Developing A Web-Based Learning Education System

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ABSTRACT: In recent years, number of web-based distance education systems has rapidly increased as a result of improvements in the Internet. Universities have an important role in this situation. Now-a-days, Distance education systems become more attractive. So, universities and other institutions began to make their education activities by using tools and services such as electronic books, electronic mails and conference calls. In web-based learning, education has triggered a shift from the teaching paradigm to the learning paradigm. As a result, students are becoming more independent from the teacher. In this paper, we focus on the application of an evolutionary software development process model to translate Web-based learning requirements into a system that provides learners with information that supports effective learning. While designing the system, MS SQL Server 2005, ASP.NET and C#.NET and some other programming languages were used for the database, web interfaces and programming, respectively. It includes system scope and learning environment, end-users, and its functions such as requirement usability, system constraints, design, coding and testing etc.

I INTRODUCTION

Instructional Web Site Design Principles specifically carried out to derive generic principles for site design, as opposed to presenting multiple models based on various learner, content, and outcome variables. It is my view that such a focus can serve an important function as a starting point, and as a foundation during this early phase of research and theory applicable to web-based instruction and training. Tertiary education throughout the world today is brimming with activity given to the design and development of on-line courses designed to support flexible learning. The Web pages of all universities proudly proclaim their preponderance of on-line courses and often the scope of universities' on-line learning offerings is used as some measure of its quality and performance.

The real value of Web-based learning lies not in accessing knowledge at any time, any place, and for anyone, but helping the right students to acquire the right skills and knowledge at the right time in order to function as active, self-reflected and collaborative participants in the information based society. Unfortunately, much of the development of Web-based learning is carried out without a true understanding of issues that are proper to Web-based learning, partly because marketing advertising and technologies still drive the construction process.

Learning cannot be designed as a conventional task, as though it were just another kind of work that can be implemented with conventional approaches with a number of inputs and outputs. This because learning is a by-product of understanding rather than an activity that can be supported directly. Therefore, progress in Web-based learning will come only from a better understanding of the learning process and not automatically from improved technology. Web-based learning is a means of implementing education that can be applied within

different educational paradigms: distance learning, blended learning, and face-to-face.

- First, Web based learning may be used as online resource for distance learning at any time, any place, and for any student.
- Second, Web-based learning may be used for blended learning. In this case, Web-based learning does not mean to replace face-to-face learning, but to extend it with electronic means. Blended learning is a meaningful integration of Web-based learning elements with face-to-face meetings and other traditional learning settings.
- Third, Web-based learning may be used as supplement to classroom face-to-face teaching. It remains to be seen which solution has the potential to improve the quality of learning.

In this paper, we focus on the application of an evolutionary software development process model to translate Web-based learning requirements into a system that provides learners with information that supports effective learning. While designing the system, MS SQL Server 2005, ASP.NET and C#.NET and some other programming languages were used for the database, web interfaces and programming, respectively. It includes system scope and learning environment, end-users, and its functions such as requirement usability, system constraints, design, coding and testing etc.

II RELATED WORK

An ideal process model for the development of Web-based learning would help content developers, instructional designers, teachers, Web developers, and administrators address the complexity of Web-based learning, deal with evolution and change, and deliver the system as quickly as possible. However, considering that developing Web-based learning is not simply another form of software development even if both involve analysis, design, and implementation, there is not necessarily any existing software development process model that makes sense for Web-based learning. Thus, considering that it does not exit any software development process model that fits the specifics of Web-based learning, it may be necessary to combine the advantages of the existing process models from traditional software engineering.

First, the linear sequential model called "waterfall model" is not flexible enough to be applied to Web-based learning, because it does not deal with evolution, change and feedback to previous development phases. But, this model is important from the management point of view since it can help the development team plan everything from the very beginning (Powell, 1998; Pressman, 2000; Sommerville, 2001).

Second, the spiral model is complicated and difficult to manage, but it can help the development team in particular during the analysis phase to reduce risks by focusing on what really matters.

Third, because of the evolutionary properties of Web-based learning, it appears that the evolutionary development process model is flexible enough to be applied to Web-based learning, because it modifies an early prototype, through continuous cycles of implementations, evaluation, and redesigns, until it provides all required requirements. In addition, this model involves feedback to earlier development phases and to the end users. Traditional evolutionary process models are however not without some problems for Web-based learning systems, which are subject to constant change. Thus, it would be difficult to determine when they are going to end.

Finally, considering that the reuse of previous components is a necessary option for Web-based learning systems, it is quite reasonable to rely on reusability.

III SCOPE AND LEARNING ENVIRONMENT

The system scope can be determined through the identification of the learning environment that directly influences Web-based learning. The

system and the environment influence each other by exchanging information. The environment can be characterized as the context of the system, which can best be described with six dimensions: the course content, learner, legal, ethical, technical and usability issues.

- The *course content dimension* refers to the content of Web-based learning that is delivered online. Content is a key element since it is one of the differentiating factors that separates effective from ineffective Web-based learning. Content includes the subject matter, scope and content of the course, the knowledge domain, its topics and
- subtopics, the definition of learning objectives and goal of the course, as well as timetabling and syllabus of the course. This information is delivered by teachers.
- The *learner dimension* refers to the learners' characteristics that affect the development and use of Web-based learning. Learners have different knowledge backgrounds, skill levels, and learning styles. They differ in how they view the learning environment.
- The *legal and ethical dimension* refers to the legal and ethical environment of Web-based learning since any system is affected by legal constraints and ethical conventions, including copyright protection of knowledge producers, as well as security against knowledge manipulation and all forms of cheating.
- The *technical dimension* refers to the information technology infrastructure dimension, which relates to the hardware and the software environment of Web-based learning. In contrast to traditional software systems, which are built using an homogeneous technology infrastructure, Webbased learning systems run in a heterogeneous computing environment that includes multi platforms, multi-browsers, multi-software and multimedia support. This heterogeneous environment has programming languages, automated Web authoring tools, and many other means of implementation, such as HTML, XML, JavaScript, CGI scripts, Java Servlets, Web editors and databases.
- The *usability dimension* refers to the user interface dimension, which is a central feature, because Web-based learning systems are intrinsic interactive. In fact, there are multi-user systems. Thus, a significant part of any Web-based learning system concerns esthetical issues to produce look and feel of Web pages. These issues are integral to the user's experience with the system. To translate users' requirements into a usable Web-based learning system, the construction process must be rooted in principles designed for human-computer interaction and user-centered practices, and criteria such as ease of use and learning, efficiency of use, and subjective satisfaction.

IV END-USER'S

Web-based development involves a variety of different kinds of people who have some direct or

indirect influence on the system requirements. Basically, six categories of end-users may influence the construction of Web-based learning:

- *Learners/students* are the users of the Web-based learning system. Thus, they must be able to operate a PC. Moreover, they need navigation skills, search engines, and file transfer. Thus, to use a Web-based learning system, they must possess some technical skills in order to browse course material.
- *Content developers* are generally teachers and instructors. They are the providers of course content, its topics and subtopics according to some educational criteria. They must be able to produce, change, update, and modify the course content whenever it is necessary.
- *Educational researchers* possess substantial experiences in educational research. This experience is needed for instructional design. Pedagogical knowledge is related to learning theories and philosophies, such as behaviorism, cognitive constructivism, and social constructivism. Teachers may take on the role of educational researchers if they possess sufficient

knowledge in instructional and pedagogical design.

- *Web developers* are responsible for developing the system. They must be able to analyze the system's requirements, produce a design solution, implement, and test the system. They need an evolutionary process model and associated techniques and methods. Furthermore, they must be able to use Web programming languages and authoring packages, and, finally, they must possess some knowledge in human-computer interaction.
- *Graphic designers* are the constructors of the Web user interface, including the look and feel of the Web pages. Web implementation requires a subtle combination of esthetical and cognitive issues and an optimal balance between visual sensation, graphic information, text, and multimedia support.
- *Web administrators* are in charge for the total Web-based learning system, its operations, database connections, security, access rights, logging, and maintenance. Web administrators need both knowledge in Web technologies and hardware platform in which the Web-based learning system resides.

V WEB-BASED LEARNING SYSTEM DEVELOPMENT

In Higher Education, it may be the university (or one of its faculties) that starts a specific project for developing a Web-based learning system. It nominates a project manager for organizing and managing the whole project. He/she may delegate the development process to Web developers together with

graphic designers and Web administrators. Web developers are then responsible for developing the system. Graphic designers focus on the graphical user interface. Web administrators are in charge for the network aspects of the system, its operation, database connections, security, access rights, logging, and maintenance.

In Higher Education, Web-based learning development can be done through HTML and Web

authoring tools like FrontPage and MacroMedia Dreamweaver, Java, JavaScript, Web-databases, UML etc. The development process continues with design, coding, and usability testing until the development team delivers a well-documented Web-based learning system that can be used and evaluated in the classroom. The evaluation ensures that learning issues are kept in mind, and that the decisions made throughout requirements analysis, design, and implementation are achieved.

A) Requirements Definition and Specification:

The requirements definition and specification is concerned with:

1. Technical usability criteria
2. Educational usability criteria
3. System requirements
4. System constraints

Technical usability involves techniques and methods for ensuring a trouble-free interaction with

the Web-based learning system while educational usability aims at supporting the learning process. Both aspects of usability are closely related to each other. The goal should be minimizing the learners' work resulting from the interaction with the system in order to free more resources for the learning process itself. They are divided into generic usability criteria that are applicable to most educational software and usability criteria that are specific to Web-based learning:

(a) Effectiveness, efficiency, user satisfaction, ease-of-use, and ease-of-learning

(b) Cross platform, accessibility, navigation and linking, and content design.

(i) System requirements:

Based on usability criteria, the main part of the requirements is dedicated to the definition and specification of system requirements. System requirements are twofold: functional requirements and data requirements. Functional requirements can be modeled with use case diagrams at a high level of abstraction. Data requirements can be modeled with class diagrams at a high level of abstraction.

(ii) System constraints

System constraints describe how the system is constrained when accomplishing its functions. Web-based learning system constraints are set with regards to:

- *Performance requirements* can become quite central to the success of Web-based learning. They specify the speed (the system's response time) at which various tasks have to be accomplished. Performance requirements ensure a trouble free function of the system.
- *Security requirements* describe user's access privileges to the information under the system's control. User can be given restricted access to the Web-based learning, including restricted access to data and/or restricted rights to execute certain operations on data. Some of these requirements are related to user requirements.
- *Operational requirements* determine the hardware/software environment in which the system will operate. These requirements may have an impact on other aspects of the management process of Web-based learning, such as system maintenance an update.
- *Political requirements* are frequently assumed rather than explicitly stated. These requirements are derived from the institutional environment, and specify the institutional, legal, and ethical issues. These requirements are very important because the system may be difficult or impossible to use for political, legal, and ethical reasons.

B) Design

This design phase is concerned with Web design and architecture design.

Web design :

The structure of the Web-based learning system is usually hierarchical with the top as the home page which presents general information about the system. Then, the system must be broken down into smaller components, which themselves may consist of one or many Web pages according to the topics and subtopics of the subject matter.

Architecture design

Architecture design is done in terms of the software/hardware platform on which the Web-based learning system is going to be implemented. This platform is the three-tier client/server architecture that separates data management from presentation via the application logic middle tier.

C) Coding and Testing

This phase enables the production of multimedia elements, e.g. text, graphic, animation, and eventually audio associated with the Web-based learning. This is followed by the implementation of the study material associated with the content pages using programming languages or specialized authoring systems or tools such as FrontPage or Macromedia Dreamweaver. It may be also possible to modify, refine, and reuse previous components that implement some of the functionalities of the system. Components may include reusable course units.

Testing is the process of exercising the system with the intent of finding and ultimately correcting various errors, such as typographical errors, grammatical mistakes, errors in content, errors in graphical representations, cross referencing errors, navigation errors, etc. This phase includes also unit and integration testing, content review, platform, browser and operating system compatibility, user interface testing and interaction with the users,

performance and reliability testing, etc. The following steps summarize the approach:

1. The content of the Web-based system is reviewed to uncover errors.
2. The design model is reviewed to uncover navigation errors
3. Selected components are unit tested
4. Integration tests are conducted
5. The assembled Web-based learning system is tested for overall functionality
6. The Web-based learning system is tested in a variety of different environment configurations and is tested for compatibility with each other
7. The Web-based learning system is tested by a controlled and monitored population of end users

VI CONCLUSION

In web-based learning, education has triggered a shift from the teaching paradigm to the learning paradigm. As a result, students are becoming more independent from the teacher. In this paper, we focus on the application of an evolutionary software development process model to translate Web-based learning requirements into a system that provides learners with information that supports effective learning. This paper highlights a number of issues for Web developers, teachers, graphic designers, educational researchers, and Web administrators. To produce effective Web-based learning in real environments, there is a need for a systematic software development methodology, because constructing Web-based learning is a product of a creative act of development, and not a result of repetitive act of manufacturing. While designing the system, MS SQL Server 2005, ASP.NET and C#.NET and some other programming languages were used for the database, web interfaces and programming, respectively. It includes system scope and learning environment, end-users, and its functions such as requirement usability, system constraints, design, coding and testing etc.

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