say, one single puppet-master might had to play several roles at the same time. And puppet shows would become more dynamic and complicated. A SME explained:

"In puppet performances, puppet-masters require to distinguish the different roles at the same time by making the best uses of his voices. ... As a result, typical casts of Chinese puppet shows are composited by few characters with significant differences in performing styles."

And, to literally express such a tacit knowledge was difficult. A developer mentioned that it was hard to understand what SME wanted to say, she said:

"To understand the various puppetry characters with the change of tones and was very difficult. SME tried hard to explain what he meant through colloquial description to let us grasp the meaning more clearly."

In order to better understand the meanings of terms, the developers began to attend puppet shows. A developer explained:

"In our free time, we watched puppet shows for better interpreting the context. ...The puppet-masters instructed us various ways of puppet manipulations. For example, 'Shen' walks with more spirit, while 'Dan' walks tenderly. We also visited a SME's studio to better observe the making of Chinese puppets. The SME explained every detail for us.... For example, different characters would have distinctive facial features with different performing styles required"

With the effort spent as mentioned above, the team tried the best to understand Chinese puppetry and to ensure correct knowledge deliveries. These processes translated tacit knowledge and established a stable understanding of Chinese puppetry to ensure that there was no misunderstanding in knowledge delivery.

4.3 Scenario 3: Negotiate Different Expectations of Project Results

Expectations difference was found when the developers demonstrated a first prototype to SME. They found that the prototype was quite different from what the SME had in his mind. And, the scope of the project was adjusted along with the interactions between the developers and SMEs. In the beginning of the project, the developers attempted to present a general introduction to puppetry, but they found that it would include a large amount of disorganized information after they consulted the SMEs. When they interacted with SMEs, the developers found that SMEs were worried about the absence of young audiences. This caution thus

shifted the developers' focus from developing the learning content for general public to doing that for attracting the youth. A developer mentioned that:

"We were told by SMEs about less young people are attracted by puppet show. ... We also found that young people would not be interested in the existing puppetry websites which provided amount of information with texts and pictures. ... Finally, we decided to decrease the project scope and to present the digitalized contents in an interactive way in order to make our e-learning content more interesting and attractive to the youth."

On the other hand, SMEs had experienced adjustments of their own expectations, too. The SMEs, experts of puppetry used to understand Chinese puppetry by characters. In their minds, the project should represent Chinese Puppetry by five typical criterion: 'Shen', 'Dan', 'Jing', 'Mo' and 'Chou' to make audiences easily recognize the core of a puppet show. For this, a SME explained:

"...we expect to represent the Chinese Puppetry according to characters. When we watch a puppet show, we are interested in the five roles that a Chinese puppet represents. We can recognize the roles by the particular appearances, clothes, and tones performed by puppets."

When they worked with the developers, SMEs altered their expectation of the project from "being professional" to "being interesting." They agreed with the developers to simply the project to alter the "abstruse" stereotype held by the youth to Chinese puppetry, therefore the project could be interesting to arouse the youth's interest. A SME explained that:

"Knowledge presented in a professional way is much like a textbook written in a foreign language, which will not appeal to the public. It is too hard for them to understand the contents. It therefore keeps distance to the general public. Instead, introducing puppetry in the way as the team proposed may be better. The knowledge becomes friendly and more attractive, which might arouse people's interest."

The pragmatic knowledge boundary rooted in the fact of incongruent expectations between developers and SMEs. While SMEs considered the project to be comprehensive and professional, the developers wanted the audience to become familiar with the knowledge. The team would not be aware of these inconsistent expectations until the developers present a prototype to SMEs. The developers and SMEs modified their expectations along with rounds of revised prototypes, scripts and sketch that worked as boundary objects for consolidate the interests of the two party.

5. DISCUSSION

This study explores the knowledge boundary problems and boundary spanning in e-learning content developments. Table 1 presents the research findings.

Table 1. Knowledge Problems, Boundary Spanning Activities and Boundary Objects

	Knowledge problems	Boundary spanning activities	Boundary objects
Scenario 1: syntactic boundary	<ul style="list-style-type: none"> ● Overload with professional terms ● Mix up factions of puppetry 	<ul style="list-style-type: none"> ● Consulting SME and taking notes ● Reading books recommended by SME ● Surfing the Internet 	<ul style="list-style-type: none"> ● Books ● SME's hand drawing
Scenario 2: semantic boundary	<ul style="list-style-type: none"> ● Having incorrect interpretations of terms ● Hard to exchange the tacit knowledge 	Translate tacit knowledge by <ul style="list-style-type: none"> ● Engaging in puppet shows ● Talking to puppetry artists ● Watching experts' demonstration 	<ul style="list-style-type: none"> ● Puppets shows ● Puppets ● Stage and properties
Scenario 3: pragmatics boundary	<ul style="list-style-type: none"> ● Having different expectations to the project scope, content, and presentation 	<ul style="list-style-type: none"> ● Negotiating the purpose of the project ● Adjusting the content to be included ● Using prototypes, scripts and sketch for making consensus 	<ul style="list-style-type: none"> ● Prototype ● Script Character' sketch

First, the *syntactic boundaries* made it difficult for SMEs to describe Chinese puppetry to the developers, and the developers failed to understand what SMEs said. To span this boundary, the developers and SMEs exchanged a number of professional terms in order to transfer knowledge. By the aids of books and hand drawing illustrations, developers gradually established common lexicons with SMEs for receiving Chinese puppetry knowledge. Therefore, books and hand drawing illustrations acted as boundary objects for successful knowledge transfers. In this light, these boundary objects collectively played the role as a “map”, which led the developers on the journey of doing the project concerning Chinese puppetry. Second, despite having common lexicons, the inconsistent interpretations prohibited a correct comprehension of Chinese puppetry. The developers spanned the *semantic boundary* by engaging themselves in Chinese puppet shows. Through observing what a Chinese puppet show was made and how puppet-masters presented the role of puppets, the developers started to get a better understanding of Chinese puppetry terms within the practical context. In this period, the boundary objects were puppet shows, puppets, stage and backdrops. These objects played the role as a “showcase,” which helped the developers to master the Chinese puppetry in practice, therefore enabling the knowledge translation. Third, the different knowledge backgrounds between SMEs and the developers had caused expectations toward the project differ. The purpose and contents of the project were adjusted by the negotiations between the two parties. In this period, the prototype, scripts and sketches played an important role as a “catalogue,” that transformed the expectations of both parties to reach the consensus for spanning the *pragmatics boundary*.

6. CONCLUSIONS

This research explores the boundaries made by different knowledge backgrounds in interdisciplinary collaborations and tries to illustrate solutions for spanning knowledge boundaries in e-learning content development context. Our findings firstly describe three scenarios of knowledge problems in syntactic, semantic and pragmatics boundaries, followed by demonstrating boundary spanning activities and boundary objects for solving the boundary problems. This study contributes both academically and practically by bringing attention to the problems caused by knowledge itself in the process of e-learning content development. This study also illustrates the problems caused by knowledge boundaries in e-learning content development, and provides possible solutions to overcome these knowledge boundary problems.

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REFERENCES

- Bechky, B. A. 2003. Sharing meaning across occupational communities: the transformation of understanding on a production floor. *Organization Science*, Vol.143, pp. 312-330.
- Boland, R. J., & Tenkasi, R. V. 1995. Perspective making and perspective taking in communities of knowing. *Organization Science*, Vol. 6, pp.350-372.
- Bourdieu, P. 1980. *The Logic of Practice*. Cambridge University Press
- Brown, J. S., & Duguid, P. 2001. Knowledge and organization: A social-practice perspective. *Organization Science*, Vol. 122, pp. 198-213.
- Carlile, P. R. 2002. A pragmatic view of knowledge and boundaries: Boundary objects in new product development. *Organization Science*, Vol. 134, pp. 442-455.
- Carlile, P. R. 2004. Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. *Organization Science*, Vol. 155, pp. 555-568.
- Davenport, T., & Prusak, L. 1998. *Working Knowledge*. Boston, Harvard Business School Press, MA.
- Dougherty, D. 1992. Interpretive barriers to successful product innovation in large firms. *Organization Science*, Vol. 3, pp. 179-202.

- Hargadon, A., & Sutton, R. 1997. Technology brokering and innovation in a product development firm. *Administrative Science Quarterly*, Vol. 424, pp.716-749.
- Hooff, B.V. D., & Ridder, J. A. D. 2004. Knowledge sharing in context, the influence of organization commitment, communication climate and CMC use on knowledge sharing. *Journal of Knowledge Management*, Vol. 8, pp. 117-130.
- Lave, J. 1988. *Cognition in Practice: Mind, Mathematics, and Culture in Everyday Life*. Cambridge University Press.
- Nonaka, I. 1994. A dynamic theory of organizational knowledge creation. *Organization Science*, Vol. 51, pp. 14-37.
- Rosenberg, M. J. 2006. *Beyond E-Learning: Approaches and Technologies to Enhance Organizational Knowledge, Learning, and Performance*. John Wiley & Sons, San Francisco, CA.
- Star, S. L., & Griesemer, J. R. 1989. Institutional ecology, translations and boundary objects: amateurs and professionals in Berkeleys museum of vertebrate zoology. *Social Studies of Science*, Vol. 193, pp. 387-420.