

Web Based Training : What do We Expect from the System

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Generally speaking a Web Based Training (WBT) system is supposed to maintain an educational process available “anytime anywhere” by means of World Wide Web (WWW) technology. Practically, any WWW site containing educational material is called a WBT system. All experienced users have discovered that there is a considerable gap between these two definitions.

In this paper we analyze the term “WBT” from different perspectives and claim that the authoring, communicational and data access tools currently available on the Internet are not sufficient to fully exploit the tremendous educational power of the largest information and communication resource mankind has ever had. We contend that primitive hypermedia node-link data model and its most prominent implementation WWW do not have enough functionality to provide the power that is needed for WBT.

We explain important features that are absent, claim that WBT systems incorporating such features are essential and mention a first such WBT system called WBT-Master, which is currently being developed as prototype in connection with the EU Project CORONET.

Keywords: WBT, user roles, node-link data model, WBT tools

1 Introduction

The term ‘WBT’ refers to a range of systems that support at least [2]:

- developing of high quality multi-media courseware;
- repository of learning resources available world-wide, including not only courseware, but also personal info on peer helpers, on-the-fly contributions of previous users, etc.
- easy access to the learning resources “anytime anywhere”;
- support for personal definition of learning goals and variety of novel learning methods;
- synchronous and asynchronous communication and collaboration among learners and between learners and experts;
- database of previously answered questions to automatically answer similar ones
- testing of knowledge level
- customisation of courseware to the knowledge level and the cognitive style of the learner
- IPR protection and brokerage of relevant learning services
- progress tracking and certification as support for assessment and recognition aspects of the acquired skills.

Thus, a typical WWW [1, 3, 17] site just covers one of requirements mentioned above – easy access to educational materials “anytime anywhere”, leaving all others to especially developed applications – communicational packages, authoring packages, intelligent agents, etc.

In the rest of this paper, we will use the following rather simple view of a WBT system [4, 6]: Information (i.e. courseware) is stored in a simple structured fashion on servers as a big collection of Multi-Media (preferably HTML documents). Typically, a document may be a piece of text containing a picture. Each document may contain links leading to (parts of) other documents in the same or in different chunks. Typical hypertext navigation through the information space is based on these links: the user follows a sequence of links until all relevant information has hopefully been encountered.

Courseware can be accessed world-wide via clients, with clients available for most major hardware platforms.

All other information services such as information searching, synchronous and asynchronous communication, collaboration, etc. are implemented as “add on” software packages using often different protocols (Server Site Scripts, Client Site Scripts, Java Applets and Applications, etc).

2 WBT Information Services and User Roles

WBT-Systems normally distinguish different *user roles* according to basic functionality which is required. Most common definition of user roles in WBT systems may be seen as follows:

Learners utilize WBT information services in order to improve their knowledge and skills. They are motivated to use the system services by a particular *Learning Goal* in mind. In a simplest case, the Learning Goal may be just a wish to pass an examination and to get some credits.

Tutors manage the learning process on some particular subject. They know the learning subject and their target audience (i.e. Learners). Since a tutor plays a very important role in education as such, they also perform many different tasks in WBT systems. In a certain sense, we may even say, that WBT systems are supposed to help tutors to accomplish their tasks. Thus, tutors bridge a gap between learners and courseware by customizing courseware, providing explanations (comments), answering questions, etc. Tutors select an appropriate learning strategy (say, Learning –By-Doing, Situation-Oriented Learning, etc) to achieve better learning results. Tutor control learners’ progress with the material, offer additional materials and point learners to fellow helpers if necessary, examine learners’ knowledge and acquired skills, etc.

Authors contribute to courseware repository creating and publishing documents, combining the documents into navigable structures (courseware libraries, courses, learning modules, etc.).

WBT Administrator does not participate in the learning process as such and mainly responsible for technical aspects of a WBT system functionality and resolving conflicts between other users.

The situation when a courseware repository is structured in accordance with the basic node-link model and all other WBT information services should be mapped onto this model or incompatible protocols need to be applied, have a number of serious flaws particularly when applied to the WBT.

The node-link (i.e. WWW) data structuring paradigm itself has a number of serious drawbacks. Unfortunately, the problems were inherited and even aggravated by WBT systems as we will see below.

Here is a list of a few illustrative examples, showing well-known problems of WWW technology as such.

Context-Independent structuring and lack of metadata: The Web is probably the most chaotic information system known to mankind. The lack of inherent structure and the lack of sufficient meta-data constitutes a serious source of frustration to all dedicated users. Normally, authors engaged in developing courseware, use such special concepts as “Course”, “Chapter”, “Examination Session”, etc. which are implemented using primitive documents and links. Hence, the system cannot operate on (say, search for) such logical entities (i.e. in a particular context) and may provide access to single documents without any sense of location instead of offering well-defined entry points to “Courses” and “Chapters” informing users on the current context.

A limiting link philosophy [9, 12]: Back in 1991 Frank Halasz referred to the “tyranny of links” [8]. Ten years later this is still of serious concern to users and Web administrators alike. First, links are left dangling by the removal or

relocation of documents and, unfortunately, no administrator can manually keep track of the thousands of links found in any large system. Second, links should not be “hardwired” into pages but kept as separate objects, so that, for example, different users may see different links and users may even add their own links. Third, links are important not just in text and graphics, but especially in video sequences, audio sequences, and 3D scenes.

Inadequate authoring support [11, 5, 12]: Authoring large collections of data is not adequately supported. E.g., many of the links that most systems require to be introduced manually could be generated by the system. For example, inserting a new document into a linear list of documents provided with a table of content (data structure which is rather often used to present educational material), requires editing of at least four documents instead of a single operation.

Unsatisfactory reuse of materials [7, 5]: Reuse is a crucial issue in developing educational material. Reuse may be applied to entities of different sizes and different complexities, from an elementary document to chapters and courses as such. Suppose an author wishes to reuse material that has been created by another author. The second author might be able to refer to those documents in the documents he creates, but has no control over the references from and appearance of documents being referred to.

Binding links to position vs. to content [14]: Links point to addresses of documents and not to the specific content. For example, instead of simple reference to an introductory course on “Databases” most recently mentioned in “ACM Transactions”, authors need to provide a fixed address which can be changed or the course may become obsolete.

The previously mentioned disadvantages of the basic WBT technology result in the following problems for users of WBT systems:

2.1 Learners

Learners often experience *getting lost* or *tunnel* effects. If many alternative references are incorporated into a document on, for example, car electrical system, a user trying to learn more about electricity, on reaching the document on Franklin, might branch off into the document on Gutenberg, which is totally out of context. All this leads to user disorientation, or the phenomenon known as the “*lost in hyperspace*” syndrome [17]. Again, if this document is provided just with references to next, prior and table of content documents within the chapter “Car Electrical System”, the user will suffer from the “tunnel effect” without a possibility to investigate some topics in depth and to skip unnecessary information.

Another common WBT phenomena may be addressed as “*isolation effect*”: learners want to communicate with class mates and tutors on topics of common interest. The usual solutions like News Boards, Chat sessions, ICQ, etc. do not work in this case because of their isolation from current learning context (for example, users want to communicate not with an abstract colleague but with a person working on the same document, preparing for the same examination, etc.).

Additionally to the isolation effect learners may experience a so-called “*I am neglected*” effect. Working through a big amount of learning material, solving a difficult problem, answering an examination question, etc. many learners need a recognition of their success from a “friendly tutor”. Similarly, learners need to know how they are doing in comparison with their class mates, how close they are to the learning goal, etc. There is another side of the same “I am neglected effect”, very often learners need visible control of their activity by a “friendly tutor”, the system should confirm finishing a current task, remind about deadlines to accomplish a next learning task, automatically offer resources (including addresses of people eager to help) needed to do so, etc.

Of course there are more other psychological phenomena that should not be ignored in WBT environment: learners always have their own cognitive preferences for presenting information, for getting additional explanation, for presenting constructional examples, etc. Learners should not feel that their preferences are simply ignored by the system. Thus, a powerful customization mechanism is of utmost importance for WBT systems.

2.2 Tutors

The success of WWW and its publicity may create the impression that WWW is the solution for most information needs including learning and training in all aspects and will replace tutors or at least considerably simplify their tasks.

The reality is different, however. The overwhelming majority of tutors is disappointed with WBT systems. Currently, many WBT systems simply ignore the tutor role concentrating on authoring and delivering courseware. Just one experiment: try to initiate an Altavista search using “WBT” as a search criteria. We had performed the experiment and got more than 200 hits. We classified first 200 references: 187 sites were simply offering “WBT Courses” without a single attempt to provide a complex learning environment with a tutor as a key player, 13 other sites were papers on the WBT or similar publications also without any references to a tutor role.

Here is a list of a few illustrative examples of problems which tutors experience working with WBT systems, in no particular order, since the relative seriousness of a problem is highly dependent upon circumstance:

On-The-Fly customization of learning material: it is a common practice that a good tutor never use one and the same set of slides for different auditoriums. There always exist peculiarities which should be taken into account: for example, particular examples referring to a daily experience of learners are very preferred, latest developments should be taken into account, answers to frequently asked questions may be incorporated into a presentation beforehand etc. While such customization does not take any particular efforts if a conventional pen and paper technology is used, it may constitute a serious difficulties in a WBT environment.

Communication in a context: when a question is asked or a help is required, the working context plays an extremely important role. An answer to the question “Why A is equal to B” depends on a particular document on which user is currently working, on the history of navigation (which topics were explained before and which terms are understandable without an explanation), on the particular user group (some learners perhaps do not need such detailed explanation as others, etc. While such context is always known in a conventional educational environment, providing information on the current user’s context is one of important functions of any WBT communicational component.

Applying different learning strategies: an answer to a simplest question like “in which order a tutor should put an explanation, example and test questions” is not so obvious as it seems to be. In some circumstances, a test question need to be put first, then the answer (correct or wrong) explained with a number of examples and only then a formal mechanism presented to learners. There, of course, may be much more complex situations depending on particular subject, tutor preferences and learners’ background and learning goals. In conventional learning environment, tutors are restricted only with their own preferences and knowledge on different learning strategies. In WBT environment, adaptation of courseware and other learning resources to a preferable learning strategy constitutes a difficult technical problem.

The main advantage of WBT – availability anytime and anywhere, creates additional problems for a tutor.

- **Multiple answering/explanation:** since, one and the same material is accessed by learners at different time, they tend to ask repetitive questions and request repetitive help actions what can lead to a serious additional work load on the tutor. The simplest FAQ solution does not work for a simple reason: questions are put in a particular context (say, questions addressed to a particular document in a particular chapter by a member of a particular user group), copying the question and answer into a separated FAQ file might be more misleading than helpful. Note that in conventional learning environment this problem simply does not exist since a particular user group describes a particular topic at a particular time and the question answered once become immediately known to all group members.
- **Progress tracking, Testing and Certification:** a good tutoring practice requires monitoring of a learner’s progress with material and testing of acquired knowledge and skills on regular basis. This activity barely can be formalized, a good tutor knows the learners personally and can always answer the question "How is this particular learner doing ?". Answering the same question in WBT environment may constitute a serious problem.

2.3 Authors

Courseware authors experience basically the same problems as other WWW authors. They suffer from *lack of metadata* and *limiting link philosophy*. The *inadequate authoring support* and *unsatisfactory reuse of materials* result in very well-known figures showing tremendous labor resources needed to produce multimedia courseware.

3 WBT-Master

WBT-Master (<http://coronet.iicm.edu/wbtmaster/master.htm>) is an innovative WBT tool that supports the construction and delivery of Internet based courseware and provides all other important WBT information services on the base of a unified HM-Data Model [13, 15, 16, 10]. In other words, WBT-Master is an Internet system that provides a set of modules and tools that use an unified internal data structures and well-defined set of operations applicable to such data structures.

WBT-Master allows tutors to make effective use of the vast knowledge source of the World Wide Web and to present their students qualified material in a structured manner visualized by an ordinary WEB browser.

WBT-Master enables synchronous and asynchronous communication among distributed teams and team members. This includes discussion forums, brain storming sessions, chats, annotation facilities and similar. The variety of communicational tools supports collaboration between different users working together. Since all information services operate with unified data structures results of any collaboration (discussion sessions, brainstorming sessions, annotations, question-answer dialogs, etc) can be seen as new learning material and can be reused by others.

Powerful customization mechanism allows users to adjust the system to fit their needs in the best way.

Tracing capabilities supported by the WBT-Master provide for monitoring of the users' activities and progress, thus giving an important feedback to tutors and courseware providers. An elaborate security mechanism allows creating of a fine-tuned environment for teams and individuals to participate in team projects. All these facilities are seamlessly integrated with an advanced user interface, and are available anytime anywhere via a standard WEB browser.

Courseware repository on WBT-Master is structured in accordance with HM-Data Model which provides for a smooth navigation through the course eliminating problems such as "getting lost in hyperspace", dangling links and similar. The model facilitate a context-dependent search and course maps. Tutors and Learners may contribute to the courseware repository "on-the-fly" using such embedded mechanisms as annotations, links to external resources and multi-media attachments. All such additional elements may be defined as public, private or visible just to a group of people, and hence provide rather powerful customization facilities.

WBT-Master supports also more traditional communicational strategies such as discussion forums, brain storming sessions, chats, exchange with private messages (ICQ). Communication may occur between learners, tutors and groups of users. Since all the communicational tools are based on the same background – HM-Data Model, any contribution may be seen as an information object which may be stored into a courseware repository and further reused.

WBT-Master implements a highly sophisticated progress tracking mechanism, which together with assessments help students to test their acquired knowledge and to plan their future activities.

4 Conclusions

In this paper we presented the current state of WBT systems. We addressed a number of problems connected with these systems. The main reason for these well-known problems we recognize in a primitive data structuring philosophy supported by the node-link data model. WBT-Master, a tool that utilizes HM-Data Model, solves a number of mentioned problems. The HM-Data Model being much more sophisticated data model, than the primitive

node-link data model, allows creation, editing and reusing of context-dependent, well-structured hypermedia information chunks. The HM-Data Model and the WBT-Master provide a solid basis for the future innovation. The structuring mechanism supported by HM-Data Model allows to introduce new types of hypermedia information chunks which all can be integrated into WBT-Master. We imagine for example, a discussion forum residing on a WBT-Master structured as a HM-Data Model type. Such forums may be reused in WBT-Master in a number of ways, i.e., as a part of a course or as a part of another discussion forum.

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