Personalized Web-Based Learning Services

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NEW TRENDS IN E-LEARNING SERVICES AND NEEDS FOR PERSONNALIZATION

New Trends

Computers have a great potential as support tools for learning; they promise the possibility of affordable, individualized learning environments. In early teaching systems, the goal was to build a clever teacher able to communicate knowledge to the individual learner. Recent and emerging work focuses on the learner exploring, designing, constructing, making sense of, and using adaptive systems as tools. Hence, the new tendency is to give the learner greater responsibility and control over all aspects of the learning process. This need for flexibility, personalization, and control results from a shift in the perception of the learning process. In fact, new trends emerging in the education domain are significantly influencing e-learning (Kay, 2001) in the following ways:

- The shift from studying in order to graduate, to studying in order to learn; most e-learners are working and have well-defined personal goals for enhancing their careers.
- The shift from student to learner; this shift has resulted in a change in strategy and control so that the learning process is becoming more cooperative than competitive.
- The shift from expertise in a domain to teaching beliefs; the classical teaching systems refer to domain and teaching expertise when dealing with the knowledge transfer process, but the new trend is based on the concept of belief. One teacher may have different beliefs from another, and the different actors in the system (students, peers, teachers), may have different beliefs about the domain and teaching methods.
- The shift from a four-year program to graduate to lifelong learning; most e-learners have a long-term learning plan related to their career needs.
- The shift to conceiving university departments as communities of scholars, but not necessarily in a single location.
- The shift to mobile learning; most e-learners are working and have little spare time. Therefore, any computer-based learning must fit into their busy schedules (at work, at home, when traveling), since they require a personal and portable system.

The One-Size-Fits-All Approach

The one-size-fits-all approach is not suitable for e-learning. This approach is not suitable for the teaching material (course content and instruction methods) or for the teaching tools (devices and interfaces). The personalization of the teaching material has been studied and evaluated in terms of the psychology of learning and teaching methods since the middle of the 20th century (Brusilovsky, 1999; Crowder, 1959; Litchfield et al., 1990; Tennyson & Rothen, 1977). The empirical evaluation of these methods showed that personalized teaching material increased the learning speed and helped learners achieve better understanding than they could have achieved with non-personalized teaching material (Brusilovsky, 2003). The personalization of teaching tools has been addressed in the context of new emerging computing environments (ubiquitous, wearable, and pervasive computing). Gallis et al. (2001) studied how medical students use various information and communication devices in the learning context and argued that " there is no 'one size fits all' device that will suite [sic] all use situations and all

users. The use situation for the medical students, points towards the multi-device paradigm" (Gallis et al., 2001, p. 12). The multi-device paradigm fits well with the e-learning context, in which students use different devices, depending on the situation, environment, and context.

WHAT CAN BE PERSONALIZED?

An intelligent teaching system is commonly described in terms of a four-model architecture: the interaction model, the learner's model, the domain expert, and the pedagogical expert (Wenger, 1987). The interaction model deals with the interface preferences, the presentation mode (text, image, sound, etc.), and the language. The learner model represents static beliefs about the learner and learning style and, in some cases, has been able to simulate the learner's reasoning (Paiva, 1995). The domain expert contains the knowledge about the subject matter. It deals with the domain concepts and course components (i.e., text, examples, playgrounds, etc.). The pedagogical expert contains the information on how to teach the course units to the individual learner. It consists of two main parts: teaching strategies that define the teaching rules (Vassileva, 1994) and diagnostic knowledge that defines the actions to take, depending on the learner's background, experience, interests, and cognitive abilities (Specht, 1998).

Based on these four components, individualized courses are generated and presented to the learner. Moreover, the system can adapt the instructional process on several levels:

- **Course-Content Adaptation:** Adaptive presentation by inserting, removing, sorting, or dimming fragments,
- **Course-Navigation Adaptation:** Links-adaptation support by hiding, sorting, disabling, or removing links, and by generating new links.
- **Learning Strategy:** Lecture-based learning, study-case-based learning, and problem-based learning.
- **Interfaces:** To provide the user with interfaces with the same look and feel based on his or her preferences.
- **Interaction:** To be intuitive, based on the user's profile.

ADAPTING/PERSONALIZING TO WHAT?

Most of the four components described in the previous section put user modeling in the center of any adaptation process. In fact, a teaching system's behavior can be individualized only if the system has individual models of the learners. The interaction model is almost the only component in the system that makes use of the device profile in addition to the user profile. Furthermore, in this context, we have a networked system, so the interaction model should take into consideration all the networking and connection features (i.e., bandwidth, protocol, etc.).

As we discussed in the section titled "The One-Size-Fits-All Approach," learners may use different tools depending on the situation, environment, and context.

Based on these parameters, the teaching system's adaptation can be accomplished by using three types of data:

- **User Data:** Characteristics of the user (i.e., knowledge; background; experience; preferences; user's individual traits such as personality factors, cognitive factors, and learning styles).
- **Usage Data:** Data about user interaction with the system (i.e., user's goals and tasks, user's interests).
- **Environment Data:** All aspects of the environment that are not related to the user (i.e., equipment, software, location, platform, network bandwidth).

OVERVIEW OF SOME IMPLEMENTED SYSTEMS

Since the early days of Internet expansion, researchers have implemented different kinds of adaptive and intelligent systems for Web-based education. Almost all of these systems inherited their features from the two well-known types: Intelligent