Currently, when aiming at providing learners with opportunities for technology enhanced learning, companies, universities, and other educational institutions mainly use so-called learning management systems (LMS). LMSs are Web-based educational systems that aim at supporting teachers and administrators in creating, administering, and managing online courses. These systems provide a great variety of features which can be included in courses such as learning material, quizzes, forums, chats, assignments, wikis, and so on. However, at current stage, such environments provide very little, or in most cases, neither intelligent support nor adaptivity for learners.

Adaptive and intelligent Web-based educational systems (AIWES) address this issue and aim at providing learners with an environment that reacts intelligently to the learners’ needs and incorporates their individual characteristics and situation by presenting suitable suggestions, information, and learning material in order to make learning more effective and easier for learners. The term adaptive refers to the functionality of the system to automatically provide different suggestions, courses, or activities to learners with different characteristics and needs. The term intelligent here means that a system uses artificial intelligence techniques in order to support learners or identify their characteristics, needs, and situation.

The first AIWESs were developed around 1995, having their roots in Adaptive Hypermedia and Intelligent Tutoring Systems. They included systems such as Interbook (Brusilovsky, Schwarz & Weber, 1996b), ELM-ART (Brusilovsky, Schwarz & Weber, 1996a), CALAT (Nakabayashi, Koike, Maruyama, Touhei, Ishiuchi & Fukuhara, 1995) and De Bra’s adaptive hypermedia course (De Bra, 1996). During the last few years, many research works have been carried out in the area of AIWESs and many systems have been developed (Brusilovsky & Peylo, 2003; Sadat & Ghorbani, 2004). While the first AIWESs focused on considering and identifying the knowledge state and progress of students in a course or task, a broader set of characteristics, needs, and states of learners has been investigated and considered in current systems, including, for example, students’ learning styles, cognitive abilities, affective states, learning goals, interests, misconceptions, and so on. Systems aim at identifying these characteristics, needs, and states dynamically by observing the students’ behaviour, progress, and interaction with the system and applying artificial intelligence techniques in order to fill and update the student model.
Another focus of recent systems is to support not only learners by providing them with intelligent support and adaptive courses/learning material but additionally aim at supporting teachers as well as developers of AIWESs. As mentioned above, a crucial advantage of LMSs, which are currently mainly used in technology enhanced learning, is that they focus on supporting teachers and course developers. In recent years, the need of providing sufficient support for teachers in creating and managing online courses in AIWESs has been widely identified. AIWESs are able to provide teachers with more than only help in creating and managing online courses. Through the application of adaptivity, the student model provides information about the learners which can help teachers in providing learners with better guidance and advice. Furthermore, AIWESs can provide intelligent support for teachers, for example, by alerting them once it is identified that a student seems to have difficulties in learning. Aiming at supporting developers of AIWESs, research is also done regarding concepts and approaches for an efficient development of AIWESs.

This special issue includes five papers, which present current research directions in the area of AIWESs. They focus on considering different characteristics, needs, and states of learners, use different artificial intelligence techniques in order to identify them, and aim at supporting learners, teachers, and developers in different ways.

The paper by Chang, Tarng, and Shin describes a study about investigating the effectiveness of scaffolding in an adaptive Web-based educational system, which detects students’ misconceptions and aims at helping students to change their mental concepts. In this study, a comparison was made between (1) the effectiveness of scaffolding through online communication between teachers and students, (2) scaffolding through face-to-face communication between teachers and students, and (3) no scaffolding. Furthermore, changes in the learning responsibility were investigated in this paper.

Limongelli, Sciarone, and Vaste introduce the adaptive and intelligent system LS-PLAN, which provides adaptivity based on the students’ knowledge as well as their learning styles, identified in a static and dynamic way, and uses an intelligent planner for presenting suitable learning material. Furthermore, LS-PLAN focuses on providing support for teachers in creating the pool of learning material.

Micarelli, Sciarone, and Gasparetti propose a model for adaptive navigation support and demonstrate its implementation in the HyperCase system. Using case-based reasoning, the model is able to offer students intelligent help by automatically deducting the students’ learning goals and providing them with guidance about where to go in order to achieve their learning goals.

The paper by Heller and Procter deals with animated pedagogical agents (APA), which are able to represent a lifelike person and use artificial intelligence to simulate communicative behaviour while guiding the interaction with the student towards pedagogical goals and objectives. Heller and Procter have investigated the persona effect of APAs, comparing the learners’ opinion and experiences about interacting with an APA, which is represented without graphical representation, as a static image of the person or as an animated image of the person.

The recent research indicates that ontologies will play a greater role in the development and maintenance of intelligent and adaptive educational systems. To that end, we decided to include a paper “Ontology-Driven Development of Intelligent Educational Systems” by Deline, Lin, Wen, Gašević, and Kinshuk that offer a glimpse into ontology-driven development methodology using an example.

REFERENCES


