DESIGN AND DEVELOPMENT ISSUES OF AN XML BASED E-LEARNING TOOL

ADRIAN COJOCARIU, CRISTINA OFELIA STANCIU
"TIBISCUS" UNIVERSITY OF TIMIŞOARA, FACULTY OF ECONOMIC SCIENCE, DALIEI STR,
1/A, TIMIŞOARA, 300558, ROMANIA
a_cojocariu@yahoo.com, ofelia.stanciu@gmail.com

Abstract:
The paper shows an original XML based solution for developing an efficient computer assisted testing and learning system. E-learning contains traditional methods and techniques and by using the information and communication technologies will assist the individual in achieving knowledge and skills in certain fields. It is an accessible way to information and knowledge, and offers new and efficient methods of teaching, learning, permanent education and knowledge evaluation. E-learning technologies may be complementary or an alternative to the traditional education methods. E-learning allows organizing the on-line learning process by subjects or themes, while traditional education is generally organized in groups by age. The e-learning tool we propose is using new and modern technologies, such as XML which has a major advantage in its adaptability, and the fact that data modeled with XML are human readable. Together with visual high level programming languages, such as Visual C++, C#, Java, XML technologies can lead to a powerful e-learning system.

Key words: e-learning, XML, computer assisted testing, computer assisted learning

JEL classification: G32, I22

INTRODUCTION

Studies upon the way people learn and upon the most efficient learning methods have been put up along the time. The comparison of the traditional classroom learning and individualized learning lead to the following conclusions: the learning performance varies from individual to individual; a students asks about 0,1 questions per hour in a classroom; in case of individual learning, when a good student-teacher communication is established, number of questions can get to 120 per hour; students' achievements will double in the last case.

Individualized learning was proved to be too expensive for applying in industry, academic institutes or government, and as a consequence the interest for the use of information technology in training purpose has grown. This way the learning rhythm and information sequence can be adjusted to each individual.

The ITS (Intelligent Tutoring System) concept illustrates best the adjusting at each individual necessities. The "intelligent" term refers to the following characteristics that ITS should provide: real time instruction by request and individual's request and free dialogue between the technology and user.

In the past there were many factors that have prevented the development of ITS, such as the fact that human knowledge science was still immature at the beginning of computers especially in the computer modeling field.

E-LEARNING EVOLUTION

The e-learning field had a permanent evolution along the time from the first types of computer assisted learning to the courses of the virtual universities that are being developed.

The development of CBI (Computer Based Instruction) carried on parallel with the development of ITS (Intelligent Tutoring Systems). The CBI technologies are shared in two major groups. The first one, connected to applied science, involves especially engineers that have followed the technological evolution of computers and have exploited this aspect. The tools they have created have been of a higher performance the result being that more persons that were not advanced programmers were able to create learning contents faster than ever. A new industry of these products and services was created by reducing costs and proving the tools' efficiency. The next step consisted in creating templates to help the person that would create learning contents without having to write program code, followed by incorporating many multimedia resources and creating systems with a lot of functions. These systems have produced instructional contents with a low portability level and that required the designing tools existence in order to work properly in other locations than the one they were made in. The second group refers to advanced research, continuing the ITS prototype producing. The researchers' opinion upon the learning content and CBI was fundamentally different to the tools designers'. They tried to generate instructional experiences and presentations that would be as close as it gets to the individual's needs, using the complex model of the person supposed to be learning. This approach had the tendency to break the sequence logic control from the instructional content and allowed the learning objects' dynamic approach concept in order to achieve specific educational purposes (competences).

The World Wide Web's appearance determined an easier communication thanks to some common standards that had been adopted, allowing easy access to information anytime and from anywhere. At the beginning the World Wide Web was compatible with CBI systems, platform independent and run by servers from distance, while CBI were locally stored and executed. The advantages offered by World Wide Web in education and other fields were quickly noticed and exploitation methods have been searched.

At first, the turning to web based learning has been done by adjusting the "stand alone" products from CD version to online versions but there was still a certain connection with the tools they were created in. This way, at that moment, the content reusability was not assured yet. Therefore, it appeared more obvious the need of creating robust server based Learning Management Systems (LMS). This solution was about to separate the educational contents from the control logic and the contents presentation. This way there was put up a bridge between CBI and ITS.

In the last few years, organization widely adopted e-learning solutions to replace the classical training methods that were based on putting together classes where a teacher would teach using chalk and board. Nowadays digital contents have a great importance, especially the ones that are created from learning-object approach perspective, represented by e-learning courses. Digital contents appear to be leading to education personalizing at a new refining level.

The new technologies are offering great possibilities regarding education, due to the hardware and software development. One of the main objectives of modern education is the permanent improvement of the teaching and learning processes by using the available multimedia technologies. The multimedia technologies offer a connection between the audio-visual effects in order to develop complex and suggestive courses and presentation. The evolution of the information and communication technologies has also lead to the development of e-learning technologies. Due to the Internet, the web product generating tools, the audio and video recording, there have been elaborated online courses and educational software. By virtual learning we understand e-learning and educational software, and it is considered to be a very efficient and useful way of

learning. This kind of education allows the student to chose what, when, where and how much to learn, situations that are according to the new paradigm of education.

It is important to understand the e-learning and educational software concepts and to show their objectives. E-learning contains traditional methods and techniques and by using the information and communication technologies will assist the individual in achieving knowledge and skills in certain fields. It is an accessible way to information and knowledge, and offers new and efficient methods of teaching, learning, permanent education and knowledge evaluation. E-learning technologies may be complementary or an alternative to the traditional education methods. E-learning allows organizing the on-line learning process by subjects or themes, while traditional education is generally organized in groups by age.

By integrating new technologies into methods of education, by conducting researching activities in the areas of standards and the cognitive psychology methods, we develop actions regarding the improvement of the teaching-learning-evaluation activity on any level or form, and in any curricular area.

The teaching-learning-testing process is going through important changes due to the e-learning technologies. The education system is definitely involved in the foundation and building of the information and knowledge society.

The educational software is considered to be any software application that is able to run on a personal computer and that shows a certain topic, theme or practical experience, or a course, being a great alternative to the traditional education methods.

Roger Bohn claims about the learning process that "*Learning is evolution of knowledge over time*", considering the quick evolution of the information and communication technologies. Technology Based Learning is significant when referring to a education forms that is using other education tools that the traditional class-room forms that include computers, television, multimedia machines. Computer Based Learning has proved an important impact upon the knowledge domain.

THE XML SOLUTION

Data management is a very important aspect of the learning and testing system, and as the data amount is continuously enlarging, one has to find proper solutions to store and manage data. XML (eXtensible Markup Language) offers an organized and elegant way to store data. Its main advantage is the adaptability, and the fact that data modeled with XML are human readable, which in many cases proves to be a great advantage.

XML is a modern format and most if the visual high level programming languages, such as Visual C++, C#, Java, are capable to process and manage XML files and the data stored in these files.

Modeling data in XML format also offers the possibility to validate data by defining so called XML schemes. The XSD (*XML Schema Definition*) files define rules and patterns the XML file should fit in. The assemble made up by the data models represented in XML format together with the XSD schemes and the applications developed in programming languages that offer function libraries for processing these data models (.Net, Java packages, Qt) represents a powerful and efficient solution, but mostly an elegant one, according to the object oriented programming point of view.

There are two main methods for parsing XML files: SAX and DOM. Each of these methods has its own advantages:

- SAX (*Simple API for XML*) is an event based method: at the parsing moment of each XML entity of the model a signal is output, signal which is received by the software developer that uses the SAX functions and will be able to realize the internal model of the data from the XML file. Among the main particularities of a SAX parser, we can mention the fast processing and simplicity.

- DOM (*Document Object Model*) is based on loading the whole content of the XML file in the memory and on the disposal of its elements to the software developer in the tree model which is typical to the format. A derived advantage of this parsing way is that in any moment one can access a node of the XML file through the functions and data types offered by the DOM function library implemented in a certain programming language. Among the main characteristics of DOM parser we mention the model hierarchy and the easy serialization.
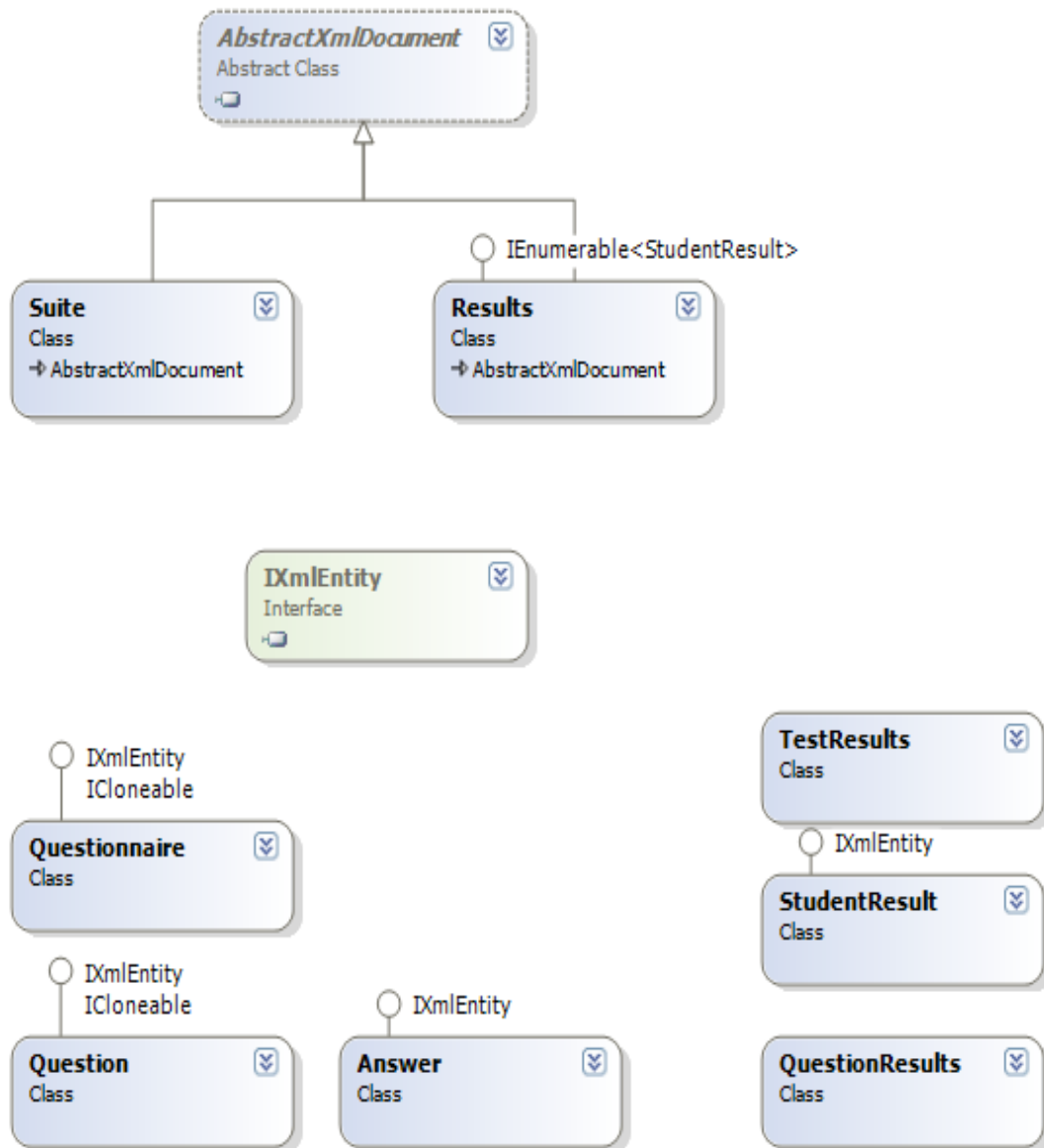

Figure 1. Class diagram for the GrileX application

We have developed a software application for quiz-based testing. The application, called *GrileX* has been developed in the C# programming language, in the Visual Studio .Net 2005 environment. Data is being stored in XML files, and the correct answers are coded with MD5 (Message-Digest algorithm 5) algorithm. This security algorithm is a widely used cryptographic hash function with a 128-bit hash value [wikipedia]. MD5 has been used in a wide variety of security applications, and is also used to check the

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integrity of different files. The class diagram on which the software application has been developed is presented in Figure 1.

The software application is based on the client-server architecture, and actually a suite that consists in three parts: a Server that runs on the server computer, the Testing application that runs on the client computers and the Administration application which allows configuring the tests. The Administration application can only be accessed by the professors using an ID and a password. The Testing application is the actual testing module, used by the students. Before the beginning of the test they enter their personal data (name, year of study, subject) and at the end of the testing process the result will be shown in a dialogue window. All this data regarding a student is sent to the Server so the professor is aware and supervises the whole testing process.

So far, computer assisted testing proved to have several advantages, but also disadvantages.

Some of the advantages are:
- the increase of the evaluation process speed;
- higher objectivity;
- the decrease of evaluation errors;
- assures transparency in the examination process;
- diminishes the nervous and emotional state of the student.
  Some of the disadvantages are:
- requires appropriate technical support;
- may reduce the capability of verbal communication of the students;
- may lead to the loss of argumentation and discussion capability.

In spite of the above shown disadvantages, the so far developed application has encountered a real success, from students and teachers, and for this reason we are aiming to extend its features and develop a complex learning and testing system that is using new and modern technologies, such as XML.

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