Chapter XVI
Impact of Context–Awareness on the Architecture of Learning Support Systems

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ABSTRACT

Recently, the situatedness of learning has come to the center of attention in both research and practice, also a result of the insight that traditional learning methods in the form of large de-contextualized courses lead to inert knowledge; that is, knowledge that can be reproduced, but not applied to real-world problem solving. In order to avoid the inertness, pedagogy tries to set up authentic learning settings, an approach increasingly shared in e-learning domain. If we consider professional training, it is the immediacy of purpose and context that makes it largely different to learning in schools or academic education. This immediacy has the benefit that we actually have an authentic context that we need to preserve. The majority of current e-learning approaches, however, ignores this context and provides de-contextualized forms of learning as a multimedia copy of traditional presence seminars. We show how making learning solutions aware of the context actually affects their architecture and present a showcase solution in the form of the Learning in Process service-oriented architecture.

INTRODUCTION

In the wake of constructivism dominating pedagogy research during the last years, the situatedness of learning has come to the center of attention, also a result of the insight that traditional learning methods in the form of large de-contextualized courses lead to inert knowledge; that is, knowledge that can be reproduced, but not applied to real-world problem solving (Bereiter & Scardamalia 1985; Renkel et al., 1996). In order to avoid the inertness, pedagogy tries to set up authentic learn-

ing settings, an approach increasingly shared in the e-learning domain. If we consider professional training, it is the immediacy of purpose and context that makes it largely different to learning in schools or academic education. This immediacy has the benefit that we actually have an authentic context that we need to preserve. The majority of current e-learning approaches, however, ignores this context and provides de-contextualized forms of learning as a multimedia copy of traditional presence seminars.

Context-aware system behavior can foster learning processes in several areas:

- If we consider the delivery of appropriate learning content, we can support employees in embedding learning activities into their work processes. We can recommend fine-grained learning resources, and make the recommendations aware of derived learning needs *(what)*, but also aware of interruptibility and stress level *(when and how).*
- Within learning objects, we can adapt the instructional strategy to the learner's current situation, such as modifying the difficulty level or the playfulness in response to (1) personal characteristics, but also (2) whether it is the end of a long and hard day of meetings, after a period of boring paperwork, or early in the morning.
- Finally, we can also foster informal learning activities by bringing together learners that are dealing with the same topic areas or the same business process activities as soon as we know what others were doing recently.

In this chapter, we want to present a systematic service-oriented approach of extending current learning support services (which comprise learning management systems, learning content management systems, communication and collaboration services) with context-aware functionality. This approach covers all aspects of dealing with context information, that is, context acquisition, context management, context augmentation, and context-aware adaptation of system behavior.

BACKGROUND

What is Context?

Although it seems to have become common sense to acknowledge that "context" is important to consider for state-of-the-art system development in general and learning support in particular, there is no shared understanding of what "context" is. Bazire & Brézillon (2005) have analyzed the scientific literature of several fields in order to find out the commonalities and came up with a vague notion of a set of constraints that can influence the behavior of a system in a given task. The most generally accepted definition in the community of ubiquitous computing is given by Dey (2001):

Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves.

This still does not define what is "the situation". In Schmidt (2006), the situation of a user is defined as a relevant subset of the state of the world at a given point in time (including the respective knowledge of history and expectations for the future at that point in time).

These definitions leave the most important question open: what is actually relevant? From a theoretical point of view, this question cannot be answered exhaustively. From a practical point of view, we can approach this problem by considering the two aspects of context-awareness (Schmidt, 2005a): (1) knowing about the user of the user and (2) adapting system behavior to this context. Context acquisition methods determine the supply side and context-aware (learning) sup-

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