16 A Gradual Process for Integrating E-learning in a Higher Education Institute

Igor Kanovsky, Rachel Or-Bach

Emek Yezreel College, Israel
igork@yvc.ac.il
orbach@yvc.ac.il

Abstract

We describe an incremental process for integrating E-learning in a higher education institute. Our basic assumption is that the burden of integrating E-learning lies mainly on the shoulders of the teachers. We suggest a process based on XML technologies that enables the teachers to: (1) separate content from presentation and concentrate on content (2) develop learning materials incrementally and implement easily at each stage (3) reuse any learning materials they have already prepared (4) reuse learning materials prepared by other teachers. In this paper we describe the process along with the various roles of each of the following: the technology, the support technical team, the individual teacher and the evolving community of practice.

Keywords: XML, incremental development, reusability

1. Introduction

Integrating E-learning in a higher education institute is not an easy task as it involves several groups of interest (such as students, teachers, technicians, policy makers etc.), as well as different kinds of considerations (such as economic, quality assurance, organizational etc.). Because of the obvious complexity it make sense to do it gradually, in scalable steps. Scalability is considered a desired characteristic, but the main question to be answered is the nature of the scalability, on which dimensions the scalability should be planned. In this study we propose a way to implement some dimensions of scalability for integrating Elearning in a higher education institute. The burden of integrating E-learning lies mainly on the shoulders of the teachers, therefore, any planned process should take into account the capabilities and limitations of the teachers and should be directed at steps and manner that suit each teacher. The technology that enables this is based on XML, where it is possible to separate between issues of content and issues of presentation. In this way we can have a relatively small multidisciplinary technical team that deals with the implementation issues, while the teachers can concentrate on the content and the ways they would like the content to be presented for effective learning. Teachers can get more and more creative and can integrate more and more interaction possibilities as the experience with the course evolves and as the overall experience of the college teachers evolves. XML is a language of tags that enables the tagging of content elements for the Internet. The pool of tags that one employs is defined by a schema that enables to distinguish (automatically) between adequate tags and other strings. Our plan is that this schema will be defined gradually according to the various possibilities that teachers employ in their online courses. The set of useful tags is expected to evolve through the teachers' experience with online learning and the expected (and encouraged) interactions and influences within the teachers' community. This is the scalability we want to employ and implement - a gradual construction of XML schemas. The advantage of our approach is that the metadata tags, which is the principal concept of XML, evolve from the teachers' conceptions, as opposed to metadata tags defined, and so forced on, by external experts. This methodology enables the teachers to develop a course according to their own conceptions, expressed by their choice of metadata tags, for their further reuse. The use of these tags will result in an automatic translation to an online learning unit. Teachers will be guided to evaluate the results and describe their further expectations of presentation, interactivity etc., which will be considered for the next stage of the XML schema. The task of the special technical team is to guarantee the respective proper presentation for each teacher processed material along with the development of an integrated dictionary (of metadata tags) for a group of teachers. This dictionary enables reuse of learning material at the organization level. The whole process is iterated for a gradual process of integrating E-learning in the educational activity of our college.

2. Integrating E-Learning in higher education - ways to go

We see the teachers as the most important factor determining the success of E-learning implementation program. Teachers can be viewed as the bottleneck or barrier on one side and as the principal carriers of change on the other hand. Several approaches can be employed to empower teachers. One approach is to introduce an e-learning delivery system such as WebCT, BlackBoard, HighLearn etc., which are easy to use and can be a platform for already prepared learning material. The main disadvantage here is that usually this approach does not involve any meaningful change in the learning materials and learning methods, in a way that takes advantage of the computer. Another approach is using authoring tools such as

ToolBook, Authorware etc. A disadvantage of this approach is the time it takes to learn to use such a system. With both approaches usability of learning materials by the same teacher in another context or by other teachers is problematic.

Use of XML technology, which will be described in more detail in the next section, enables separation between content and presentation and so provides a way to deal with some of the disadvantages just mentioned. Because it is possible to let the teacher not bother with the presentation, it is a lot easier for him to prepare the learning materials. This separation of content and presentation also enables reusability and gradual development of learning materials in incremental steps that can be tried and evaluated.

Fitzpatric (Fitzpatric, 2001) describes an XML approach to creating an interactive multimedia learning environment for science curriculum. The motivation for using XML in this project was that certain parts of the same basic content or learning material may be required to respond to different learning occasions, e.g., a lesson, a tutorial, or an exploratory exercise. Cap (Cap, 2000) advocates the use of advanced mark-up techniques for computer-based education, especially for standardization of content structuring and usage patterns. Use of XML technology can be further used for dynamically generating interactive course adapted to the student's goals, preferences, capabilities, and knowledge; as demonstrated in the ActiveMath learning environment (Melis et al., 2001).

Our approach is similar to the previous examples with regard to the use of XML technology to enable flexibility and reusability, but our overall goal is different. Our goal is to establish a process of integrating E-learning in our college, a process that is incremental and adhere with teachers' conceptions, habits and limitations, as opposed to forced standardization. The following sections elaborate on the use of XML and related technology and how the teachers can use it.

3. XML technology - What is it and what does it enable

XML stands for eXtensible Markup Language. XML was designed to describe data. XML tags are not predefined; one must define his own tags. The idea was to construct a genuinely open standard, driven by user needs. These needs include:

- **Extensibility**, to define new tags as needed.
- **Structure**, to model data to any level of complexity.
- **Validation**, to check data for structural correctness.
- **Media independence**, to publish content in multiple formats.
- **Vendor and platform independence**, to process any conforming document using standard commercial software or even simple text tools.

This list of users' needs, which motivated the development of XML, is exactly what is required for designing E-learning materials.

It might be worthwhile to explain what is XML by contrasting it with the familiar tagging language HTML that is used widely in E-learning. HTML is a tag language (more formally, a markup language) -- a set of standard delimiters with standardized meanings that can be put into documents in order to indicate the role of particular pieces of the document. XML on the other hand, is a technology that allows the creation of an unlimited number of different markup languages for different purposes. The point of XML, is that all the various special-purpose languages that can be defined using it can be parsed by a single standardized processor small enough to be built into every web browser. This is the reason that XML is becoming so popular.

Along with the use of XML technology for content, XSL technology can be used for presentation. Presentation files, or stylesheets, are based on XSL (extensible Stylesheet Language), a sophisticated language that visual designers can use to define page appearance. The XSL stylsheets are applied to the XML content files to obtain files, which can be viewed using any web browser without special plug-ins.

XML tags have two major roles (Mizoguchi, 2000): (1) explication of class for each specified text in the document and (2) define arbitrary "data structure" for interpretation of the multiple fragments of texts. These tags provide metadata, which is a data of the data (the document). Examples of XML implementations already exist for chemistry via the Chemical Markup Language - CML (XML-CML.ORG, 2000), mathematics via the Mathematical Markup Language - MathML (Kamthan, 2000), and music via the Music Markup Language - MusicML. There is also development of XML standards for Higher Education www.PESCXML.org .

We do not strive to compliance with some standardization efforts. We can use them for some inspiration, source of requirements or terminology; an inspiration and not constraints. We want the teachers to use their own tags and maybe get some consensus among themselves on some sets of tags. Big standardization projects are motivated by the idea of publishing learning objects, while we are motivated by supporting teachers in using XML technology in a way that enable reuse of existing learning materials and enable easy modification and immediate testing. Such requirements make it easy to reuse learning materials for different levels of students and for different versions of a course.

4. The process

The aim of our paper is to describe the process for the incremental implementation of E-learning in a college. As was stated before, the teachers are the most important factor determining the success of an E-learning implementation program. A basic assumption is that a higher education

teacher has already some viewpoint on the subject matter he teaches (significance, issues to emphasize, relation to other topics, etc.) and also a teacher has some viewpoint on how this subject matter should be taught (sequence, type of tasks, media for demonstration etc.). Beside the viewpoint, a teacher usually has some teaching materials he had already accumulated, prepared and used. Different topics have different terminology, different learning objectives, different emphasizes etc. For example, in mathematics, a proof might be an important learning object (or objective), while in political sciences a debate is an important learning object (or objective). We envision a process that enable a teacher to stick to his conceptions of the subject matter and to the way he believes this subject matter should be taught. According with this basic guideline of ours, we provide the teacher with open and flexible facilities to put his course on the web. We provide him also with various facilities to share and negotiate possible tags with other teachers and the technical team.

The incremental process we are talking about is actually combined of three incremental processes for: (1) an individual teacher (2) a group of teachers teaching similar topics (such as teaching programming with different computer languages to varied audiences) (3) the whole group of the college (or any other higher education institute) teachers. A technical team supports all these incremental processes. The vision is that a teacher gradually improves his course by adding content, adding interaction facilities (interaction with the learning material or interaction among students) etc.; through reuse of his learning materials and maybe even learning materials of his colleagues. The group of teachers of similar courses incrementally (with the help of the technical group) establishes a mutual dictionary (of metadata tags) that enables sharing and reuse of learning materials. And as for the third process, the college gradually establishes norms and procedures for developing E-learning within the college, which enable reusability, collaboration among teachers and some standard interaction facilities for students.

5. The technical support team

The technical team is an interdisciplinary team, composed of programmers experienced in Internet technologies, experts in graphics and interface design, and experts in instructional design. Experts of interface design and of instructional design are faculty members. The technical team is expected to support the teachers while the emphasize is on support initiated by the teachers, not support that is imposed on the teachers. The support is combined of guidelines for using XML technologies, examples, and support for communication and negotiation of XML tags' meaning among teachers, especially among teachers from the same or similar subject matters.

On top of supporting the teachers through the creation of XML files, a major responsibility of the technical team is to enable reusability of learning materials. The support for the individual teacher should promote the reusability of learning materials by the same teacher (e.g. an example that demonstrates several principles, an exercise that serves also as an exam item etc.). For reusability among teachers, which can make E-learning commercially attractive, the technical team should look carefully into the "dictionaries" of the individual teachers, check for parallel notions and initiate meaning negotiation processes between teachers. Such processes, beside enabling a common dictionary, are very important for the college ongoing process of making sure learners are getting a coherent and relevant view of their field of study.

6. The development process from the teachers' perspective

It might be instructive for understanding the overall process to describe the development process as seen from the teachers' perspective. The technical team gives the teachers basic guidelines along with some examples. The basic guidelines include the following:

- Introduction to XML.
- An editor and instructions for writing XML documents.
- Explanation of the use of "name-space" and the requirement of distinguishing between tags of pedagogical meaning (such as lesson, exercise) and tags related to the topic to be taught.
- A dictionary of tags that are mandatory.
- A common dictionary of tags that can be used.

Along with the guidelines, a teacher can get examples of the XML document other teachers had already prepared. With these guidelines and examples, what we call "starting bundle", a teacher can prepare an XML file for his course, using whatever learning material he had prepared before.

The technical team then review the file, prepares (or reuse) XSL relevant file(s) and shows the teacher the online learning material that results from the XSLT conversion. A process of corrections and improvements follows until a satisfactory online learning unit is produced.

From this point on the teacher can modify by himself the learning material; update, change, add examples, illustrations, exercises etc. After any modification, the teacher can also check by himself how it works online. The teacher, of course, can turn to the technical team for support at any stage. The whole process is depicted in Figure 1.

When a teacher prepares any new learning materials he can reuse the XSL files, which were already developed and used for particular presentations in his previous online courses. In this way the teacher can prepare new online courses by himself, with no (or minimal) involvement of the technical team. Figure 2 depicts this mechanism.

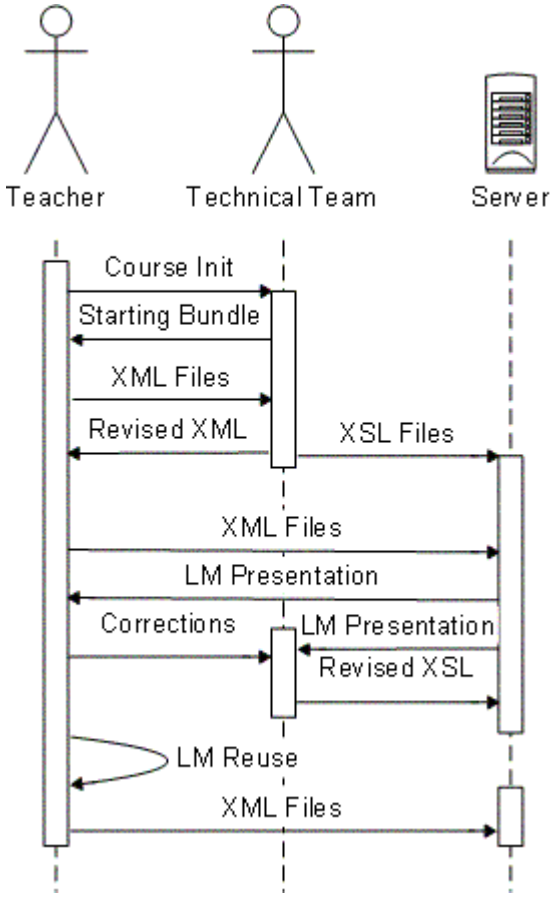

Figure 1: The process of online course development. LM-Learning Materials.

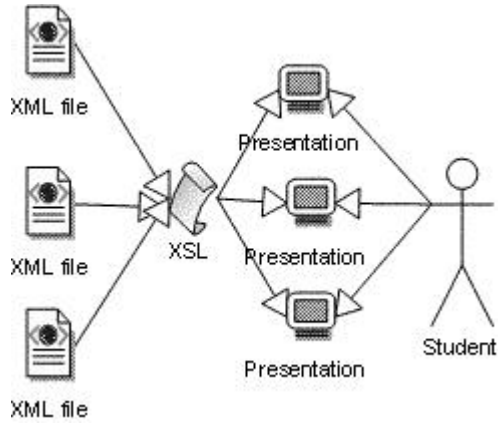

Figure 2: Mechanism for incremental development by a teacher. Once XSL file has been created, the teacher can present new LM in the same way without the technical team involvement.

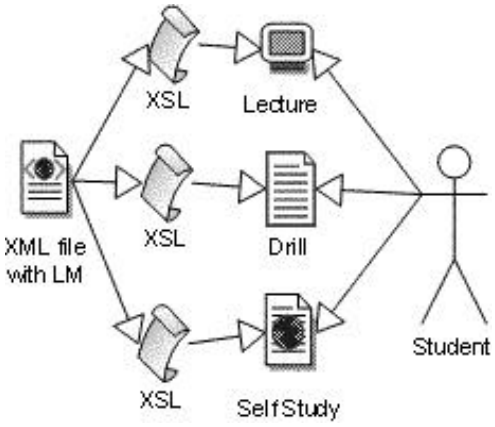

Figure 3: Mechanism for Learning Materials reuse. One XML file with different XSL files can present different part of LM in different ways.

Different XSL files can be used for achieving different presentations of the same learning materials. For example, a question with the respective answer can be used during a lecture for explaining an issue, but can also be presented without the answer for drill and practice. Figure 3 depicts this mechanism.

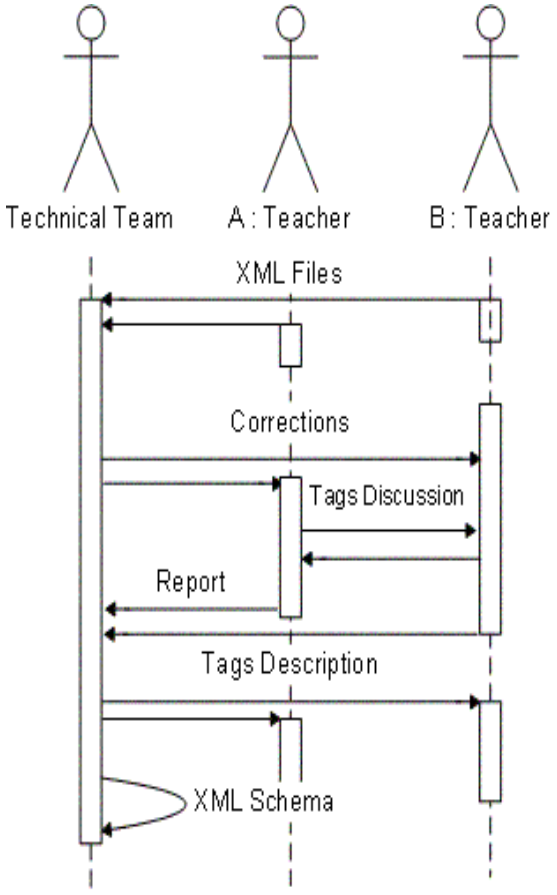

Figure 4: The process of shared dictionary development.

As more teachers are joining the process the pool of examples grows and the dictionary of tags expands. The technical team tries through negotiation with the teachers to establish dictionary tags that are agreed of by teachers of similar topics. These shared tags are necessary for reusability of learning material, which is a main goal of this project (Figure 4).

7. Discussion and future plans

Use of ICT in education should promote learning. This means that considerations about how to integrate E-learning in higher education should emphasize expected effects on learning. Many of the platforms used for E-learning do not enable the teachers the flexibility they need for supporting learning in various situations, for a variety of students etc. We argue that the use of XML technologies provides teachers with the required flexibility and reusability options. As for the higher education institute itself, use of XML technologies in the way we described, enables scalability of the integration process, reusability of learning materials, some uniformity in learning materials, and facilities for quality assurance.

In accordance with our view of the teachers as the main carriers for integrating E-learning in higher education, we were concerned with the needs of the teachers. The main advantages for the teachers that we see in our approach are:

- Teachers can concentrate on content without worrying about style and formatting.
- Teachers can reuse learning materials. These learning materials can be their own from before or during the process of creating an online course, and can also be learning materials of other teachers.
- Content modules can be used in other contexts (e.g. in related courses, for different skill levels).
- Indexes, summaries, glossaries etc. can be generated automatically.
- Evolvement of a community of practice. Through the dynamic establishment of shared dictionaries of XML tags, teachers (especially from related subject matters) dynamically create communities of practice.

Our future plans include the implementation and evaluation of this process in our college, generation of templates, and two research and development directions based on the flexibility that XML technologies provide. The generation of templates will facilitate the first stage of using this XML approach by the teachers. The templates will be based on instructional design principles, demonstrating typical pedagogical strategies. The two research directions we plan are:

1. Using the flexible rendering of the learning materials (by XSL files) to allow experiments with screen designs, navigation concepts etc.
2. Using XML technology for knowledge representation that enables adaptation of learning materials according to learners' needs, learners' profiles etc. The tagging mechanism and the respective schemas can be used for both the diagnosis process for obtaining a learner profile and also for an intelligent tutoring process that adapts learning materials to the learner profile and the context.

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