Context and Scripts: Supporting Interactive Work-Integrated Learning

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Abstract: Computational support for work-integrated learning will gain more and more attention. We understand informal self-directed work-integrated learning of knowledge workers as a by-product of their knowledge work activities and propose a conceptual as well as a technical approach for supporting learning from documents and learning in interaction with fellow knowledge workers. The paper focuses on contextualization and scripting as two means to specifically address the latter interaction type.

Motivation

Following Machlup (Machlup 1962), we describe a knowledge worker as an employee of an organization whose essential operational and value creating task is the production and distribution of knowledge. This specifically entails the engagement within four types of knowledge work: creating knowledge, acquiring knowledge, transferring knowledge and applying knowledge (Kelloway & Barling 2000). In our opinion, learning is both a by-product and an enabler of knowledge work (de Hoog et al., 2008). Technical support for learning and especially for learning while doing knowledge work has to be developed to support knowledge workers in increasing their productivity – this was postulated by Peter Drucker (1999) to be one of the major challenges of the 21st century.

The goal of the EU-founded APOSDLE[1] project is to enhance knowledge worker productivity by supporting informal self-directed work-integrated learning (Lindstaedt et al., 2007) in the context of knowledge workers' everyday work processes and within their computer-based work environments. This paper will describe the APOSDLE projects' approach to work-integrated learning and the APOSDLE (software) system supporting knowledge workers in work-integrated learning.

Work-integrated learning within the APOSDLE project

The APOSDLE project aims at providing technical support for informal self-directed work-integrated learning. This support should be provided by means of a generic application that is not domain specific. Two workplace learning studies have been carried out within the APOSDLE project to empirically examine actual work-integrated learning behavior of knowledge workers (see Kooken et al., 2007 and more in general Feldman, 2004; Cross and Parker, 2004; Dalkir, 2005). The following results are most relevant:

- Interpersonal help seeking is the solution most often applied by a knowledge worker in order to find the knowledge she needs. This is complemented by other sources of material such as (digital or paper) documents.
- When searching for documents, difficulties are experienced in trying to figure out what one is looking for, not being able to decide on what is important to know and not knowing where to find the documents.
- When trying to find knowledge in documents the main problems are that the information is too specific for immediate use, the information is not sufficient to solve the problem and no information can be found at all.

Resources for supporting work-integrated learning are *documents*, such as text documents, images or video's on the one hand and *interaction* with other people on the other hand. We will shortly explain our approach for the first kind of resources and than go into more detail for the second. In order to computationally support such highly interactive, flexible, and domain-independent types of learning we have to apply intelligent technologies which are able to handle uncertainty, imprecision and continuous change. Lindstaedt et al. (2008) describe how scruffy technologies can be applied for user context detection, user profile maintenance, and knowledge resource recommendation.

Supporting work-integrated learning through interaction with documents

The main challenge for APOSDLE is that the learners and domain are not known in advance. This rules out standard instructional design approaches, including the construction of specific learning material. In APOSDLE

[1] Advanced Process-Oriented Self-Directed Learning Environment, www.aposdle.org

the existing documents in the organizational repository are the only resources available for supporting learning. The solution for this challenge is to define some generic components that can be instantiated at the moment the learner asks for information from documents. The first generic component is establishing the goal of the search. For this we use the basic classification of learning goals developed by Anderson and Krathwohl (2001). From user experience with earlier APOSDLE prototypes, it became clear that these abstract learning goals are hard to understand for users. We decided to rewrite these learning goals as a set of predefined questions or request as proposed by Gehry (1991). This leads to questions like: What must I do? How do I do it? Am I doing it right?, or requests like: Show me…!. By presenting these questions and/or information types to learners, one can help them in their orientation and choice of learning goals.

The second generic component has to do with the content of the material. Apart from a topic, this content can have a meaning that goes beyond the immediate content covered. As APOSDLE is domain independent, this second meaning should be applicable across a wide range of domains. The concept we use is the *material use* of a document (see de Hoog et al. 2002). Material use reflects the role a document, or part of a document, can play in supporting learning. Examples of material use we employ are definition, explanation, how-to and checklist. As can be easily seen, these material uses do not depend on a domain. An explanation can occur in any domain, the same holds for definition.

In APOSDLE we link the first generic component (learning goals, questions) to the second (material use). Each learning goal is associated with one or more material uses. Next we develop for each material use a template that is instantiated when a learner selects a question (learning goal) if she is using the system. This template is filled with a document, or a snippet of a document, retrieved from the organizational document repository, that matches the topic and the material use(s) associated with the question. In addition, hints are provided about how to learn more about the question and the topic. These hints are also based on the selected learning goals and the associated material use(s) and are intended to support the learning functions proposed by Simons (2000).

Combining generic learning goals (questions) and generic material uses, enables us to overcome some of the problems caused by the need to be domain independent. We do not claim that this solution is optimal, it is to be expected that domain tailored learning environments with their own specifically designed learning material will do better. However, this advantage is offset by the costs involved in building these systems, but also by the fact that they are quite often separated from the workplace and cannot flexibly adjust to problems and learning needs that arise during daily work.

Supporting work-integrated learning through interaction with fellow knowledge workers

As literature (Feldman, 2004; Cross and Parker, 2004; Dalkir, 2005) and the APOSDLE workplace learning studies suggests, interaction with other people is a major source of learning at the workplace. The interaction itself can be understood as a process consisting of several steps and activities. We modeled this process in order to be able to understand and support the different activities that have to be carried out for a successful interaction between a knowledge seeker on the one hand and a knowledgeable person on the other hand.

The contextualized interaction process is a general model of interrelated events occurring while two or more knowledge workers interact with each other, e.g. communicate, collaborate or coordinate their activities. The three phases of the contextualized interaction process correspond to Simons (2000) learning functions for self-directed learning as explained above. Typical preparatory functions are carried out within the pre-interaction phase, while executive functions are mapped onto the interaction phase. Finally, closing functions are applied within the post-interaction phase.

The APOSDLE model of contextualized interaction includes an approach for supporting interaction of knowledge workers through guidance. Scripts are used to provide guidance on different granularity levels and fading levels. We differentiate between interaction scripts on macro and on micro level as described by Dillenbourg and Hong (Dillenbourg, Hong 2008). On macro level the *interaction guidance script* will guide interaction partners through the overall process and helps them to internalize the process phases. This is visually done by an APOSDLE system wizard component It makes the process phases and steps visible to the knowledge workers. Scripts on micro level will help knowledge workers to individually use each process phase as efficiently as possible for problem solving and learning. We developed interaction scripts for all process phases. For the pre-interaction phase we developed a *request script* by adapting problem formulation scripts (Nückles et al. 2007) and social scripts (Weinberger et al. 2003). Considering Dillenbourg's work we further formulated the request script for different fading levels (Dillenbourg, Hong 2008) which depend on the knowledge workers increasing internalization of the process phases.

Summary and discussion

In the previous sections we described the conceptual and practice driven approach to work-integrated learning in the APOSDLE project. Based on a formal model of the interaction process we especially showed how

contextualization and scripting are applied to improve learning at the workplace while knowledge workers are interacting. This approach has been implemented in prototypical software which was used in a field evaluation together within four application partner organizations. First evaluation results are promising and showed the overall validity of the underlying concepts and models in real world scenarios. Thus a generic work-integrated learning process was modeled from interviews with application partners. It shows the interconnection of learning from documents and learning from interaction with others as basic strategies of knowledge workers to solve a work related problem which approve the presented approach.

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