WEB-BASED LANGUAGE LEARNING: AUTHORING AND ASSESSMENT TECHNOLOGIES

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Using up-to-date web technology we designed 13 language activity templates using *XML*. On the authoring side, for each activity type, we created an easy-to-use web interface to *XML* templates allowing teachers to create language exercises on-line easily. The interfaces create the *XML* code for the given exercise and an on-line parser transforms the *XML* specification into a dynamic *HTML* page inserting all the necessary scripts, objects, images and links for the selected exercise type. The final page is ready to be saved, enriched with audio/video samples and inserted into a module/course using the support provided. We also make provisions for language skill assessment (placement test or final academic test), designing a system for writing, administering and making reports on tests for thousands of students in a secure and efficient way. The tests use a similar schema for all the available languages, for the assessment of grammar skills, reading skills and listening/comprehension skills.

1 Introduction

The language centre at the University of Bologna has been involved for many years in teaching languages using multimedia software in self-access environments. Starting from this paradigm, several projects have been developed to set up complete language courses for university students, military personnel, school children etc. [2,4,5,8]. The natural evolution of such a system started 10 years ago using Hypercard and Toolbook programs to produce standalone applications. Now the paradigm is radically changed and the need for more flexible, web-based tools for distance learning drove us to devise new environments for designing language learning materials as well as on-line testing systems. Two new projects rely on such an environment for course design needs.

With the new reform, started in the academic year 2001/02, a specific language test, with associated credits, has been introduced into all the new university curricula. For this reason, two years ago, a new project, ALTAIR [6], has been started for testing all the university students applied in the new university curricula and to provide them with all the learning materials needed to prepare them to pass the language tests. The project consists of two separate phases: the learning phase and the testing phase. In the first phase we have to provide suitable teaching materials and adequate procedures to prepare a large number of students (12,000 per year) for the final exam, while in the second phase we have to set up procedures to assess these students.

2 The first phase: learning

2.1 The requirements

Before describing the new tools used to devise and manage the learning materials, let us examine the requirements impacting on the design stage. What we needed was an authoring tool to create web-based exercises, modules and courses for language learning. Such a tool had to be flexible, and able to accommodate the necessary procedure for the designing of language learning materials in the form of a large variety of exercise types. These materials may include, multimedia content as text, images, audio samples, and video clips being used at the same time.

A central requirement is the simplicity of the authoring schema. One of our goals was the absolute necessity for such tools to be used directly by language teachers, without the need for them to learn complex interfaces, document formats and style-sheet or complex graphical layouts. The tools had to accept the simplest input from teachers, ideally only exercise texts and multimedia contents, and to produce ready-to-

[1] The authors drafted this article together. As far as academic requirements are concerned, F. Tamburini takes official responsibility for sections 1, 2 and 4 and S. Paci for sections 3.

use teaching materials for distance learning to be used in a self-access environment. From the student perspective the materials had to be attractive, rich in different stimuli, and from the technical point of view, they had to be used on a standard widely diffused interface. Another important issue was the option of accessing the materials world-wide through the net.

2.2 The adopted solution

Very few free technologies were available to satisfy such requirements. The quite recent improvements of Web-based technology, in particular for dynamic HTML mark-up specifications and JavaScript additions, drove us to devise a system heavily based on this technology. Using such technology, that is widely available and familiar to most young people, all the tools needed to design multimedia applications for language teaching can be adequately implemented. Drag & drop features (using layers), dynamic changes in the page layout, appealing interface design and multimedia delivery are examples of such features.

Using this technology we designed an authoring tool that allows teachers to directly specify the exercise contents using a pre-designed **XML template**. All the XML templates are available on the web. The teachers can insert the XML specifications of a specific exercise type (presently we have 13 on-line templates), and an XML parser builds the final DHTML page inserting all the necessary scripts, interface objects (buttons, boxes, menus, layers, etc.), images and links for the selected exercise type. The final page is ready to be saved and inserted into a module/course/activity. This was the first step in the tool design. Managing the XML code directly is sometime difficult for teachers, especially for complex exercise types. To solve this problem we designed **Template Interfaces** that allows teachers to build a specific exercise interacting with a dynamic page using a web browser. These interfaces, one for each exercise type, allow the teacher to design the desired exercise in a simple way, putting the contents in specific fields and building the exercise step-by-step through interactive operations. At the end of the process the interface produces the XML code automatically, considerably simplifying the teacher work. It is important to note that all these tasks use the same technology described above: a web browser and DHTML/Javascript pages. Figure 1 shows an example of the generation process.

The XML parser plays a central role in such schema. It has been implemented in C++ on a Unix machine and is able to translate our XML templates into the final web documents adding all those features (multimedia links, scripting additions, etc.) needed for the correct use of the language activity, as well as the design of a proper interface with standardised, but appealing and reconfigurable, layout. Such a structure allows for a neat separation between the process of creating language material by the teachers, and all the technical issues needed to publish web-based documents. Such a generation model will allow the teachers to use the templates with minimal training sessions. They do not have to be concerned about local applications and XST specifications. Technical personnel can manage all the technical issues directly modifying the parser behaviour through configuration files. For each exercise type a DTD specification was defined for checking the XML syntax and there is support to link the DHTML generated files into teaching modules or entire web-based courses.

For fast delivery of audio and video samples we compress files with MP3 and DivX (mpeg4) technology, obtaining excellent quality, as well as a good compression ratio for network delivery.

3 The second phase: student assessment

3.1 The requirements

The second crucial step of the ALTAIR project is language assessment. We were in charge of designing a system for writing the tests, administering them and making reports on for thousands of students in an efficient way. The project required two types of tests:

- A placement (or entry) test for students that had to start the ALTAIR multimedia course in order to determine their language level at the beginning of their language study and to advise them on the most suitable learning path through the multimedia materials. According to the teachers guidelines, this test had to be "*adaptive which can often pinpoint a test taker's ability level faster and with greater precision then paper and pencil tests*" [10].

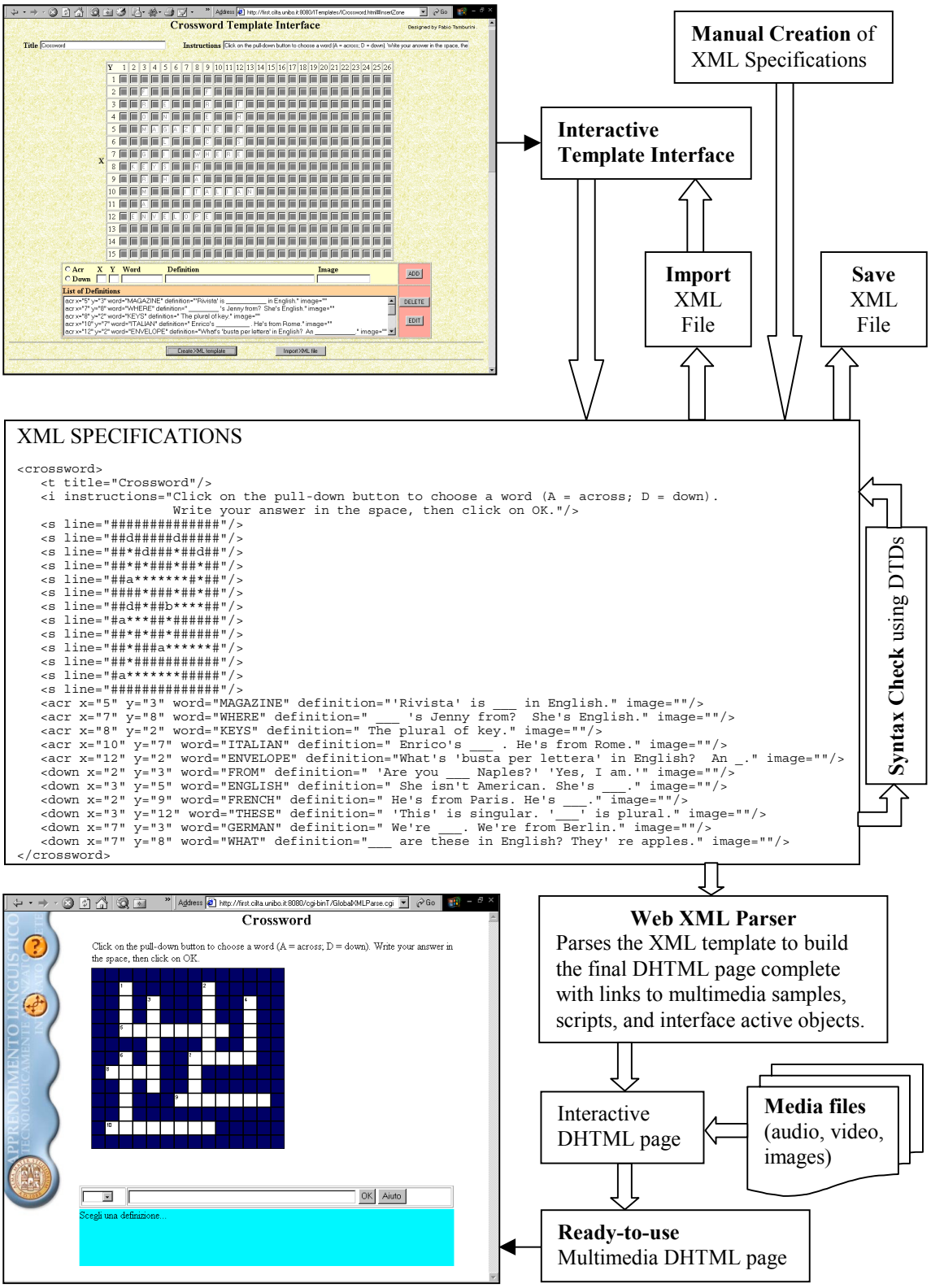

Figure 1: An example of the language learning materials generation process.

- An academic test for all the students who need language credits in their academic study. This test replace the old exam with the teacher, so it had to be a "pre-set test" [1], non-adaptive, very secure and, according to the European framework, it had to assess different language skills: grammar, reading, listening and comprehension.

All the tests had to be delivered to a large number of students (2000-4000 for each session), they had to take place in different laboratories and at different times, and we had to administer remotely the sessions and the tests upgrades.

3.2 Advantages and disadvantages of the chosen technology

All these requirements led us to use a Web Based Test (WBT) [3] that is a computer-based test (CBT) delivered using Internet. It is written in DHTML and enhanced by scripts. The advantages of this technology, also compared with the old CBT, are well known in the literature: the test is "anyplace, anytime". Anybody connected to the Web can complete the test at any time from anywhere in the world. This is not the case for traditional CBTs which need special delivery platforms. Moreover, for any dichotomous test (one that has only right/wrong or closed answers), the scoring can be handled by a script providing test takers with immediate feedback on their performance.

"*A great limitation of WBT is their lack of security with respect cheating and item confidentiality*" [3]. In fact it is impossible to ensure that the test taker does not download the test or receive suggestions and help. To deal with this problem we decided to organise exam sessions in large supervised laboratories equipped with more than 70 computers, where students are identified before entering and all the downloading functions are disabled. Another aspect connected to WBTs is the problem of secure data storage: test taker responses must be automatically stored on the server. Special care has to be taken to avoid damage caused by system failure and our choice was to design a WBT that run client-side and use a computer server for retrieving items, holding the test, and storing students' answers.

3.3 The web test architecture

The technological skeleton of the Web test system is based on Web technology and DBMS systems as shown in figure 2. The student or test taker does all the test using a Web Browser in the laboratory. The pages are written in DHTML and enhanced with Javascript and PHP codes and are stored in an Apache web server. All the necessary data are stored in a MySQL database server and it can be accessed via an ODBC connection to do all the query and the relevant statistics to optimise the test performances.

The Javascript client-side scripting language is used:

- to secure the Web environment disabling navigation bars, tool bars, and all the other functions to disable downloading and hide solutions;
- to control student interaction with the test pages preventing a student from listening to audio files more than twice, and to stop the recording;
- to check the time of the test, and stop the student at the end of the test, to calculate the time spent and to give him or her an idea of the running time;
- to make corrections and calculate the score giving immediate feedback;
- to randomise versions, question and answers and to minimise the risk of copying among students.

PHP scripts were added to the html pages to manage student data and transfer them to and from the MySQL DBMS, storing user data, answers and scores at the end of the test. The data are passed through HTML forms and PHP variables are sent to the MySQL DBMS. There are many types of database software available and the most powerful ones are servers such as Oracle, Microsoft SQL server and MySQL. We used the latter because it is completely free and well integrated with PHP language.

All the tests were developed for English, French, German, Spanish and Italian and use a similar schema for all the available languages. The academic tests consist of three parts: the first part for the assessment of grammatical skills, the second part for testing reading skills, and the third part for listening/comprehension skills. The placement test is different and consists of two parts: a close C-Test in the first part and a multiple-choice exercise in the second part. The second part contains adaptive exercises that depends on the total score of the first part and this is done using Javascript scripts.

When the test is finished the students receive immediate feedback; for the academic test, if they pass, they receive a report (*verbale*) to sign, while for the placement they receive a report containing written advice about their language level. Test administrators can then obtain different types of reports from the database according to the test type through ODBC interfaces and MS Access. These reports were developed for statistical purposes and to improve and validate the evaluation system. They provide a graphical analysis of data such as question difficulty, analysis of answers, mean time for solving each part and so on.

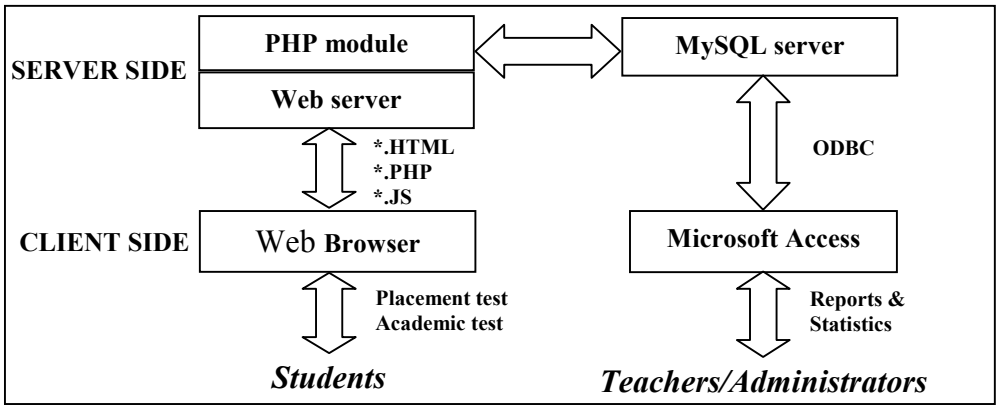

Figure 2: The overall schema of the technological system for managing the ALTAIR tests.

4 Conclusions

We are using the templates, and this schema for XML to DHTML page generation, in two major projects for multilingual language teaching. This process is proving to be flexible, efficient, and well suited to teachers needs. The teaching staff appreciated this schema, as it not only allows for the creation of a single exercise serving their individual needs, but at the same time lends itself to a greater production of exercises for larger projects. The production of materials from these templates is currently in use as a learning tool at all teaching levels for different languages (from elementary to advanced levels) and for different age groups from children to university students. The testing system we developed has also proved highly efficient. We have already handled sessions for 3,000 students at a time without any particular problem.

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