Eliciting User Needs for a Knowledge Management System to Align Training Programs with Processes and Policies in Large Organizations

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Abstract

Large organizations struggle to keep their training programs aligned with their business processes and policies. Lesson plans are often stored as static documents, which are neither readily searchable nor linked to approved processes and policies, rendering corporate training programs inefficient and outdated. A well-designed knowledge management (KM) system would be able to meet this technological need, but generating software requirements for such a system is typically a time and resource intensive process.

A unique combination of requirements elicitation techniques was employed to elicit a robust set of user needs without the need for face-to-face meetings. Employees of a government agency were asked to tell their stories about the problems they experienced in training management and common themes were identified in their responses. The resulting user needs for the KM system were documented in conceptual diagrams that represent the participants’ view of the current and future state of affairs. These models will serve as artifacts to be used for future requirements definition, validation, and prioritization.

1. Introduction

Large organizations that manage hundreds of business processes typically are governed by an even greater number of policies. To improve efficiency, some of these organizations have implemented business process management (BPM) strategies, which seek to eliminate workflow bottlenecks and wasteful tasks [1]. Efforts to manage business processes, however, may be wasted if employees are not trained adequately on those processes and the policies that authorize them to perform those processes. In fact, connecting all three of these areas—training, processes, and policies—is a task often neglected by large organizations [2], which results in ineffective and irrelevant training programs.

Coordinating corporate training programs with processes and policies is a problem that is well-established in the literature, and the proposed solutions predictively involve some sort of knowledge management (KM) system. For example, Zhang and Su [3] argued that the variety and scope of business processes require careful attention to matching online learning tools to training needs. Capuano, Gaeta, Ritoavato, and Salerno [4] proposed a technology-enhanced learning (TEL) system because they recognized that “a better integration of TEL with business process management is, in fact, one of the greatest challenges for today’s knowledge management” (p.56). Teaching a large number of processes and polices to a large workforce naturally has pushed organizations to seek a technical solution.

Indeed, organizations have spent billions of dollars to move their training to online learning environments [5]. However, many corporate learning initiatives concentrate on tasks that are common across the workforce rather than on more granular, job-specific responsibilities [2]. O’Brien and Hall [6] found that online learning solutions created by third-party vendors seldom are adequate to meet the unique needs of individual organizations that wish to communicate their current business processes to their employees. Likewise, Newton and Doonga [7] reviewed several corporate e-learning initiatives and concluded that corporate e-training did not address strategic business objectives. Martin, Leyking, and Wolpers [8] summarized the corporate training problem succinctly: “Existing eLearning approaches miss consistent alignment with business operations and objectives” (p. 1).

Typical e-learning solutions fail to meet corporate training needs because they fail to connect training content to an organization’s processes and policies. Some have attempted to map online learning to business processes [4, 9] or to map business processes to competencies [10]. However, there is no published work that explicitly addresses the mapping of training products to both the business processes that are taught to the workforce and the policies that govern the execution of those processes. Clearly, a new KM system is required to meet this need.

The goal of the current study was to elicit user needs in preparation for defining software requirements for a KM system that manages the linkages between an organization’s training products,
its business processes, and its organizational policies. The subject chosen was the Federal Bureau of Investigation (FBI), a large organization that continues to struggle with the challenge of changing its business processes and policies in the face of an expanded national security mission and a new case management system [11]. Since the terrorist attack on September 11, 2001 the FBI has responded to a great deal of public scrutiny of the agency’s efforts to automate its business processes [12]. In addition, post 9-11 information overload and high-pressure decision-making policies have contributed to what Krause [13] calls “vigilance fatigue” (p.3), a condition that weakens security awareness. As a result, the FBI’s capacity to manage the training of new processes and policies has received even less attention.

An expert panel of FBI training professionals was used to develop a natural language description of a KM system that could manage training content by linking to processes and policies, while continuing to support usability and facilitate compliance with Federal Law Enforcement Training Accreditation (FLETA) requirements. This user-based description is the essential first step in defining the system goals and preferences [14] from which software requirements are written. The remainder of this paper is organized as follows: A set of definitions is provided to clarify the scope and context of the research. Next, the purpose of the study and research questions is introduced, followed by a review of the literature and a discussion of methods used. Finally, a summary of the research findings is presented, along with considerations for future work.

2. Definitions

Coordinating training programs with business processes and organizational policies is one of the most difficult challenges of a large organization. The current study focused on the training programs of the FBI, but its results are generalizable to all large organizations that manage several thousand employees and dozens of job families. For the sake of readability, this type of large organization will be referred to as a CALO, defined by Kiper [15] as “a Company, Agency, or other Large Organization” (p. 14). Examples of CALOs exist in the public sector (e.g., U.S. State Department and the Drug Enforcement Agency) as well as in the private sector (e.g., Microsoft and Coca-Cola).

A business process (BP) is a segment of defined activity in an organization. It is a set of tasks that logically are related to fulfill an organization’s objective [1]. Through the use of symbols and arrows, BP diagrams define how work is done and who does it. Due to its size and diversity, a CALO’s workforce participates in hundreds of processes every day [16]. In the FBI Training Division each person’s contribution to a business process is referred to as a job task (JT), which is the entity used to map to instructional materials used to train that person. To avoid confusing study participants with an unfamiliar term, JT was used in place of BP throughout the study.

An organizational policy (OP) refers to a CALO’s documented guidance to the organization. OPs articulate outcomes and strategic goals that are, in practice, fulfilled by BPs [1]. OPs may be produced internally by the CALO or adopted from a higher authority such as the CALO’s parent organization. Statutes, regulatory guidelines, employee handbooks, and standard operating procedures are examples of OPs. An OP may take the form of an electronic or physical document and convey the specific rules, protocols, or directives approved by CALO executive managers. The FBI manages several hundred OPs through its Policy and Guidance Library [17].

Finally, a learning object (LO) is a construct used to chunk educational material into smaller units for content management in online learning environments [18]. An LO may be defined broadly as a container of learning materials that manages instructional content and resources maintained by an organization. However, like other CALOs, the FBI typically manages this type of information in the form of a lesson plan (LP). Again, an LO is probably a more accurate term to describe this concept in the anticipated KM system. However, to avoid introducing a new word to the study participants the term LP was used to refer to the anticipated collection point for job tasks (JTs), organizational policies (OPs), and instructional products—PowerPoint slides, job aids, and demonstrations—needed to communicate the JTs and OPs to the learner.

3. Purpose

As noted previously, the FBI needs a robust KM system to coordinate its training content with its processes (JTs) and policies (OPs). To build such a system it must first collect the user-defined needs, and collect them in such a way that the results may be transformed into software requirements.

Requirements engineering is a branch of software engineering that involves the elicitation, modeling, analyzing, communicating, agreeing, and evolving requirements for software [19]. The primary focus of this study was on the elicitation process, which employs the techniques used to capture software
requirements from a selected group of stakeholders in a CALO.

The overall goal was to develop a rich set of user needs that describes a KM system by which FBI training content may be mapped to its job tasks and organizational policies. To attain this goal, the following pair of questions was addressed:

- What KM processes and technologies are required to associate LPs with JTs and OPs?
- How will user needs be defined for a KM system that will manage LPs, JTs, and OPs?

These research questions effectively establish the system boundaries [19] that guide the process of defining the problem scope and requirements for such a system.

4. Background

Nuseibeh and Easterbrook [19] suggested that “the primary measure of success of a software system is the degree to which it meets the purpose for which it was intended” (p. 37). Defining software requirements—statements about how the system will function—is the most effective way to ensure that goal is met. The process for defining those requirements is known as requirements elicitation (RE), which Saiedian and Dale [20] defined as “the specific processes of gathering, determining, extracting, or exposing software requirements” (p. 420).

Japenga [21] distinguished between system requirements and software requirements. The former sets forth specifications about the entire information technology system, which would include hardware, software, and possibly networking components. The latter focuses exclusively on the features and functionalities associated with the software, because that is where the end-users interact and where most of the complexity is encountered. For the purpose and goals of this study, RE techniques will be used to generate user needs and software requirements, which will refer only to the natural language descriptions of the envisioned KM system and not to the more technical statements used to bind software developers to activities specified in contracts.

The Institute of Electrical and Electronics Engineers (IEEE) offers many types of standards for hardware and software developers (see www.ieee.org). Their most recent set of recommendations regarding software requirements specification (SRS) is contained in the document known as IEEE STD 830-1998 [22]. In this standard, the IEEE presents several benefits for developing software requirements, which include establishing common agreements between customer and developer, reducing development effort, facilitating estimating costs and schedules, and providing the basis for validation and compliance.

Notwithstanding its guidance regarding the characteristics of requirements, the IEEE standard offers very little in terms of how the requirements should be developed. Fortunately, there are many studies that have suggested best practices for accomplishing the RE task. In general, they have focused on two areas: the people involved and the techniques used.

Saiedian and Dale [20] identified customer stakeholders as those who pay for the system (buyers), those who understand the organization’s problem addressed by the new system (domain experts), those who will maintain the system on behalf of the organization (software maintainers), and, finally, those who will actually use the system when it is built (end users). On the developer side, there are those who oversee the project (project managers), those who identify and document the requirements (requirements engineers), those who provide design constraint expertise (software engineers), and those who evaluate the system (testers). For ease of reference, this paper refers to these groups as simply customers and developers.

A close working relationship between customers and developers is essential to the success of the RE process, and, ultimately, to the success of the project. How they interact with each other is defined by the selected methodology. Chakraborty, Sarker, and Sarker [23] reviewed more than a dozen studies that propose RE methodologies and noted that the majority of them do not attempt empirical validation of their findings. Rather, the studies focused on the elements of various RE methods as a way to generate requirements by following a set of prescribed steps. Moreover, the steps identified in these studies seemed to fall into a familiar trend – they began to mimic each other as well as development methodologies in unrelated fields. For example, the activities of identification, conceptualization, formalization, implementation, and testing presented by Byrd, Cossick, and Zmud [24] seem to echo the phases of analysis, design, development, implementation, and evaluation that comprise the ADDIE model of Instructional Systems Design [25].

The empirical studies reviewed by Chakraborty et al. [23] sought to uncover dimensions of RE based on observed patterns of interaction behavior among stakeholders. The problem with these studies, according to the reviewers, was that they represented stand-alone research rather than offering a unifying framework that could represent all elements of RE found in the various studies. Chakraborty et al.’s solution was to analyze the RE process from the
perspective of knowledge sharing, trust, and development of shared mental models using a grounded theory approach. By collecting (primarily interview-related) data from two very different organizations, the researchers uncovered RE characteristics that were common to both organizations and, presumably, generalizable to other organizations.

Chakraborty et al. [23] identified four “states” of the RE process: scoping, sense-making, dissension, and termination. Eventually, the participants would want to arrive at the termination state, which is typified by a clear set of requirements, explicitly codified knowledge, a high level of trust, and a shared frame of reference. In this way, their process model explained user-developer interactions in the RE life cycle that are independent of specific techniques.

Techniques—or variations of techniques—must be employed to elicit requirements. The RE techniques described in the literature may be categorized into several major types. Nuseibeh and Easterbrook [19] referred to traditional techniques as those that employ surveys; questionnaires; interviews; and the review of organizational policies, guidelines, manuals, and other existing documentation. Group techniques such as brainstorming, focus groups, and Joint Application Design (JAD) seek to build consensus among stakeholders [26]. Other techniques include modeling (requiring detailed pictures), prototyping (requiring a functioning mockup of the system), and contextual techniques, requiring the developer to observe user job tasks in their natural setting [19].

While several studies in the literature have recommended certain sets of RE techniques, there are fewer that attempted to research the effectiveness of those techniques, complained Davey and Cope [27]. However, one such study by Coughlan and Macredie [26] involved a comparison of four common RE methods: MUST (a Danish acronym for initial design theories and methods), Joint Application Design (JAD), User-Led Requirements Construction (ULRC), and Soft Systems Methodology (SSM). The study found certain methods, such as MUST and SSM, involve close communications between customers and developers and employ a wide variety of techniques. On the other hand, JAD is “intensely group-focused and much responsibility is placed on the skill of the facilitator to direct the session” (p. 67). While using the ULRC method, most of the burden of modeling requirements lies with the users. With MUST being a relatively new methodology and SSM enjoying a 30 year track record in research, one is left with the impression that SSM may be the more prevalent and therefore more validated methodology to consider.

SSM was not developed exclusively as an RE technique, but rather as a problem-defining methodology [28]. However, according to Coughlan and Macredie [26], the SSM approach is particularly well-suited to the RE process for complex systems because it calls for representing the problem in pictorial form. As the RE activities progress, SSM guidelines call for other conceptual models to be used for contrasting the desired system with the current system. These illustrations are sent to participants throughout RE to spark discussions and debates regarding the requirements. As the visual models mature, they are used to refine the requirements in the final stages of RE.

Although Coughlan and Macredie [26] provided a thorough analysis of available RE methodologies, they recognized their study was theoretical in nature and called for more research in realistic settings. To achieve results in such a practical setting, Laporti et al. [29] attempted to develop, and then validate, a unique RE method. Their study was based on the premise that “On one side, users and clients prefer natural language to express their needs; on the other, analysts prefer a more formal, less ambiguous language…” (p. 367). The goal was to transform the natural language stories provided by customers to the more rigid and technical format of use cases, a commonly used tool for capturing software requirements. They noted that RE techniques such as extreme programming and JAD focus too much on the role of the analyst (developer) rather than on that of the user (customer). The roles and structure defined by these two techniques actually inhibit participation and collaboration among stakeholders.

Rather than attempting to extract knowledge from customers via rigid surveys or questionnaires, Laporti et al. [29] enabled them to tell stories of their experiences—good and bad—regarding systems and processes. Each story was then deconstructed into fragments, which described specific activities in the story. The story fragments from various participants were consolidated and transformed into a standardized description format called scenarios, which were made available to the customer group for comments and corrections. When consensus was reached, the scenarios were transformed into the standard format of use cases. In this way, the RE process enabled the evolution of requirements from contextualized, free-form stories to structured data in scenarios and use cases, from which formal software requirements may be written. In addition, the researchers were able to track this evolution so that use cases and software requirements may be traced back to the scenarios and stories that inspired them.

Although the development of use cases and formal software requirements are outside the scope of this paper, it is worth noting that Laporti et al. designed a
simple experiment to test the effectiveness of their method. The researchers tasked two groups of six Masters degree level students to elicit the requirements for a system that would sell movie tickets in an online environment. One group was asked to strictly use a traditional interview technique for RE, while the other group was asked to use the new method. The second group developed fewer use cases, but their use cases were more detailed than those of the first group. The differences were attributed to the fact that the activities of the second group involved more discussion, and therefore conflict, which needed to be addressed on a regular basis.

Questionnaires given to the participants indicated that the new model served to direct the discussions and resulted in more accurate and complete requirements. Reflecting on this experiment, the researchers concluded that the conversion process for their method was effective, but difficult and time-consuming. They noted that an asynchronous collaborative method of communication would have made better use of participants’ time. As described in Section 5.3, such a method was adopted for the current study.

The above examination of the literature uncovered a wide variety of techniques used by developers to elicit requirements from customers. Regardless of the specific techniques used, however, the consensus among all researchers is that RE processes should concentrate on collaborative activities between those who represent the users, or the consumers of the product, and those who represent the developers, or the providers of the product. All RE techniques must focus on the relationship between these two groups [20] so that a common understanding of the envisioned system will lead to a strong and stable set of software requirements.

5. Method

The consensus from the literature rejects the idea that a single RE method or technique is appropriate to every situation [19, 20, 23]. In fact, Coughlin and Macredie [26] observed, “When methodologies are used, it is more the case that parts of them are used (or parts from different methodologies) rather than following all the steps required by a particular methodology” (p. 68). Consistent with this opinion, the current study adopted a variety of activities from the established RE methods reviewed in the previous section. Saiedian and Dale [20] justified the use of RE techniques in the design of information systems:

In order to gain an understanding of the user’s work, we try to appeal to the very resources upon which the participants draw to achieve their own understanding of their work. Knowledge of many of these aspects can only be gained from experienced co-workers (p. 421).

The methods employed by the current study were implemented in three phases. First, existing documentation was reviewed to guide the parameters of the study and to serve as a reference for the identification of requirements. Next, FBI stakeholders were identified and study participants were selected based on experience, expertise, and ability to influence the implementation of the proposed system. Finally, data collection was conducted using a mix of techniques tailored to the goals of the study.

5.1. Review of existing documentation

While some researchers recommend the reviewing of existing documentation as an RE technique itself [19, 26], it may be even more important to review documentation before employing an RE technique. Such documentation may inform the questions asked in customer interviews, such as: Which documents containing organizational policies and job tasks are most relevant to lesson plans?

A thorough review of the documentation helped to articulate the constraints of the system to the user, which is a challenging task [20]. In this case, the proposed KM system will be constrained by internal security policy, investigative guidelines, U.S. code, instructional systems design procedures, and guidelines published by FLETA (see www.fleta.gov).

5.2. Identification of stakeholders

Of course there are advantages to selecting a randomized sample of users to participate. However, there would be no guarantee that those users would have the time, expertise, or willingness to participate. Fortunately, in CALOs it is common to have “user representatives who are domain experts” [23]. In other words, larger organizations have employees who not only have experience as end users but also are familiar with the system analysis process.

The stakeholder participants were recruited personally from the customer job categories described previously as buyers, domain experts, software maintainers, end users, project managers, requirements engineers, software engineers, and testers [20]. The seven FBI employees who agreed to participate included two frontline instructors, who regularly design and deliver training; one supervisory instructional systems specialist, an expert in instructional systems design (ISD); two unit chiefs who supervise instructors and training programs; one unit
chief who regularly answers division-level data calls regarding FBI training; and a unit chief with significant technical expertise in learning management systems. These participants not only were knowledgeable of the needs of the FBI Training Division, but also had sufficient status in the organization to influence the implementation of the project if it was approved [26].

Because the elicitation study described in this paper did not support any current KM system project, there was no developer who had been named or assigned. Instead, the researcher acted in the role of the developer and served to collect, analyze, and present the data as an advocate for a future KM project plan. This decision carried a risk of researcher bias, as the researcher has intimate knowledge of both the problems and participants involved in this validation study. However, this risk was mitigated by the application of sound, objective, and literature-based methodologies that governed the collection and analysis of data. The participation of the researcher, who is an onboard employee and future user of the proposed system, ensured a strong contextual understanding throughout the RE process [19] and eliminated the “us vs. them” mentality [20] that typifies customer-developer relationships in these types of projects.

5.3. Data collection

Saiedian and Dale [20] observed, “As with any process, elicitation has to be adapted to match the scope of the task, the initiative maturity of the using agency, and the cost and schedule constraints” (p. 426). Informed by those techniques with documented success in the literature, the RE processes followed by this study included semi-structured interview questions, conducted asynchronously, informed by a review of existing documentation, augmented with SSM diagrams, and subjected to group consensus.

Taking into consideration the time constraints, the diversity of stakeholders, and the ability of those stakeholders to fit participation into their schedules, the collection of data involved a series of written interview questions, resembling open-ended surveys, which were delivered by e-mail. Collecting this type of qualitative data via e-mail is becoming increasingly more popular [30], and in this case proved effective in eliciting user needs from busy people without the need for time-draining face-to-face meetings.

Participants were asked to recount stories about their jobs as they relate to curriculum management, including the problems they encounter on a regular basis. This free-form story telling technique is similar to one used by Laporti et al. [29], although their strict procedure of converting the stories to scenarios and use cases was replaced with activities that supported the construction of SSM diagrams [26] as described below. The participants were asked to substantiate their stories with specific examples of the “pain and suffering” experienced with inadequate curriculum management resources. When required, follow up questions and responses also were sent through e-mail.

The original elicitation and clarification of participant stories were conducted via one-on-one e-mail communication; none of the participants knew who else was participating in the study. The data collection method approximates a typical e-mail survey and was used to avoid undue influence of ideas by other participants. However, after the stories were deconstructed into coded activities (see Analysis below), the activity descriptions—both current and future—were consolidated from those submitted by all participants, and the list was provided to the entire group in the form of illustrative diagrams. This approach followed previously described SSM guidelines [26, 28]. At this point, the participants were asked to respond to the consolidated product with comments and corrections about the activities and models.

As a general rule, effective communication is “notoriously difficult to achieve and is a recurring problem” (p. 48) during the RE process [26]. However, asynchronous communication (such as e-mail) provides advantages in terms of response time flexibility and the ability for participants to “think through” their responses, which increases the quality of the responses. The one-on-one e-mail communication method used in the study sparked uninhibited discussions about user needs that led to a common understanding among all participants. As expected, the participants expressed their preference for this method rather than a long series of group meetings. In addition, the e-mail exchanges created a written record of responses, without expending additional resources in recording and transcription. However, these communications were planned very carefully, making the most out of each exchange so that the responses closely tracked with the study’s RE goals. Firm deadlines were set on responses, and tactful reminders were required to keep the information flowing.

As Scheinholtz and Wilmont [31] noted, successful RE “strongly depends on the right questions being asked in such a way that the user stakeholder can provide the right details in his response” (p. 72). This philosophy was used for developing both original questions and follow-up (probing) questions to induce appropriate responses from the participants. The first e-mail message sent to the participants contained the following questions:
1. Organizational policies (OPs) define what we’re allowed to do in the FBI. If FBI training products could be linked to policy documents, which policy documents would be the most important?  
2. When someone (e.g., FBIHQ divisions, the Director, Inspection Division, Congress, etc.) asks you questions about the curriculum you manage, what kinds of questions are you asked? In other words, on what kinds of training information have you been asked to report?  
3. What are the specific challenges (i.e., “pain and suffering”) that you’ve faced when creating/managing content for courses or curricula? What circumstances have prompted you to say, “There must be a better way of doing this”?  
4. What are some ways you think an information technology system could help the FBI develop and manage curriculum?  
The number of open-ended questions was kept to a minimum to respect the participants’ time. However, in order to fully capture their requirements, the questions were crafted in a way that encouraged the participants to express their needs in both a negative (i.e., what is currently wrong) and a positive way (i.e., how things could be better). The questions also were meant to elicit procedural skills as well as explicit knowledge, as suggested by Scheinholtz and Wilmont [31]. The wording of the questions was based on personal conversations with the participants during their recruitment, thus ensuring the questions would be understood clearly. The analysis of their responses will be discussed in the following section.

6. Analysis

As with other qualitative studies, the free-form data collected was first subjected to a content analysis whereby common themes among written submissions were identified. Next, following the approach offered by Laporti et al. [29] the e-mailed stories were deconstructed into fragments that describe specific activities. A total of 37 “Activity Themes” emerged from the story fragments to reflect the shortcomings of current processes as well as the desired features for a future KM system. Finally, from these Activity Themes six categories of KM features were identified: Access, Reporting, Accountability, Development, FLETA Requirements, and Versioning. As described in the next section, the results of these coding efforts were checked for accuracy by the participants.

Table 1 provides a small sample of story fragments, quoted directly from the participants’ responses, along with the corresponding activity themes and feature categories. In addition, each story fragment was tagged with a number (indicated in parenthesis) that corresponds to a particular participant. This numerical assignment became an indicator of the variety of participation from individuals as well as the uncanny convergence of issues brought forth without collaboration among participants. It also provides a means to track support for each identified need back to the original raw expression of that need.

<table>
<thead>
<tr>
<th>Activity Theme</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>For me it is really about having all the documents to include archives in a central repository that can be easily searched and information pulled to address inquiries.” (2)</td>
<td>ACCESS REPORTING</td>
</tr>
<tr>
<td>I think just linking a course to a policy is 80 to 90% of the goal... it would be helpful to be able to map to the most granular requirement, whether that is at the course level or learning objective level, whether it is a policy, regulation, or statute [law].” (4)</td>
<td>DEVELOPMENT REPORTING FLETA REQUIREMENTS</td>
</tr>
</tbody>
</table>
The study participants were selected from three different sections at the FBI Training Division and their jobs varied considerably. Nevertheless, they all seemed to converge on a common set of themes that represent both the current state of affairs as well as envisioned solutions. Every participant, for example, recognized the need to link LPs to JTs and OPs. Some expressed the need as supporting the development of LPs, while others justified it as a way to comply with FLETA requirements.

One of the surprising phenomena observed during the study was the level of emotion expressed by the participants during their responses. One could sense their frustration as they recounted the time and effort wasted in dealing with rudimentary content management processes that result from unsearchable static documents and training data that regularly is unavailable for reporting – the type of reporting required to respond to FLETA-related inquiries.

Consider the following comment from one of the participants:

The first challenge that comes to mind is FLETA, and everything associated with it… The amount of time these tasks have taken… gives the appearance that we have lost our focus on why the [FBI] Academy exists and what its function truly is in the organization.

It is likely that the researcher’s efforts to safeguard the identity of the participants enabled such candid and detailed responses. Indeed, by allowing the participants to tell their stories without fear of reprisal likely has resulted in a more accurate and robust set of user needs than what could have been obtained otherwise.

Analysis of the story fragments revealed that some activity themes corresponded to one particular category, while others could be associated with multiple categories (see Table 1). This many-to-many relationship between themes and categories lent itself to depicting the model as a webbed system rather than a hierarchical one. Therefore, two SSM diagrams were developed to illustrate these complex relationships—one depicting the current problems with training management and the other illustrating the goals of the proposed KM system. These diagrams were e-mailed to the participants for their review and feedback. After their feedback was incorporated, the final SSM models were developed. Figure 1 shows the current problems encountered with training management and Figure 2 shows the goals of the proposed KM system. For the sake of readability, only an excerpt of each SSM model is shown in these figures.

Figure 1 represents the relationships between activity themes, identified from participant story fragments, and the categories that represent problematic conditions to which they contribute. Solid arrows represent primary relationships, and dotted arrows represent secondary relationships based on the analysis of the data.

The SSM diagram in Figure 2 represents the relationships between the activity themes and the categories of positive conditions to which they contribute. Liaskos et al. [14] refer to these concepts as goals and preferences, which form the basis for defining software requirements.

8. Conclusion and future work
The goal of this study was to discover the KM capabilities required to associate LPs to JTs and OPs and to develop a strategy to capture the user needs for such a KM system. Indeed, the first research question was answered by the collective input of the participants and documented in an SSM diagram that relate user needs to broad categories of functionality (see Figure 2). To answer the second research question, user needs were elicited and documented using a combination of traditional and group RE techniques [25, 28, 30], none of which included time-consuming face-to-face meetings. Indeed, it usually is difficult to find a representative group of stakeholders due to constraints on time, status level, and required expertise [25]. However, managing communications by e-mail enabled the participation of several knowledgeable and influential people, who are often the busiest in the Training Division. In addition, the safeguarding of identities resulted in rich responses that were candid and extensive.

Extracting key statements from participants’ stories enabled the expressed needs to be coded and categorized, resulting in meaningful goals and preferences for the KM system. In this way, the strength of support for particular KM goals (and consequently, KM preferences) may be traced directly back to the raw participant input that provides context for the user needs. Finally, transforming the activity themes and categories into the goals and preferences displayed in SSM diagrams promoted a common understanding of user needs among the participants.

The participants represented a variety of FBI Training Division stakeholders. It is easy to understand their eagerness to help define the KM system that will improve the management of training content across the enterprise. For senior managers, the KM system tracks to the Training Division’s strategic objectives and will enable them to respond quickly to data calls regarding training content and management. For instructors, the ability to map content to policies and processes will facilitate LP creation and modification by directly linking to JTs and OPs, which change frequently. For curriculum managers, having ready access to mapped LP content means they will be able to determine whether current training content still is relevant and whether JTs and OPs are covered adequately by training programs. Virtually every FBI Training Division job function may be improved by the implementation of a KM system described herein. Even students – who will not interact with the system and who did not participate in this study – will indirectly benefit from future training programs that are up-to-date and relevant to their job roles.

Drawing a contrast with their own theoretical treatment of requirements elicitation (RE) methodology comparisons, Coughlan and Macredie [26] suggested, “More research therefore is required on methods in use that conduct studies in real-life settings employing more naturalistic techniques so as to reveal the facets of communication in action and context” (p. 71). The findings presented by this paper answer the call for research in real-life settings. In fact, while most studies examine RE techniques after the fact, the FBI study examined techniques to develop user needs and requirements for a KM system that has not yet been formally proposed. Moreover, the researcher acting in the role of developer for a project that does not yet exist is an approach not found in the literature. Eliciting requirements in this way eliminates the schedule, budget, and legal constraints that typically apply to KM projects.

By following the RE methods outlined in this study, a strong set of user needs emerged from the collective input of high caliber FBI Training Division employees. However, the same RE methodology would be applicable to the large KM development projects of other CALOs who struggle with building RE consensus among its stakeholders.

Taken together, the captured user needs have described effectively the problem scope of the proposed KM system by defining the criteria for actual software requirements. Future efforts should concentrate on the validation and prioritization of these software requirements in preparation for a formal statement of work or request for proposal.

9. References


