Revised Dynamic Teaching Materials Concept for Community Learning

George Moroni Teixeira Batista, Mayu Urata, Mamoru Endo, Takami Yasuda

Abstract— for teachers, handling information technology is not easy because it is not their specialty. This is even more apparent when they have to use it to create interactive and/or multimedia teaching materials. How can they be assisted in learning the necessary information technologies and in creating, sharing, and teaching e-Learning content? New technologies and the students represent an important part of the continuously changing learning environment, with students usually already knowing the technologies that teachers are trying to learn. Therefore, perhaps there is a way to allow students to help teachers to learn the technologies. This may be better than having a separate technical support team for the teachers, as the teachers end up depending on the support team and are thus unable to handle the technologies by themselves. This paper introduces a revised version of the dynamic teaching materials concept, based on the results of the evaluation tests done up to now. It aims to create a learning community system that allows students and teachers to help each other to learn and to improve the learning environment based on their own necessities.

Keywords— Community learning, e-Learning, education, teaching materials, version management.

I. INTRODUCTION

In August 2007, the Escola de Línguas Online (ELO) project started in the Department of Foreign Language and Translation of the University of Brasilia, Brazil. The objective of the project is to create an e-Learning environment for language teaching that promotes the use of technologies such as computers and the Internet to improve teaching materials and learning techniques, following the same ideas stated by Boggs and Jones [1], "The Internet is a professional development tool for teachers," and Jones and Buchanan [2]: "There is much more to online learning than converting lecture overheads and unit profiles into HTML and placing them on a server. An integrated online learning environment should provide support for tasks including, but not limited to, assignment submission, automated (self-) assessment, evaluation and both synchronous and asynchronous communication."Evaluation tests were completed, and as stated by Batista, Urata, and Takami [3] and Batista, Urata, Endo, Yasuda and Mouri [4], "The system has shown good results, allowing teachers to create interactive multimedia teaching materials, even without knowledge of any programming language." These results have been made possible because of the creation of the dynamic teaching materials (DTM) concept. As stated by Jones and Lynch [5], "(Educational) context is continually changing and that Web-based systems must continue to adapt and evolve to meet these changes." The DTM concept emphasizes the creation of teaching materials that teachers themselves can update in real time in order to meet educational context changes, thus allowing their teaching materials to evolve. After the creation of the DTM concept, the research continued with the Sky Navi project. The objective of the project is to evaluate the application of the DTM concept in teaching subjects other than language and in alternative learning environments, such as a science museum. For this kind of test, the Nagoya City Science Museum was chosen as the research environment because, as stated by Iwazaki et al. [6], it has a large variety of visitors and a different theme every month. Therefore, the museum's environment is continually changing, just as the educational context does. It would be good if the contents displayed in the museum could follow the theme changes and be adapted to the different types of visitors there. After the evaluation tests, the DTM allowed the museum curator to create contents at least two times faster than before, allowed the creation of a content database, allowed contents to be updated, and allowed for the creation of templates in order to create new similar contents.

The current research study's objective is to improve the DTM concept based on the evaluation tests' results. The DTM concept was used to achieve the objectives of the ELO project and the Sky Navi project; however, even with the objectives achieved, some improvements still need to be made to solve the problems found during the evaluation tests, especially those regarding the content database, content management, and the search engine. The concept requires improvements in order to help users to have more control over content management, new tag techniques, and search filters. These improvements are also meant to allow users to have more control over the content's accessibility, improve the resources' reusability, and make searches for contents or resources more efficient. Also, it is important to create features and techniques that allow system users, teachers and students, to help each other offline and online in an effort to improve the learning environment.

The rest of this paper is organized as follows. Section 2 describes the system concept. Section 3 explains how the concept can be applied in e-Learning environments. Section4 is about the evaluation tests done up to now. Section 5 discusses the conclusions and future work.

II. CONCEPT

The objective of this concept is to create an e-Learning environment that allows teachers to create interactive multimedia teaching materials in real time, allows teachers to share these materials, enables the teaching materials to be accessed from any place with an Internet connection, and allows teachers to learn more about the system, teaching techniques, and technologies as they use the system, through feedback and the employment of utilization patterns. This can help teachers to learn from the

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teaching experiences of colleagues who have more experience.

As stated by Roberts, Romm, and Jones [7], nowadays, technologies such as computers and the Internet are a basic part of daily life. It is important for teachers to be able to handle these kinds of technologies in order to reach their students. However, at the beginning of the ELO project, the development team had several problems with trying to develop an e-Learning environment using e-Learning platforms and content management systems (CMSs) such as Moodle, Joomla, Dokeos, and eFront because the teachers were not prepared to use these kinds of technologies. As stated by Alexander [8], teachers' inability to handle new technologies can become a huge barrier in the development of e-Learning projects. To break this barrier, the development team decided that the environment should have something to help the teachers to learn how to use the necessary technologies. For instance, there could be some kind of "technical assistance team" whose objective is to help the teachers to learn how to use the technologies rather than using the technologies for them, which is what usually, happens in e-Learning environments. Because students usually already know today's technologies, it is good for students themselves to teach teachers how to use these technologies. Students can show teachers how they themselves use the technologies, which also makes it easier for them to understand what their teachers are doing in the classroom. Having people who can help teachers in this regard is just as important as having a user-friendly system interface. Teachers who do not know how to use the computer need to begin learning the basics, and they also need to be willing to learn other new technologies and teaching techniques, because it can become a big motivational barrier especially if they try to learn alone.

To make teaching materials more accessible to everyone, it is important to create an e-Learning platform as a Web application that can run on Web browsers. In the ELO project, the system was developed using the Adobe Flex framework. The reason for using this technology was because it was considerably easy to develop compared to other technologies, such as Java, that were available when the ELO project began. The technology was also free, and it was compatible by default with almost any Web browser at that time. Thus, users did not need to download and install anything on their computers in order to be able to run the application. However, due to several security issues with the Flash Player plugin for Web browsers now, Flash Player may not be available in the near future, especially with the advent of HTML5, which is also compatible with a great number of mobile devices, such as smartphones and tablets. Therefore, the development team is strongly considering developing a new version of the system using HTML5 in order to expand the accessibility of the system to mobile devices. The system also uses MySQL and PHP technologies for database and data transfer. The database stores users' data, teaching material contents, some system settings, and tag references for the search engine.

The main objective of the real-time editing feature is to allow teachers to make revisions and to create updated versions of their teaching materials on their own, which will prevent the teaching materials from becoming too old and outdated for students. The system also needs to allow the creation of different versions of the same teaching materials so as to allow the content to be used in different types of classes or with different student age groups. When users are editing teaching materials, the system needs to create an action history of almost all of the actions the user executed using the interface. This action history is used for the undo and redo functions and to reproduce the content edition process. The reproduction of the edition process is one of the features designed to help the teachers to learn more about the system as they use it. With this feature, the teachers can see step by step how every version of every teaching material was created, understand more about the system's features, and learn how the settings are made.
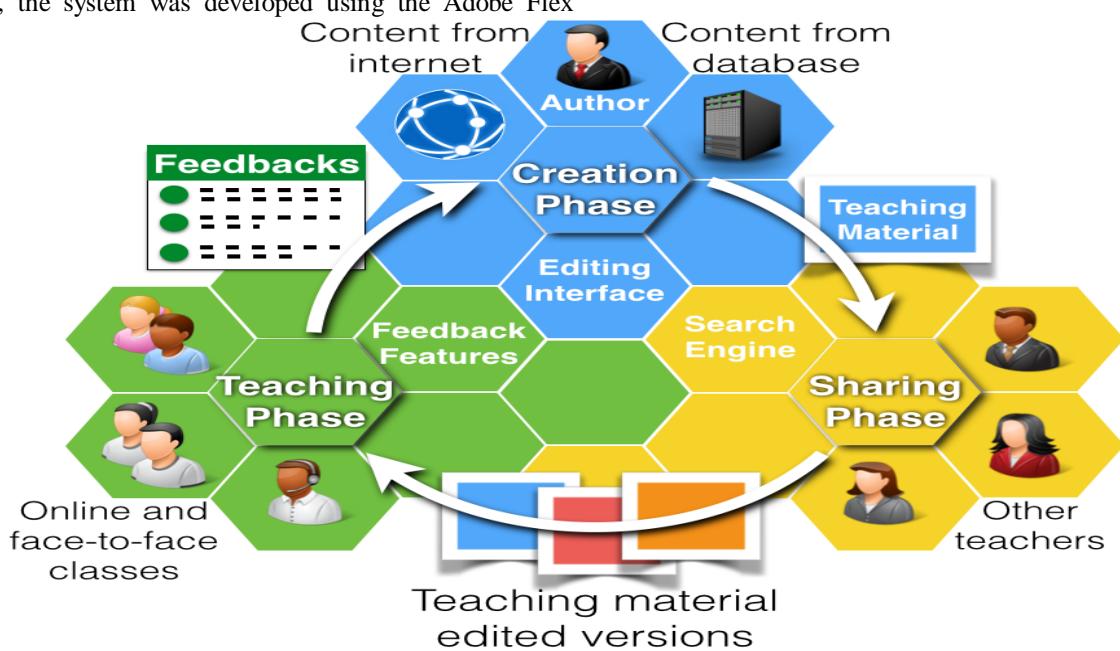
Figure 1. System Diagram

The system operation is a cycle divided into three main phases: The first one is the creation phase, the second one is the sharing phase, and the last one is the teaching phase. As can be seen in Fig. 1, the three phases go in order until the last phase is

finished and the first one begins again. Basically, the teacher creates some teaching materials using the system editing interface and stores it in the database. Because the teaching material is stored in the database, it can accessed by any one of the students and teachers who is also using the system. In other words, the content is automatically shared and can be used by a student who wants to study the subject, by another teacher who needs to teach the same subject, or even as a template for the creation of new content based on it.

A. Creation Phase

Trying to use new technologies can be a difficult task, as stated by Gillani [9], especially when the teacher is not a specialist in the technology. To solve this problem, the system needs to have a WYSIWYG interface that allows the teachers to create interactive content. Therefore, even without programming knowledge, teachers can create the necessary e-Learning content. However, there is a limit to the features that can be established using only a graphical interface without making the interface too complex. Most of the teachers who participated in the ELO project, though, stated that because they did not have the ability to design very complex interactive contents, simple features such as mouse clicks, drag and drop, and simple collision detection should be enough in most cases, and creating this level of interaction for objects on the screen can simply be done using a context menu.

The utilization of open technologies such as HTML5 also enables the creation of additional plugins for the system. Therefore, if some teachers have programming knowledge, he/she can still create additional plugins for more complex tasks and additional features for his/her teaching material, and because everyone is using the same system, once the plugin is installed, the other teachers can also use it. This kind of feature prevents more advanced users from being limited by the simple interface created specifically for novice users. Other important feature that the system needs is real-time editing. The idea is to allow teachers to turn on the editing interface anytime, even if they are in the middle of a class. For example, with this feature, the teacher can make changes or updates such as inserting more sample images or sample sentences into the teaching materials as needed during classes. The teacher can even make some corrections to the teaching materials if he/she notices some outdated information or other kinds of problems. The system should also allow the teacher to search and add content from the Internet, such as images and videos, to provide more concrete examples of the subject in study, from inside the system interface. The important part of real-time editing is the speed at which the student can access the newly updated version of the content. Instead of waiting months and having to pay again for an updated edition of a book, the teacher himself/herself can make all of the necessary changes, and the students can access this information almost instantaneously and for free. Real-time editing is also important for solving teaching materials' context problems. As stated by Jones [10], "Examples and analogies that make perfect sense to an Australian student may mean nothing to a student in Singapore." Using someone else's teaching materials can be difficult, especially if the teacher is trying to use the teaching materials with a group of students other than that for which the teaching materials were intended. In

this situation, usually the teacher will have to use the blackboard to give other examples that are more suitable for the students in his/her class. However, if the students do not take notes of these extra examples, they cannot review them because the extra examples are not included in the teaching material. The real-time editing feature allows the teacher to change the examples in the teaching materials or add new ones and create a new version of the teaching materials for his/her class. Therefore, the new extra examples will be stored in the database, too, and the teacher and students can easily access and reuse these examples afterwards.

After the edition is finished, the teaching material is stored in the database. The database stores information such as who the author is, when the teaching materials were created, the contents of the teaching material, the history of the actions the author took to create the teaching material, and if the teaching material was completely original, was an updated version of older teaching material, or was brand new teaching material created based on another one. All of this information allows the system to track who the original author of the teaching material is, who made the edits in each updated version, if the teaching material was used as a template to create other teaching materials, how the teaching material has changed over the time, and what actions the users who edited the teaching material took to edit the contents. The database also has a reference to the tags used to describe the teaching material; this is designed to help other users to find the teaching material using the search engine, and it shows them how they are expected to use the teaching material.

B. Sharing Phase

The sharing phase is the most simple for the users because it happens automatically. After the teaching material is stored in the database, the system uses its tags to control access to the teaching material. When the user stores teaching material in the database, he/she needs to add tags to describe the teaching material. The tags are also used as keywords for the search engine. Differently from a normal version management system that merges the different version files to create a final one including all of the changes, in the DTM concept, the system needs to keep all of the versions separated because storing the evolution of the teaching material is important for understanding how and why it changed over time. For this reason, all of the different versions and updates need to be available all of the time. However, if the user is just a student searching for some material to study, the intermediary updates are not necessary. The system needs to show only the complete finished versions. Another problem that may occur is when the teacher who is updating a teaching material needs to stop the update before it is finished, resulting in a teaching material that is not complete and thus should not be accessed until the update has been completed. In this situation, the system needs a feature to control access to some teaching materials or filters for the search engine, to prevent unnecessary results in the search engine.

Having all of the updates and versions of the teaching materials available is important for novice users. This includes storing in the database even unfinished updates that are going to be

completed later. Users can use these updates to see the entire editing process of the teaching material step by step through the action history feature, and they can then understand exactly what the author did to create the teaching material. In the situation where users need to access only the most recent complete version of the teaching materials, the system can use tags and a search filter to control the results in the search engine. For example, a student may be searching for a teaching material to study, or a teacher might be searching for a teaching material he/she can use in his/her class. They need only the completed versions of the teaching materials; therefore, the search engine can give them the option to show only a completed version of the teaching materials in the search results and hide the intermediary and unfinished updates. The author of the teaching materials can use tags to tell the system which updates are the completed ones, or the system can have some specific option in the save menu where the author can indicate if the teaching material being saved is a completed one or if it still in the editing process.

C. Teaching Phase and Feedbacks

The teaching phase is the part of the process when the teacher uses his/her own or someone else's teaching material. When choosing teaching material to use, it is important for the teacher to know how the teaching material was meant to be used. Therefore, the teacher can choose the material that best fits his/her teaching abilities. As stated by Koehler and Mishra [11], teachers needs to combine his/her knowledge about the teaching subject, knowledge about the teaching techniques and methods, and knowledge about the technology he/she is planning to use in order to teach. To help other teachers, especially novice teachers, the author who creates the teaching material can add orientations in the teaching material description, giving suggestions about how to use the teaching material and for which kinds of students the teaching material was created for. Furthermore, teachers who have found different ways of using the teaching material can share his/her findings through feedback.

After using a particular teaching material, teachers and students can give feedback to the authors, and in the case of face-to-face classes, the teacher can even gather feedback from the students in real time during the class. Feedback is important for the authors to understand possible problems and also for them to get suggestions for how to improve the teaching materials. The system stores the feedback for each teaching material update and version individually. Therefore, it is also possible to follow the feedback and see how the feedback has influenced the updates and the creation of different versions of the teaching materials.

After getting feedback, the system operation cycle is finished, and it restarts when the teacher uses the feedback to improve the teaching materials, creating updates or different versions to be used in different situations. The updates and versions resulting from the feedback follow the same cycle as the previous versions did: After being created, they are shared, and after they are used, the feedback can spark new updates and versions, thus continuing the teaching material evolution.

III. POSSIBLE APPLICATIONS

Until now, the DTM concept was used in two situations: (1) language teaching in the e-Learning support platform of the

ELO project at the University of Brasilia, Brazil, and (2) astronomy teaching at the Nagoya City Science Museum in Nagoya, Japan. For language teaching, the e-Learning platform was used as a support platform for face-to-face classes, the course management was made using Moodle, and the DTM was applied to create an application that was used as a plugin only for creating the teaching material due to several problems with the Moodle content-editing features. In the case of the museum, the teaching materials were created and used in alternative learning situations, such as school tours at the museum, classes in the planetarium, and publications on the museum's website and in magazines and newspapers.

In the two cases listed above, the DTM concept was inserted in projects that were bigger than the DTM itself, and the applications created using the DTM concept needed to be adapted or limited to each environment. This situation helped the development team to develop the teaching material evolution part of the concept because the main objective was to solve problems with content creation, content updating, and the database. The development team also used the concept to create the assistance team that helped the teachers to learn how to operate the applications. However, even if the objectives of the projects were fulfilled, many things could still be done to improve the projects.

To use all of the potential of the concept, the best approach is to create a system that works like a small social network, for example, a social network only for the teachers and students of a given school. In this situation, teachers can discuss and decide together how to organize resources and the teaching materials to prevent students from getting lost when looking for what they need to study. Because the teachers at a school know one another, they can communicate more easily and also help one another more. It also becomes easy to organize a workshop to help novice users. One important thing that really should be decided in a group is which tags should be used for which type of teaching materials. This allows the teaching material description to become more uniform and readable, and it also makes it easier to find related contents.

The creation of this kind of community is also part of the system, as the idea is to create a learning environment for both teachers and students where the students need to learn the subjects in the course curriculum and, at the same time, the teachers can learn about new teaching technologies and techniques. The community essentially allows both parties to help each other by sharing their experiences both online and offline.

IV. EVALUATION TESTS

During the ELO project, the main objective of the tests was to find what was necessary to allow teachers to create e-Learning teaching materials by themselves, determine how they could share the teaching materials, and how they could keep the materials updated. The system was tested from February 2008 to April 2009 by teachers and tutors from the University of Brasilia. It was found that because a large number of the language teachers participating in the project were novice

computer users, or they almost did not have any computer experience, having a support team to help the teachers with the basics of operating a computer was so important as having a user-friendly interface. Was necessary to organize workshops to teach the participants and to also have tutors to help with installing and operating the necessary hardware during classes. At the end of the tests, the participants could learn how to use the system and create the interactive multimedia teaching materials. However, some problems remained in the management and accessibility features.

After the ELO project, the DTM concept was tested in the Sky Navi project. The main objective was to improve the database, version management, and content accessibility through the search engine. The system was tested by the Nagoya City Science Museum curator and the chief of the astronomy division of the same museum. The new database, version management, and search engine allowed the museum curator to create contents at least two times faster than before due to content reusability improvements. The version management capability and search engine allowed the curator to create different versions of the contents, use contents as templates, and reuse parts of contents, combining them into a new one. However, some problems still exist with the search filters and content accessibility control, and it was not yet possible to test the system with other museum curators.

The evaluation tests and interviews with the participants were really important for finding problems and parts of the concept that could be improved. For example, they helped with finding new possibilities such as making the users themselves help one another to improve the teaching materials, finding new teaching techniques, discovering that offline technical assistance is so important as online assistance, especially to novice users, and finding other ways to improve the learning environment for everyone. The DTM concept was revised and improved after the tests, and now the development team will try to find a research environment to perform future tests, focusing on the application of new approaches such as teachers' community learning, helping novice teachers to learn from senior teachers' experiences, and trying to create an environment where students and teachers can help each other to learn online and offline. The development team can also perform tests on new technologies such as the HTML5 in order to improve the compatibility and accessibility of the system through devices such as smartphones and tablets.

V. CONCLUSION AND FUTURE WORKS

The DTM concept was created and tested during the ELO project and SkyNavi project. The results of the tests performed in these projects allowed the development team to have a better understanding of teachers' and tutors' needs in online and offline e-Learning environments as well as curators' needs when using e-Learning in science museums. The findings allowed the development team to create a revised version of the DTM concept that not only covers teaching material creation and management processes but also can help teachers doing continued education to learn new teaching techniques and technologies.

The DTM concept extended from a mere approach to making teaching materials evolve in continuously changing learning environments, to a concept that embraces the entire learning environment and how participants should interact with one another in order to improve the environment as a whole. The concept still requires the use of tests to evaluate the utilization of new technologies such as HTML5 in these kinds of projects. Tests are also needed to evaluate new approaches of community learning that are designed to help novice teachers to access and utilize the e-Learning technologies both offline and online.

The participation of the learning community is really important for breaking the barriers to implementing e-Learning projects, as these parties are the ones who know their related needs. Better than simply bringing a possible solution from another place is actually helping them to understand the situation, helping them to learn what they can do, and helping them to evolve, thus creating a new original environment where teachers and students can learn.

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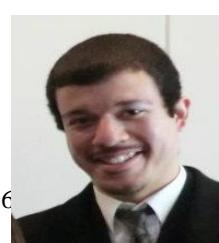
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