

XLX and L2P – Platforms for Blended Learning

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The University of Muenster is working on an ongoing project involving the development of an e-learning system called „eXtreme e-Learning eXperience“ (XLX), which is mainly used in support of the exercise portions of technically oriented university courses (e.g., database systems, database implementation, computer networks, workflow management). XLX is part of our “blended learning strategy” that consists of regular classroom teaching and electronic exercise work.

Basic Considerations for XLX

Our motivation for the development of XLX is based on the following observations:

1. Current university classes (and embedded exercises) typically take place in strictly periodic meetings, are bound to certain teaching-environments, mostly ignoring the progress, needs, and time constraints of individual students.
2. The above mentioned target courses for our system, in particular databases and information systems, offer lots of potential for computer-based, interactive, often visualized or animated, training and testing.
3. Students need to practice and train their skills with full-scale Software-Systems (e.g. DBMS) which are often available at the university only. Moreover, if the software is also allowed to be used at home, they don't have the knowledge to install and administer it or their hardware doesn't comply to the installation-requirements.
4. Students spend less and less time and efforts to work up courses and exercises continuously. Reasons for this trend are manifold and shall not be discussed here.

The XLX platform allows us to address the above observations as follows. Students can work on their exercises anytime and anyplace if Internet access and a standard web browser are available. Students may determine their own pace when solving exercises; however, a didactically meaningful sequencing of exercises is enforced by the system (as is a time limit per assignment). Moreover, students may ask for additional exercises either if they have difficulties with the presented material or if they would like to work on more challenging problems. Finally, learning modules based on realistic problems and transparent access to underlying commercial systems raise hopes in more fun and better learning success while solving the exercises accompanying a course.

XLX embodies a personalized learning platform that offers hands-on experience in terms of practical exercises covering a wide range of conceptual, language specific, or algorithmic aspects of a particular field. XLX gives transparent access to underlying (commercial) systems (e.g., database or workflow management systems), which are administrated centrally in our group. As explained above, the XLX platform is designed as a supplement to traditional lectures, not a replacement for them. XLX supports web-based exercise solving, where exercises include “arithmetical” tasks, e.g., in the context of the relational algebra, formulation of queries or programs, e.g., in SQL, XSLT or XQuery, or practical projects based on real-world systems.

The platform organizes courses in terms of closed user groups, where every member has his or her own password-protected account. The platform is divided into five parts:

1. **Learning section:** Even though XLX is currently used for blended learning, we included a module to present SCORM compliant learning objects to present additional material to learners.
2. **Test section:** In this section students are enabled to train their skills concerning course relevant techniques (e.g., XQuery and SQL queries, object-relational features of SQL:1999, transformation of XML documents with XSLT), and they can deepen their understanding of covered algorithmic techniques (e.g., database system algorithms such as algebraic query optimization, two-phase-locking protocol for transaction synchronization, redo-winners protocols for restarts after system crashes).
3. **Submit section / Correction section:** These two sections contain the exercises that have to be solved during the term and ahead of predefined deadlines. New exercises show up in the submit section as the necessary background is covered in class. Solutions can be prepared and sometimes tested in the above mentioned test section. Once submitted, solutions cannot be changed any more by students, and they appear in the correction section on the worklist of a teaching assistant by whom they are corrected and annotated. So far, the XLX platform knows five types of exercises: free-text, multiple choice, SQL queries, XQuery expressions, and XSLT transformations. While the first two of these exercise types are standard ingredients of e-learning systems, the latter three are unique to our system, as they are coupled with transparently integrated underlying systems, in our case a relational database for SQL, an XSLT processor, and an XQuery engine. The integration of different systems avoids technological and administrative barriers as students do not have to install these systems at home; instead, these systems are accessed via standard web browsers. Finally, we note that exercises for the last four of the above types are stored along with solutions inside the XLX platform, which allows for automatic prechecking of solutions and makes life of teaching assistants easier.
4. **Communication section:** As many learning platforms, XLX includes a discussion board for communication purposes and an email list as well as a news section and a download/upload area.
5. **Administration:** To maintain the courses and the platform, XLX provides broad administration functionalities like user administration, content administration, and exercise administration, just to name some of them.

Architecture of the XLX Platform

The XLX platform was designed with several technical requirements in mind. On the client side, it should be independent of hardware, location, or operating systems used; on the server side, it should be able to generate web pages dynamically, provide security as far as personal data is concerned, and deliver 24/7 availability. XLX is based on open source software (except for integrated third-party systems) and is implemented in three-tier client-server architecture. Web clients form the outermost layer and can access the platform via a web browser. A web server builds the second layer and processes client requests. A database server represents the core of the innermost layer which also is the integration layer for different third party systems (like, e.g., IBM DB2). Internet-based client access allows for platform independence on the client side and enables continuous availability. The HTML pages of the XLX system can be rendered by all current browsers, and session cookies are used to identify students and to track their actions; besides, extended browser functionalities such as plugins or Java are not needed.

Experiences

XLX has been successfully used during the last two years in seven different kinds of courses having more than five-hundred students working on exercises. The curricula of these courses were about databases, XML, operating systems, distributed systems, workflow management and computer networks. Each student had to solve an average number of 40 exercises throughout the term. The XML-course was a teleteaching-cooperation with the University of Augsburg (Germany) where XLX was used by the students in Muenster and Augsburg to solve the corresponding exercises. From Mai to August 2002 XLX was used by the University of Essen (Germany) to train students in their virtual program VAWi.

We recognized a high acceptance of the system and especially of the test section. There was a frequent usage of the third-party systems, for example hundred students of one course generated 50.000 SQL-statements to query the integrated DB2 database. Students accessed the XLX-platform from all over the world and all around the clock. Some of them, who stayed abroad, for example in Finland and Australia, used the system to work on the exercises to manage their examination after their return.

Commercial version and demo access

Since the beginning of the year 2003 there is a commercial version of XLX called *Leonardo Learning Platform (L2P)*, which is not only suitable for educational institutions, but also for companies to train their employees on the job. L2P is hosted as an ASP solution by the Leonardo Computing GmbH, Germany (<http://www.leonardo-computing.com>). The platform can be found on the web under URL <http://demo.l2p-online.de>. Its frontend is entirely designed in English so that even foreign learners can use it.

References

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