Chapter 63
Engineering and Reengineering of Technology Enhanced Learning Scenarios Using Context Awareness Processes

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ABSTRACT

This chapter proposes a context modeling process to help tutors adapt their tutorship actions based on students' profiles and performance on Technology Enhanced Learning environments (TEL). It attempts also to involve teachers as designers in the engineering process of a TEL system development and to support their activity of auto-regulation regarding the students' guidance and assistance. This aim leads to improve teaching strategies as well as to enhance the quality of the learning objects and the learning scenario itself. In fact, if the TEL system is already adaptive, by means of this approach, its improvement is fostered. If not, the process will support its iterative transformation from predefined to adaptive. The Model Driven Engineering (MDE) methodology is used since it gives educational designers (teachers for this proposal) and software designers the ability to define, communicate, and test a solution while creating artifacts that become part of the overall solution. The Usage Tracking Language (UTL) has been developed to provide the actors of a TEL system (designers, tutors, learners, and analysts) with a dutiful tool to describe the observed uses of the descriptive pedagogical scenario and their semantics, including the definition of the observation needs and the means required for data acquisition. The structure of tracks and their transformations from raw data allows the calculation of indicators which supports the building of users' models that will influence users' decision making. Finally, a case study using the Hop3X environment for learning Java programming to apply this process is presented.

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INTRODUCTION

Much research work has been developed to achieve by Information and Communication Technologies (ICT) student-centered education considering that concepts like learning, knowledge, skills, competences, learning outcomes and qualifications make up the core of current educational perspectives (Peña et al., 2008). This chapter is based on studies in-line with these research objectives and focuses on adaptation of tutorship actions on students' performance during a learning activity using a TEL environment.

At this moment, some TEL environments delegate to humans as tutors, teachers or the learners themselves an adaptive decision making while other works explore the possibility to adapt dynamically its performance and configuration, as in Intelligent Tutoring Systems (ITS) or Adaptive Educational Hypermedia (AEH). Anyhow, these kinds of adaptation are based on the interpretation of the learning context. This interpretation could answer the following questions for teachers/instructors/tutors/trainers: Who are the ones involved in the activities? How are they acting? What do they need? Who should be assisted?; and questions coming from learners: What to learn? When ? How ? Why should we?.

In short, both, humans and the TEL environment need information of the learning situation (context) to make an adaptive decision of performance.

This work takes into account the following elements from the learning context as constraints for adapting the tutoring act to the students' needs: their profile (e.g., name, age, learning style, disabilities, and preferences), their performance (e.g., formative assessment, and knowledge level), and their accessibility means and conditions (e.g., hardware, software, connectivity, and institutional policies). Part of this context is directly given to the system by data captured and processed through questionnaires (e.g., learning style, using the Index of Learning Style Instrument (ILS); knowledge level, applying a subject domain questionnaire; preferences, by the application of a subjective likes instrument, etc.) since other part is identified from the students' actions on a learning environment (the interactivity context).

In order to formalize data mining, data analysis techniques and capitalize them as design and inspection patterns from the interactivity context, the Usage Tracking Language has been proposed (Choquet, & Iksal, 2007). By this language, the automatic methods for collecting data and creating significant indicators (in the meaning of Harrer et al., 2009) for the users could be expressed in a declarative and generic way, and could be interpreted for mining tracks from different TEL systems (Pham Thi Ngoc et al., 2010).

The context modeling process here proposed has to be considered as an original answer to the following current open question in instructional design: how to involve teachers as designers in the engineering process of a TEL system development?.

Basically, existing TEL systems fall into two categories:

1. Systems designed by Information Technologies (IT) experts, such as Intelligent Tutoring Systems mainly without the help of final users. These systems are then proposed to teachers.
2. Systems designed on generic platforms, such as Learning Management Systems (LMS) where the final users (e.g. the teachers) could organize resources and services for defining a learning activity.

These last systems are often basic in terms of pedagogical scenarios because:

- Teachers are not able to develop/adapt well-suited and riches resources and
- Teachers have a lot of difficulties to "predict", different alternatives of the learning activity.

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