wiEGO (wiki integrating Electronic Graphic Organizers): Assisting Group Projects through a Collaborative, Visual Medium

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Abstract

This paper describes my design and implementation research activities for the Canadian Distributed Mentor Project (CMDP) this summer. wiEGO, my summer project, is a java based applet that interacts with an open source content management system, Moodle, and a wiki, Annoki, to assist Junior High students with their group projects. wiEGO supports the inter-play of *linguistic* and *spatial-visual* intelligences held by the collaborating learners though the integration of a visualization toolkit. I will use wiEGO, in a research study in September 2007, to investigate the role that wiEGO can play in the study of (a) language arts, (b) social studies, and (c) science. These subjects were chosen because they involve activities, such as writing, information gathering and organization, and student collaboration, all of which can benefit from the wiEGO support. My findings will be reported in June 2008 and will be submitted to various publications and conferences.

Introduction

Fostering the appropriate learning environment for students can be a daunting task for many educators, due to the wide variety of skill levels present in a classroom. Howard Gardner, in his "Multiple Intelligences" theory [1], defines intelligence as the potential ability to process a certain sort of information, such as tones and rhythms, or the position of one's body in space. The different types of intelligence Gardner defined are (a) linguistic, (b) logical-mathematical, (c) spatial-visual, (d) kinesthetic, (e) musical, (f) interpersonal, (g) intrapersonal and (h) naturalist. Essentially, Gardner's theory asserts that these different types of intelligence are independent and rely on different neuronal connections in the brain. Thus, depending upon one's brain "wiring", one may be more likely to learn when information is presented to them in a medium compatible with their own intelligence strengths or when placed in a learning context that encourages their personal learning preferences. Keeping Bloom's Taxonomy of learning objectives in mind, to enable increasingly rich levels of learning, wiEGO supports a variety of graphic organizer structures of different complexities and enables the association of a single wiki document with multiple graphic organizers.

There has been much research into the effects of student groups and student collaboration ([2], [3]), and overall it has been recommended that it is very beneficial for students to collaborate together on projects in all areas of study. Not only do students have the chance to gather new ideas from other students in their groups, they are more likely to contribute and criticize others ideas, ultimately causing the level of group success to increase. This form of student collaboration is often called student centered learning. Over the last few years there has been a great push to transform the methods though which teachers educate their students towards student centered approaches. One of the most common ways this is done is by encouraging students to use computers to complete most of their tasks.

Throughout North America and Europe, there has been a surgence in the number of projects that involve students using computers, which is more commonly termed 'one-to-one' computing ([4],[5]). 'One-to-one' computing involves providing each student in a classroom

with a laptop that they can take home. The projects usually starts in grade 7 and continues on until the students have graduated High School. This way, students are able to work on homework anywhere, at anytime. In most of the preliminary results obtained in Alberta and The United States, mobile 'one-to-one' computing has received excellent results and school boards in both locations are looking to expand their programs, (but are hindered by the cost of such programs which is roughly $1200 a student). Most of the schools that implement one-to-one computing also make use of many e-learning systems such as Moodle, WebCT, Blackboard, KEWL and FirstClass. These systems allow teachers to post all course materials on the internet and provide students with an enriched learning experience by linking them to multi-media content on sites such as YouTube, and Google Video.

One of the schools starting to become involved in the Alberta 'one-to-one' mobile computing initiative project, LakeLand School, will adopt wiEGO into their program for their grade 7 students. I will be given the opportunity to conduct a research study on the effectiveness of wiEGO with their grade 7 population of students. The CDMP has provided me with the resources to work on the wiEGO design and implementation this summer so that I can begin my research study in September when my target audience is back in school.

Previous Work

As most users of any wiki would agree, it can be quite cumbersome to navigate back and forth between pages: one forgets where they were, another topic can catch your attention and you are taken in a different direction or instead of traversing 5 links to your desired topic, it can take you 20. To cut down on the confusion that occurs when using a wiki, Dr. Stroulia has spent a lot of time doing research on the impact graphic visualizations of a wiki's content can have on a wiki user's performance and behavior. She has previously shown ([6], [7]), that using a graphic visualization alongside a wiki allows users to see the underlying relationships that occur between different wiki pages and assists them in efficiently navigating through a wiki.

Last summer, Dr. Stroulia decided that she wanted to discover if it would be possible to scale down the domain of visualizing a whole wiki, and instead wanted to visualize a smaller collection of wiki pages. She decided to restrict the domains to those wiki pages that were semantically related, say all the pages from a single project group, or to a single wiki page identifying the important sections of a page. Dr. Stroulia had me begin my work last summer on the latter, which was titled AnnokiBlooms. Through my work, I was able to create a java applet (AnnokiBlooms, See Figure 1) that utilized the University of Alberta internal software engineering wiki, Annoki, and XML files to dynamically visualize a single wiki page (we chose the domain of story writing to test this on). The idea in using story writing allowed us to investigate the multiple semantic graphs that a story could have, such as timelines, topic maps, spider maps, flow charts and hierarchies. The bulk of my work involved creating wiki parsers that would parse a story and create multiple XML XTM files, and then transforming a XTM into a different graph (such as a timeline, spider map, flow chart or hierarchy), complete with different shaped and colored nodes and edges.

After showing that single page wiki visualizations were possible, my goal for this summer was to design and implement the second phase of Dr. Stroulia's idea, visualizing a domain of wiki pages that was restricted to a single group project.

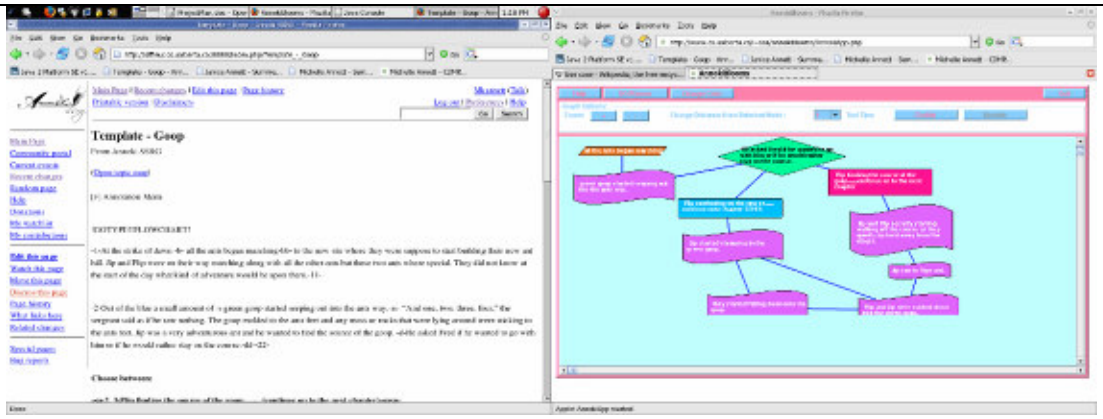

Figure 1 - Annoki Wiki on the left, AnnokiBlooms on the right.

Design

In software engineering it is very important to create use cases that describe the different behaviors and functions your program should have. The first user case that wiEGO will implement revolves around group project planning.

Use Case One: Project Planning
Organizing the work within a group project and keeping all the members updated as to the current progress of the group is challenging. wiEGO provides students with a variety of tools to assist them in their group work. Using project topic maps, wiki pages with the groups comments and history, and email notifications of changes, students will be able to better keep all of their research work synchronized and up to date. Each graphic organizer, and its corresponding wiki pages will be accessible and updatable at any time, and students will be able to export the graphic organizers they create to a variety of formats (.jpg, .gif, .png) so as to view the evolution of their project and determine who did what work.

Preconditions:

1. The students have a task and domain given to them (ie. Book report, research project).
2. Each student is assigned to a group and each group has a specific set of wiki pages they can use.
3. The student has access to the wiki (or group wiki area) on their computer.

Course of Events (example):

1. Initially, students will divide the group tasks that need to be done (ie. Plan outline of paper/project, determine timeline, who researches what subtopics, write rough drafts, edit drafts, and prepare the final copy).
2. Students will be able to use wiEGO to plan out the various tasks:

   Project outline: Students can create a hierarchy or spider map of the tasks to be completed (via GO) and the corresponding wiki pages will be created. The pages can be edited by all students in the group key changes will be viewable in GO.
   Timeline: This can be created using a blank timeline graphic organizer and can be modified or updated when new tasks arise or (a textual representation will be added to an Annoki page and changes to either the Annoki page or GO will be reflected in the other) are

completed. Students can also be emailed with task reminders or when another group member completes a task.

Rough Drafts/Draft Edits: To encourage all students to participate in the writing process of posters or papers, the students will be able to create outlines of the different paper sections using GO with story evolution, topic maps or spider map structures (the subsequent wiki page or pages will be created). After this has been done, the students can freely edit or add to the different sections and their paper will be created, or create pages that store research links (which are displayed on a topic map, spider map, timeline).

3. Upon completion of the project, if a presentation has to be created, students can use wiEGO to create a timeline or spider map of the different presentation topics and sections. As well, teachers will be able to view the paper evolution, determine which students have done which work and comment on their students' papers whenever they want to.

To successfully execute the design of wiEGO I decided to use my previous work, AnnokiBlooms, and made some necessary modifications and additions to fulfill the requirements of Use Case One. The total time period of my design process was approximately one month, which included fixing some "bugs" in AnnokiBlooms, researching HCC as well as becoming familiar with the content management system, Moodle, that LakeLand School will be using.

Implementation

The implementation of wiEGO took place from June 2007 to August 2007 and is comprised of three main sections: Moodle, Annoki and EGO.

Moodle

Moodle (*Modular Object-Oriented Dynamic Learning Environment)* is a platform independent content based management system (CMS) that is used by educators at all levels of education (elementary, secondary and post-secondary) throughout the world. Moodle takes a "constructivist and social constructionist approach to education, emphasizing that learners (and not just teachers) can contribute to the educational experience in many ways" [8]. It is used to post course materials, administer quizzes, create assignments, blogs, message boards, and forums, and manage course content through an online e-learning website (Figure 2). Moodle is not only user friendly for students and teachers, but it is also developer friendly. Everything in Moodle is modular, so any new additions that need to be made, which are called 'blocks', are extremely easy to author and implement. All code is written in php.

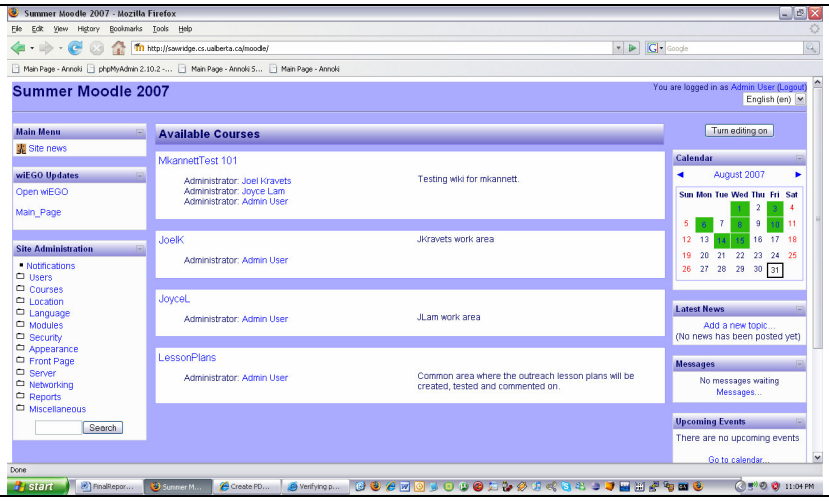

Figure 2 – Moodle Environment

To implement wiEGO, not many modifications needed to be made to our Moodle installation. I added in a 'wiEGO Block' that allows a user to view all of the wiki changes fellow group members have made since their last login to Moodle. A user can select a page title from the list of recent changes and they will not only be taken to this page to view the changes, but also logged into Annoki so they can edit, view or add new pages. This transparent login allows a student to only log in once, to Moodle, and not twice (once to Moodle and once to Annoki).

Annoki

Annoki (Annotated Wiki) is web-based wiki that contains a variety of wiki extensions. A wiki is a website that encourages individuals to collaborate with other via editing and commenting on 'wiki' pages. A wiki is an excellant piece of software to use for group project planning because it can track user behavior and allow for an anytime, anywhere collaboration between group members. When a group is writing a final report, this is very efficient because any member can edit a section of the page, and no one will have to email their section of the report to another group member. As well, a teacher can look at the history of a page and determine which group members have collaborated when, and how meaningful their contributions were.

With is in mind, Annoki is based on the very popular Mediawiki software application. Mediawiki is a LAMP system (Linux, Apache Server, mySQL, PHP) that is platform independent. In terms of the wiEGO project, the seamless combination of php and mySQL allows me to easily query the mySQL database and output XML files that can be used in the EGO program.

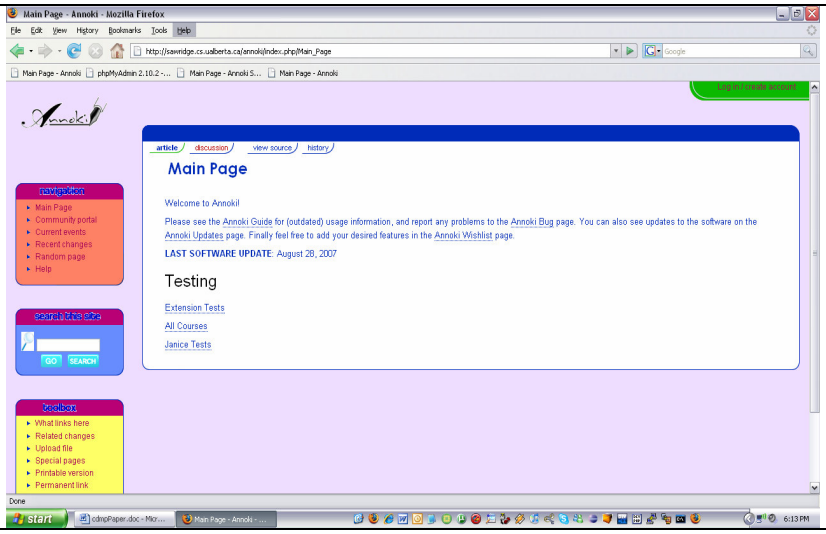

Figure 3 – New Annoki Skin

There are many different extensions and modifications that I added to Annoki to fulfill the wiEGO project. Finally, I needed to update Annoki from version 1.5 to 1.10, which took me roughly 2 weeks. I also added a spellchecker, pdf viewer, task pages, calendar, group access control, special pages to create new group projects (for teachers) and wiEGO extensions to seamlessly allow users to open EGO in a new browser window, to name a few. I also spent a large amount of time on the CSS of the website and changed the wiki skin (Figure 3). Some of the new functionality required me to write some JavaScript to interact with the PHP and mySQL of Mediawiki.

EGO

Because wiEGO contains an extension of AnnokiBlooms it implements a previous toolkit that Dr. Stroulia had created, TOMU. TOMU is java-based applet that reads in an XML XTM file. The

XML files TOMU uses are created by our wiki, Annoki. This being said, TOMU queries the database for every wiki pages' name and associated pages and outputs them to an XML XTM file. This XML file is read by the TOMU toolkit, and TOMU uses a package called TouchGraph to render a topic map (Figure 4).

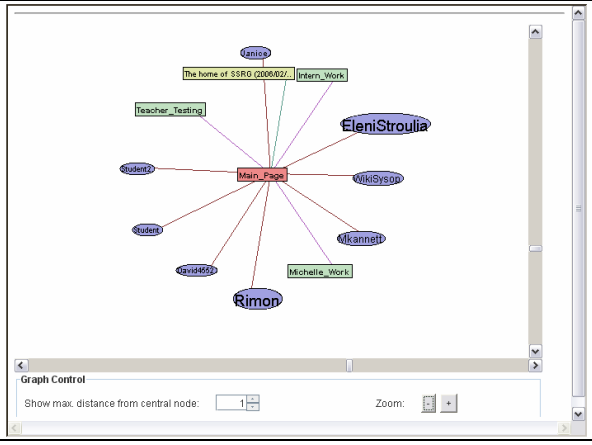

Figure 4 – TOMU

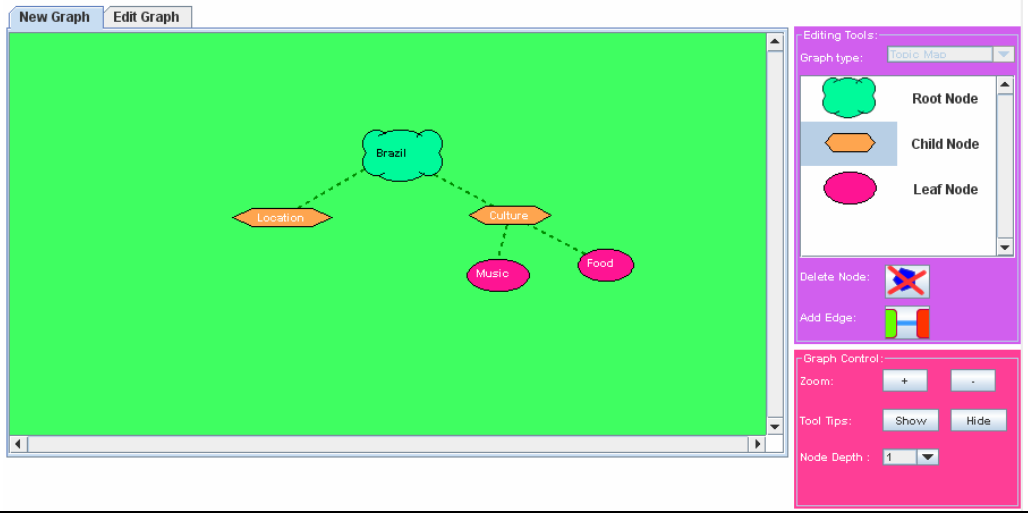

Figure 5 - EGO

Keeping with the methods used in TOMU and AnnokiBlooms, EGO also reads in an XML XTM file, but unlike TOMU, EGO can also create new topic maps or edit the existing topic maps. The new graphs can take the form of spider maps, topic maps, timelines, hierarchies or flow charts. Not only are new graphs created in EGO, they are also transformed into new wiki pages, wiki sections or content, meaning that a user can change the wiki content from another source outside of the wiki. By allowing students to do this, we are providing those visual-spatial learners with an alternative method to creating projects, reports and collaborating with their peers. The flow of information from Moodle to EGO is as follows:

Moodle login -> Click on wiEGO page link -> Logged in to Annoki ->

Taken to chosen wiEGO page -> Student adds or changes content ->

Clicks on link to open EGO -> EGO opens

Future Work

As previously stated, we timed the development and research study of wiEGO to coincide with the times when our target audience is on vacation and out of school. While the majority of development on wiEGO was completed this summer, there is still a large amount of future work that can be done. Before I deploy wiEGO to my audience, I need to develop a synchronization mechanism that will allow Annoki to interact and inform EGO of any changes that have occurred whilst a user is working on EGO. This mechanism is needed to eliminate any editing conflicts that could occur when multiple users are editing and changing either the wiki or the ego graphs. As well, I will need to integrate some metrics into wiEGO (group statistics, individual user behavior) so that I can easily analyze the user data I will be gathering once the project is in use at LakeLand school.

The next obvious step after wiEGO's development is to execute my research study. I have found a school that is interested in adopting wiEGO into their 'one-to-one' mobile computing initiative and in the process of obtaining ethics approval from the University of Alberta Ethics Committee. Therefore, the next step is to actually conduct my study. This will be done in a series of stages, each of which will have a series of user interviews and questionnaires, an upgrade to the software, and will involve me collecting the previous stage's wiEGO and metric data. After I have collected and analyzed all of the data, I should have a full report on wiEGO and my findings in June of 2008 available at http://www.cs.ualberta.ca/~mkannett, that I will be submitting to various publications and conferences.

In terms of other work and applications for wiEGO, wiki's and visualizations, I will include some Natural Language Processing in the parsing and creation of the EGO graphs so that the wiki can find semantic links between and within pages. One could also extend wiEGO into many different domains such as reading comprehension and story writing, business applications, and post-secondary course planning. After my finds have been reported, I would continue my work on wiEGO or on other wiki projects.

Conclusion

Using a collaborative, visual medium such as wiEGO, I will show that those involved in group projects not only complete their projects in an efficient and timely manner with the assistance of visual aids, but that wiEGO helps them to organize their thoughts and ideas in a way which will assist them in the group planning process. To achieve this goal, I have created wiEGO. Through its month long design phase and three month implementation phase, wiEGO developed into a three part program combining a CMS (Moodle), a wiki (Annoki) and a java applet (EGO). In September 2007, I will be running a research study to test my hypothesis about wiEGO with a school that is implementing a one-to-one computing initiative, focusing on increasing student centered learning.

Acknowledgements

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Dr. Stroulia also appointed me as supervisor for her summer WISEST student, Joyce Lam. Thank you to Dr. Catherine Descheneau for appointing me supervisor of her high school intern, Joel Kravets. Mentoring both of these students allowed me insight into the world of teaching and mentoring.

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