REUSING DISCUSSION FORUMS AS LEARNING RESOURCES IN WBT SYSTEMS

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ABSTRACT

Discussion forums are highly popular and widely applied tools in Web-based training (WBT) systems. Usually, discussion forums are places where learners discuss topics related to courseware, their current learning task, or the learning project they are working on. These discussion forums contain tremendous educational potential for future learners, since they contain question and answer dialogues, discussions, or examples made by previous learners. Thus, by simply reusing these discussion forums as new learning resources in WBT systems, the future learners would have very valuable learning information based on the hand-on experience of previous learners. However, implementing such a simple yet powerful idea in WBT systems is not a trivial task. Extracting useful information from discussion forums might be seen as a rather tedious task, and the results of such process leave much to be desired. In this paper we present a simple tool that solves problems related to information extraction from discussion forums and thus allows their reuse as learning resources in WBT systems**.**

KEY WORDS

WBT systems, Discussion forums, Reuse, Learning resources

1. Introduction

Discussion forums are applied extensively as an easy-to-use and yet powerful communication tool in numerous Web-based applications in general and in Web-based training (WBT) systems in particular.

For example, in scientific digital journals and digital libraries discussion forums are heavily used to discuss different articles, to comment ideas presented in these articles, or simply to write "letters to the editor". In software development discussion boards programmers come together to exchange their views on different programming techniques, software design methods, project management concepts, etc. Also, the existence of numerous Web-based communities and communities of practice, such as Open Source communities, scientific communities, and many other relies mostly on discussion forums, which are usually the essence of such communities. Such list of Web applications built with and around discussion forums goes on and on.

Similarly, in WBT systems discussion forums are applied with the highest user acceptance for many different purposes. Usually, each WBT course offered in the system is associated with a special discussion forum that provides the place for context-dependent discussion of issues related to that course [1]. Learners taking a part in the course work with the associated discussion forum to write there their questions about presented learning material, to discuss topics from the course, to publish their examples, and so on. Also, in problem-solving or project-related WBT courses learners may use discussion forums to discuss the actions they take on each particular step of their work [2].

On the other hand tutors, authors and teachers may use special discussion forums offered by the system to discuss issues related to implementing different training sessions in the system. For instance, they may discuss the content of a particular WBT course that they need to prepare, or a particular training strategy for the training session that they are conducting [3].

One of the main reasons for the large success of discussion forums is the simple and intuitive nature of these tools. Discussion forums come with a very simple user interface, which is highly usable for a wide range of users with very different and possibly non technical backgrounds. Thus, users simply read through contributions arranged in a tree or a list and reply to those contributions by simply activating a special reply button. Structurally, contributions in discussion forums are arranged into a tree, where non-leaf nodes represent so-called threads, i.e. contributions that have replies. Visualizing and providing a simple Web-based user interface to such a simple structure is technically very easy task to accomplish.

Another important aspect of applying discussion forums, especially in WBT systems is the possibility to reuse them as valuable learning resources in such systems.

For example, a particular discussion forum that was associated with some WBT course contains large amount of information in form of question and answer dialogues, discussions, attached examples that previous learners created, etc. Of course, new learners coming to that particular course may extract very useful learning information from this discussion forum. Further, a discussion forum attached to a problem-solving or project-oriented WBT course includes all the steps of the learners' progress in the course and shows all the actions taken by learners in reaching their goal. Moreover, the reasons for a certain learners' action at the specific moment in the project are described in details through the discussion that was going on at that time. Thus, such a discussion forum represents a new and valuable learning resource as well. On the other hand, discussion forums used by tutors, authors and teachers to discuss the content or methodology of a WBT course contains tremendous educational potential. Such a discussion of experts in a certain subject matter results eventually in a new learning resource containing knowledge and experience extracted from these experts. This, of course may be seen as a very fine read for interested or advanced learners.

Although there exist such a great educational potential in simple reuse of discussion forums as learning resources the results of such reuse are mainly disappointing. Comparing it to the success of these tools in their primary application area we get an even worse picture.

The reason for this failure is a very bad support for retrieval or extraction of desired and useful information from discussion forums. For example, threads are organized in a simple temporal sequence, i.e. they are shown in a list sorted by time when they have been started. This means that older contributions are not easily accessible. Usually, the older threads become completely ignored, irrelevant, or even sometimes completely removed because they expire. Further, in each thread replies start usually with a simple "RE:" (abbreviation for "Reply") followed by the title of the main contribution in that thread. If we have more than one level of replies these contributions usually start with so many "Reply" abbreviations as there are reply levels. This of course has as result discussion forums that are completely unclear for readers. Thus, extracting useful learning information from such discussion forums constitutes a rather serious problem.

We believe that the reason for this problem lies in complete lack of any conceptual structure (except the temporal structure, which can be hardly seen as a conceptual structure) of threads and contributions in a discussion forum. Conceptual structure would involve organizing and classifying contributions around a conceptual schema, i.e. assigning contributions to elements of such a schema. Extracting information from such a conceptual structure would be very easy: we easily access the needed information through searching for contributions belonging to a certain concept or by simple browsing of concepts. The resulting discussion forum would be very concise and clear for its readers and could be easily reused as a new learning resource in WBT systems.

In this paper we present a possible approach to support conceptual structuring of discussion forums. In addition we present the tool that we implemented in the WBT system called WBT-Master following the presented approach. This tool allows us to create, manage and reuse conceptually structured discussion forums but still be able to preserve the basic premise of discussion forums: intuitive and highly usable organization and interface of these tools.

2. Approaches to Conceptual Structuring of Discussion Forums

Conceptual structuring of a discussion forum involves creating and managing a separate conceptual schema, and at the next step assigning contributions from the discussion forum to concepts provided by the schema.

Essentially, conceptual schema defines a number of concepts and semantic relationships between concepts. The simplest conceptual schema may only support one type of semantic relationships: "is part of" relationship. Thus, such a conceptual schema arranges concepts in a simple tree of concepts and sub-concepts.

Currently, there exist a number of approaches for creating, and maintaining conceptual schemas and assigning (classifying) documents from document collections to that conceptual schema [4, 5]. Since discussion forums may be seen as a kind of document collections, we investigated these approaches in details. However, none of these approaches could fit into our requirements for conceptual structuring of discussion forums.

Here are the two most important approaches with comments on disadvantages of these approaches for our application:
- Automatic classification of documents to already existing schema, or automatically created and maintained schema. This approach usually involves natural language processing for extracting key words from documents [6]. These key words may be applied to maintain the conceptual schema (in the case of automatic maintaining of the schema) or simply to assign documents to the schema by comparing key words and the concepts from

the schema (in the case of manually predefined schema). Although, results of such classification mechanisms may be surprisingly good they have also a number of disadvantages [7]. Firstly, natural language processing is dependent on the language, and requires a special processor for each particular language. Thus, such mechanism is not universal enough, and we need to have different applications for different languages. Further, good results in natural language processing have been achieved only for English language, processing of other languages leaves much to be desired. Finally, having a multi-lingual discussion forum could lead to serious problems in implementing this approach.

- Creating predefined structure of discussion forum where this structure corresponds to the final conceptual schema [8]. Users of this discussion forum would need to select a particular thread, which corresponds to the concept they want to contribute and write their contribution there. The final result could be satisfying; however having such a predefined discussion structure violates the associative nature of discussion forum. Thus, we would end up with little discussion and more of simple contributing to a certain topic. Adding a special thread just for discussion would not help much either, since these contributions would be lost for classification unless we manually assign them to certain concepts.

Since none of the above approaches could fit into our requirements we tried to invent a new approach, by simply trying to avoid the disadvantages of the mentioned approaches. Thus, we decided to have a separate conceptual schema attached to a discussion forum with users manually assigning their contributions to the schema. The design goals we tried to achieve with our approach are as follows:

- Flexible conceptual schema; since the schema is predefined there exist a problem that this schema can not introduce all relevant concepts for a particular discussion. Thus, there should be a possibility to modify the schema on-the-fly. The modification of the schema should be allowed only to few designated users (moderators). Of course, modification of the schema may happen upon user's request or as a result of fruitful discussion in the forum.
- Flexible assignment policy; sometimes a contribution may belong to a number of concepts. Thus, it should be possible to assign contributions to a number of concepts.
- Reliability of assignment; the final classification must be reliable, i.e., if we have contributions assigned to concepts that they actually do not belong we did not achieve much with this approach. To improve reliability of the approach we may introduce a simple voting system that will allow users to agree or disagree with a certain assignment. Thus, the author of a contribution would assign this contribution to a particular concept and other users may agree or disagree with this assignment. If the contribution gets more disagreement than agreement then this contribution is removed from that concept.

- Users' motivation; since this approach relies on users who manually assign their contribution to concepts a proper motivation of users might be needed. In WBT systems the high level of users' motivation may be achieved as follows. Usually, tutors, teachers and authors prepare courseware in WBT systems. They discuss issues related to courseware in a discussion forum, and then proceed with preparation of the courseware on their local sites. Since, a discussion forum with a proper classification may be already seen as a learning resource motivating tutors, authors or teachers won't constitute a problem. In that way they won't have much of work (if any) on their local sites in order to prepare the courseware. On the other hand, motivating learners may be easily achieved by providing them with additional points for their final note for each useful assignment that they make.

Following to the presented approach we implemented a tool called Virtual Discussion Room in WBT-Master system. The next chapter presents this tool in more details.

3. Virtual Discussion Room in WBT-Master

Virtual Discussion Room consists of two components: the discussion forum and conceptual schema.

A special user (moderator) creates a Virtual Discussion Room and publishes it in the system. Also, moderator creates the initial conceptual schema and attaches it to the Virtual Discussion Room. Note, that the conceptual schema may be modified on-the-fly, whenever there is a need for an update.

Once after the Virtual Discussion Room has been provided with the conceptual schema and published in the system users may access it and work with it. Initially, they just work with the discussion forum. The discussion forum provides the standard functionality, allowing users to work through contributions, read them and post their replies. Note that the Virtual Discussion Room provides a simple tree-like graphical user interface to the discussion forum (see Figure 1.). Additionally, users may assign certain contributions to concepts from the conceptual schema. To assign contributions users need to activate the special button. The system visualizes the conceptual schema, allowing users to navigate through the schema until the desired concept is reached. Note, that the visualization mechanism is again based on a tree-like graphical user interface. This provides for the unifying look and feel of the whole tool, thus keeping the user interface as intuitive and simple as possible (see Figure 2.).

Figure 1: Working with Discussion forum

Users may of course choose to work with the conceptual schema directly by activating a special button. As a response the system visualizes the conceptual schema with assigned contributions. Note that users working directly with the conceptual schema may vote for or against assignments made by other users (see Figure 3.). Each positive vote increases the "weight" of an assignment, thus making it more trustworthy.

On contrary, each negative vote decreases this "trustworthiness". If a particular assignment reaches a negative "weight", then this assignment is automatically removed from the conceptual schema. Note that while working with the conceptual schema the original discussion context of a particular contribution is visible and users may switch to the discussion forum at any time by simply clicking a button.

Figure 2: Assigning a contribution to a concept

Once when the discussion is closed, users work with the conceptual schema in the same way as users who contributed to that Virtual Discussion Room. Additionally, search function is available for the users.

Figure 3: Working with Conceptual schema

4. Virtual Discussion Room in Practice

We applied Virtual Discussion Room to conduct the 2002 summer term course in Social Aspects of Information Technology (IT) at the University of Technology in Graz with more than 200 students [9]. This course consisted of:
- 12 lectures on different social aspects of IT, such as legal issues of IT, IT and medicine, Knowledge Management, and so on.
- Virtual Discussion Room where students discussed about the topics presented in lectures. The lecturer, two tutors, and all students were taking a part in the discussion. The lecturer prepared the conceptual schema, arranging 36 concepts into a tree of concepts.

The students needed to take an active part in the discussion by writing and reading contributions. Further, they were asked to assign contributions to conceptual schema and to vote for or against particular assignments. Grading of students was based on the number of written and read contributions, the number of assignments and the number of votes.

The results were as following. On average, students wrote 10 and read 45 contributions. They made 3 assignments and voted 2.5 times on average. Thus, the final discussion room had 2000 contributions, 600 assignments (450 different contributions were assigned) arranged into 36 concepts. The average "trustworthiness" (how many students agreed to a particular assignment) of assignments was 2.3. The conceptual schema and assignments will be available for students taking this course in the 2003 summer term.

After the course students were asked to fill in a simple evaluation form. Here are some of the results of this evaluation.

Students generally liked the idea of having a course based solely on discussion with other students and the teacher. 80% of students saw tremendous advantages in using such communicational tool to work together on a certain subject matter. 85% of students answered that they acquired additional knowledge during the course in a very simple manner, i.e., by simply taking a part in a discussion. 65% of students answered that they acquired additional knowledge by working with the conceptual schema and trying to assign contributions, or to vote for particular assignments. 90% of students were satisfied with the user interface of the tool. For 70% of these students working with the conceptual schema was easy because of the same user interface as in the discussion part of the tool. Finally, the overall assessment of the

course and the tool was 1.9, where 1 is the best mark on the scale from 1 to 5.

5. Conclusion

The first results of applying Virtual Discussion Room tool in WBT-Master were quite successful. Thus, the tool supports the standard functionality of Web-based discussion forum, but further it provides means for conceptual structuring of contribution form that discussion forum. The efforts on the users' side to create this conceptual structure might be seen as minimal. Users only need to assign their contributions to concepts from the already existing conceptual schema. This can be seen as a very easy task to accomplish, since the user interface to the conceptual schema is the same as the user interface for the discussion part of the tool.

On the other side, the benefits of having a discussion forum structured according to the conceptual schema are numerous. Extracting useful information by simple "conceptual" browsing or searching by using key words from the schema might be very easy for a wide range of users, to say at least. However, we believe that such a tool might have more potential than it might be visible on the first look. For example, the tool might be easily applied as a general knowledge extraction tool. We can easily imagine a situation where a number of experts in a particular subject matter come together to discuss certain topics in a Virtual Discussion Room. The result of this discussion and the attached conceptual schema might be seen as a structured excerpt of the knowledge that these expert posses about these topics. Our future work with Virtual Discussion Room will concentrate on these issues.

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