Identification of User's Learning Goals in Workflows

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Abstract. Nowadays, the main focus of business process management research is concentrated on keeping the enterprise business processes up to date and conform to the enterprise business goals. The fact that enter- prise employees need to adapt to the new process flows, efficiently make decisions in a new situation and apply recently emerged technologies is often left without attention. The authors of this work argue that the methods of goal oriented adaptive e-learning will help employees to solve the problem of being informed up-to-date and competent without taking off work. The paper presents a method for employee's learning goal elicitation during their work with the enterprise workflow management system.

1 Introduction

Once,Workflow Management Systems (WFMS) [Allen 05] were intended to support the enactment of the enterprise business processes and to guarantee the quality of process results. However, the modern world sets harder requirements to business process management [Scheer 05] because of the permanent changes in the economy trends and the hard competition in the global market. Changes in the enterprise workflows can lead to embarrassing consequences for enterprise employees. Examples of challenges for the employees can be the necessity to make decisions in a new situation or to efficiently use a newly emerged technology on a certain workflow step. As recent surveys [Ridge and Solis 03] show, an appreciable amount of time nowadays is being spent on looking for information on the internet, local desktop or in the corporate document repository. Although the methods and tools for efficient information search are being permanently developed [Safari,GDS], we advocate the approach of the lightweight proactive information delivery and business process oriented knowledge management described in [Holz et al 05]. In the TEAL (Task Embedded Adaptive Learning) project, we extend the idea of context-specific, proactive information delivery by using up-to-date e-learning technologies enabling just-in-time delivery of goal-oriented, user-tailored learning curricula, helping workflow participants to solve problems autonomously and competently (workflow embedded e-learning) [Rostanin et al 06]. The current paper presents a method for employee's learning goal elicitation during their work with the enterprise workflow management system which has been realized in the project TEAL.

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2 Goal Orientation in Workflow Learning

In order to achieve the effectiveness of workflow embedded learning (short time and acceptable quality), two requirements have to be met by information assistants delivering the task-specific information to their users that are integrated into a WFMS: first, the delivered information has to satisfy the user's current information need (be just-in-time); second, it is necessary that the delivered information does not overextend the user (just-enough) [Rostanin and Holz 05]. Hence, the concept of goal-oriented learning is highly relevant for enterprise workflows. Let's consider an employee that is facing a new task. The employee mentally checks if his knowledge is sufficient to perform the task. If the necessary knowledge is not present a knowledge gap is identified. From this gap the learning goal "cover the knowledge gap in the context of the given task" is identified. For complex tasks more than one learning goal might be identified.

Learning goals influence the learning process in two ways:

– They narrow the range of content which is considered necessary to be learned (what to learn).

– They guide the learning process by specifying the learning strategy (how to learn).

To illustrate the notion of learning strategies, we consider the following example: A software team has to develop a client-server system using the J2EE [1] technology. The team consists of one project manager and four programmers. Neither the project manager nor the programmers have experience in programming with J2EE, so they have to learn J2EE to accomplish their task. The project manager's learning goal is to receive knowledge about the architecture of J2EE and about the advantages of the technology so that he can design the system. An overview of the technology is suitable learning content for him. The learning goal of the programmers is to learn how to program the system with J2EE. They require more detailed and specific learning content than the project manager (including exercises and examples). Even if the same knowledge is involved in both cases, the appropriate learning contents are different according to the learning goals.

According to the above considerations, we define a learning goal as a triple $g = (c, s, m)$ where g is a learning goal, c is a concept from the learning ontology (see chapter 3), s is a learning strategy and m is the user's motivation to achieve the learning goal. Typically, the motivation is a reference to the current workflow task that has to be fulfilled after the user eliminates the knowledge gap. The problem of learning goal identification can be narrowed to finding a target concept and an appropriate strategy of learning. Once the learning goal is identified and accepted by the user, it receives the following runtime characteristics: identification date, current state (not started, started, finished) and completion date. In TEAL we call an identified learning goal a *potential learning goal*. After the potential learning goal is accepted by the user it is called a *current learning goal*.

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[1] J2EE: Java 2 Platform, Enterprise Edition. URL: http://java.sun.com/javaee/

3 A Method for Learning Goal Identification (Project TEAL)

3.1 Learning Concept Ontology and LeCoOnt Tool

The basis for the retrieval of the concept to be learned is the ontology of learning concepts that depicts the outline of the learning content in the Learning Content Management System (LCMS) used for workflow embedded e-learning as an information assistant. The purpose of the learning concept ontology is to model the domain of knowledge related to the given workflow. Learning objects contained in the LCMS are bound to the corresponding learning concepts using adequate metadata. The more concepts are preserved in the ontology, the finer knowledge gap identification can be achieved.

The creation and maintenance of such ontology is a long and time consuming process. To simplify the ontology maintenance, in the project TEAL there was a tool created called LeCoOnt that allows to present the ontology graphically, conveniently navigate in the ontology, search, add and change ontology concepts[2]. On the figure 1 one can see a screen of the LeCoOnt tool showing a part of the software engineering ontology that contains concept SQL and related concepts. In addition to the graphical editor, the LeCoOnt tool provides also functionality for automatic extraction of learning concepts from the online glossaries[3] that allows to significantly reduce time needed for the initial ontology creation. Later, the ontology will be continuously refined and complemented using the graphicaleditor.

3.2 Proactive Delivery of the Potential Learning Goals in Workflow

For identifying the potential learning goals of the workflow user, there was a middleware component developed called DyLeGo (Dynamic Learning Goal). The DyLeGo component can be integrated into any WFMS that provides open API for accessing the workflow context information. The workflow context includes a variety of information about the task environment that allows identifying potential learning goals:

– Task information
  - Task name, description, task-relevant concepts and documents provide the key information about what the user is currently doing. Using task name we can identify potential learning goals of the user.
  - Reference to the instantiated task model if the current task is instance of the certain activity model it can givemore precise information on what the user is currently doing than just using a task name.
  - Project information, connection to other tasks The information about the project and other tasks (predecessor, successor etc.) of the user can help to interpret current user actions.

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2 LeCoOnt. Learning Concept Ontology Editor. URL: http://lecoont.opendfki.de

3 Sun Java Enterprise System Glossary. URL: http://docs.sun.com/source/8166873/index.html

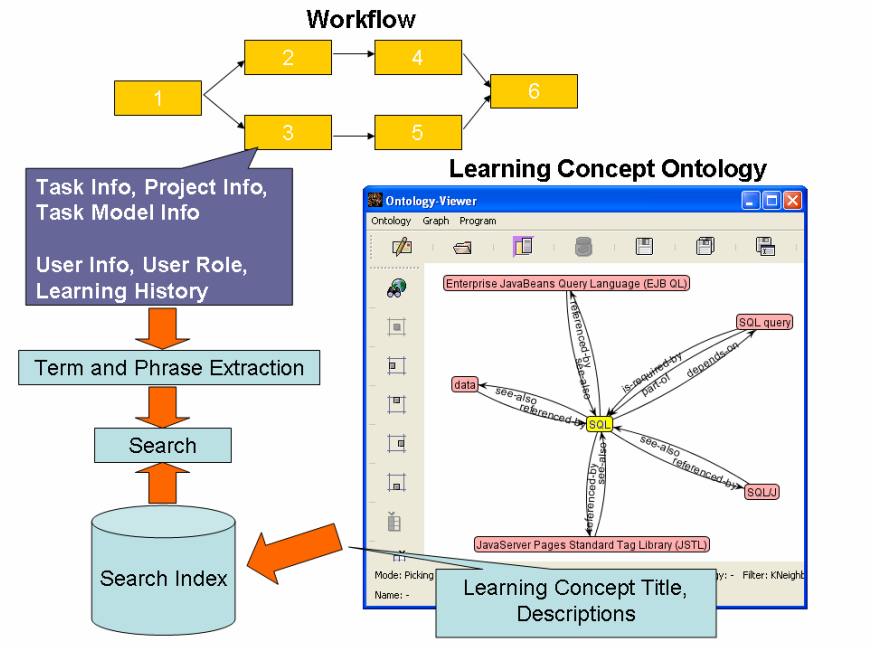

Fig. 1. Learning Goal Identification in the Workflow Context

– User information
  • User role is the base for determining learning strategy of the user (see example in 2).
  • User skills, interests, working and learning profile allow us to exclude concepts that user already knows or include concepts that are unknown for the user.

If the workflow context has changed, DyLeGo issues an automatic query containing workflow context information to the learning concept ontology and delivers a list of potential learning goals to the workflow user. The delivery is conducted proactively (push-approach) so the user does not need to start search or to specify query manually and is not interrupted in his work. To enable efficient search of potential learning goals, DyLeGo creates a text search index from the learning ontology concepts using Apache Lucene software[4] (see figure 1). The learning concept retrieval is based on extracting important keywords and subphrases from the name of the current task and its description and querying the learning concept ontology for the corresponding concepts. Found concepts are filtered using the user's learning history and his competence profile (delivered from the WFMS). The algorithm being used to determine the optimal learning strategy for the user is based on the user role in the

[4] Lucene. URL: http://lucene.apache.org/

current workflow (see example in chapter 2). The database of DyLeGo contains a special table that provides information about matching between a learning concept, a user role and a recommended strategy. The contents of the table is initialized by the authors of the learning concept ontology who can make recommendations about the usefulness of the corresponding concept for every role. During the usage, the system learns which users prefer which strategy and the information about concept-role-strategy matching is being automatically updated. Other information used for specifying the learning strategy is user's skills, interests, working and learning history. In the TEAL project the following learning strategies were identified:

– **overview** Very short description giving the general impression about the subject to be learned. One can compare this with glossary description. On the basis of the overview Bob should be able to judge whether he needs to learn this subject deeper or not.

– **cursorily** If the learner decided to learn the subject but he/she does not need to get expert-level knowledge on it, the cursorily strategy should be chosen. For instance, it would be the case if Bob's manager would like to get acquainted with possibilities of the SQL language.

– **detailed** Provides expert-level knowledge on the subject. If Bob would like to optimize a complex Oracle query and has no idea about optimization, a detailed course on Oracle SQL tuning should be delivered for him.

– **repeat** Serves as reference material on the subject. If Bob finished the course on Oracle SQL tuning he might still need a succinct reminder course on Oracle optimizer hints. The above listed strategies were oriented on the learning course generator [Ullrich 05a] developed in the LeActiveMath[5] project and used in TEAL for dynamic goal-oriented course generation. In the future, the list of strategies will be extended and should cover the Bloom's learning goal taxonomy [Bloom 56].

4 Conclusion

This short paper introduces a simplified model of goal oriented learning in enterprise workflows and presents a method for user's learning goal elicitation in the workflow process. The proposed method is a lightweight approach based on the assumption that most of the concepts used in the current workflow are modeled in the learning concept ontology. It also assumes that users give names to the current tasks according to certain naming conventions (e.g., the name of the task starts with a verb etc.). In order to sophisticate the presented approach, further research and evaluation is currently being conducted.

The feasibility of the proposed method was proved during the TEAL project. In the project, the DyLeGo system was successfully integrated into a flexible workflow engine called TaskMan that was developed at DFKI[6]

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[5] LeActiveMath. URL: http://www.leactivemath.org

[6] FRODO Taskman. URL: http://www.dfki.unikl.de/KM/content/e179/e506/index_ eng.html

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