AC 2011-2713: EXPERIENCE WITH SOFTWARE SUPPORT FOR MANAGING STUDENT-AUTHORED WIKI TEXTBOOKS

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Experience with Software Support for Managing Student-Authored Wiki Textbooks

Abstract

Traditionally, students study from textbooks written by "experts" in the field. But there are important pedagogical advantages to having them write part or all of their textbook. Until Web 2.0, however, student-authored textbooks were infeasible because of the overhead in reviewing contributions and making them available to the rest of the class. A wiki meets both of these needs very nicely. But substantial administrative overhead remains. Our Expertiza system has features for managing this overhead. We have used the system for two semesters. This paper reports on our experience. Student reaction has been quite positive, especially with regard to how much insight students gained from their writing. We also learned that certain aspects of the experience (such as double-blind review) were more difficult, and other aspects (such as sequencing between chapters) were easier than expected. These experiences are guiding further development of the software, which is available to any instructor who wants to use it to manage development of a wiki textbook.

1. Introduction

In the middle of the 19th century, a revolution swept through the American textbook industry, as understanding replaced rote memorization as the goal of education [1]. No longer were textbooks written in the catechetical question-answer style, but they now incorporated word problems that students were challenged to solve. We may be on the cusp of another revolution, as linear, printed textbooks may soon give way to hyperlinked electronic ones [2]. The earlier revolution was driven by technology (the growing availability of blackboards, and more affordable pens and paper) as well as pedagogy. The new revolution is being driven by technology, but also by pedagogy. One aspect of this change is the idea that students should be more actively involved in interacting with their textbook.

Taking the idea of interaction one step further is the student-authored textbook movement—the idea that students will benefit from *writing* all or part of their textbook. There are many advantages to this approach: It forces students to confront the primary literature, reading technical articles about the subject they are writing on. It gives them experience in organizing their thoughts for their peers, which in itself can lead to gains in writing ability [3]. Writing for peers differs from writing for an "expert" audience as students normally do, because peers cannot be expected to understand the material unless it is well explained. It teaches students to "find truth" on the Web, by making inferences based on reading multiple sources and evaluating their respective claims.

While students may not immediately appreciate the pedagogical benefits of wiki textbooks, they do understand their price advantage. The idea of a free textbook has instant appeal. If students are asked to pay for a textbook, then they should reap some benefit from it:

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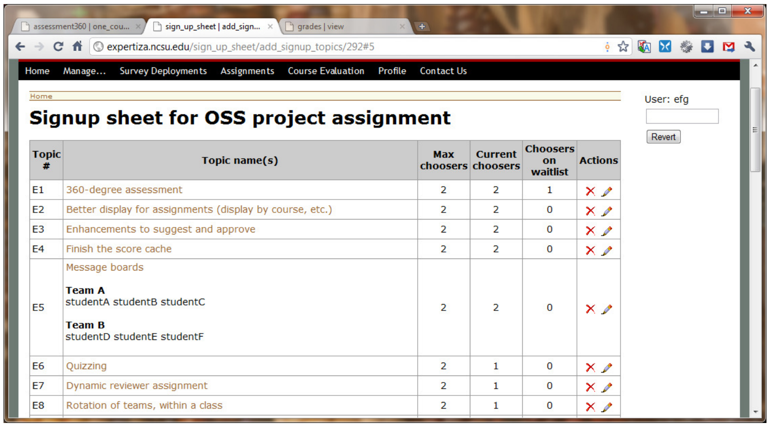
students who purchase the text should do better in the class. But a British study [4] found "no correlation between textbook purchase and the grade received." While scholars are beginning to examine the effectiveness of student-authored wiki textbooks [5, 6], research has rarely been done on the pedagogical value of commercial textbooks, either before or after publication [7].

Despite their advantages, student-authored textbooks were infeasible until Web 2.0. First, there was the problem of assembly: multiple wordprocessor documents would have to be collected and put online for the class to see. Then there was the review problem—most students could not be expected to write well enough on their first draft to convey new ideas effectively. Feedback and revision would be necessary. Wikis and online peer review has changed this [8]. Now students can edit text in place, with the results being immediately visible to anyone who visits the page. Online review systems make it possible for the instructor and other students to provide rubric-based online feedback to the author. Our Expertiza system [9, 10] allows authors and reviewers to engage in a double-blind two-way rubric-based conversation, as described below.

2. Administrative needs

The administration of a large wiki textbook project is demanding, encompassing aspects of topic selection, communication, role and responsibility assignment, assessment and monitoring.

1. *Signup sheet.* Only a limited number of students or teams must be allowed to select any particular topic, to assure that all the topics will be chosen by somebody. Passing around a signup sheet in class means that some students get first choice because of where they sit in the classroom. Using standard software tools for this task—shared spreadsheets or message boards, for example—is unreliable, since these tools don't have any way of preventing "too many" students or teams from signing up for a particular topic. Expertiza uses an "electronic signup sheet" (Figure 1), which allows the instructor to specify the number of "slots" for each topic, that limits the number of students or teams allowed to choose the topic (if a topic is full, students may choose to be waitlisted, in case a slot opens up later on).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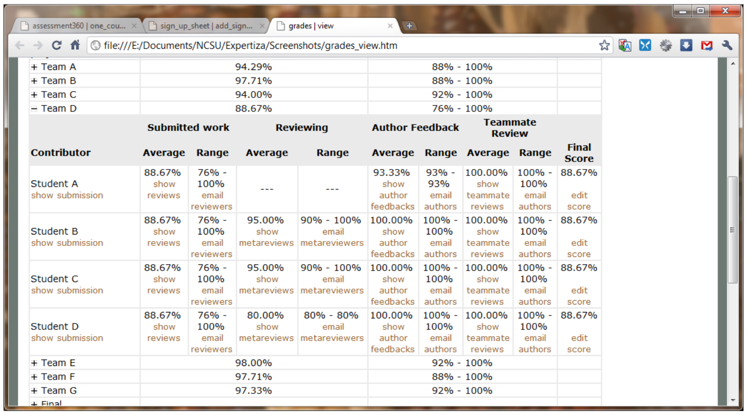
Signup sheet for OSS project assignment

Topic #	Topic name(s)	Max choosers	Current choosers	Choosers on waitlist	Actions
E1	360-degree assessment	2	2	1	✕ ✎
E2	Better display for assignments (display by course, etc.)	2	2	0	✕ ✎
E3	Enhancements to suggest and approve	2	2	0	✕ ✎
E4	Finish the score cache	2	2	0	✕ ✎
E5	Message boards **Team A** studentA studentB studentC **Team B** studentD studentE studentF	2	2	0	✕ ✎
E6	Quizzing	2	1	0	✕ ✎
E7	Dynamic reviewer assignment	2	1	0	✕ ✎
E8	Rotation of teams, within a class	2	1	0	✕ ✎

Figure 1. A signup sheet in Expertiza



assessment360 | one_cou... sign_up_sheet | add_sign... grades | view

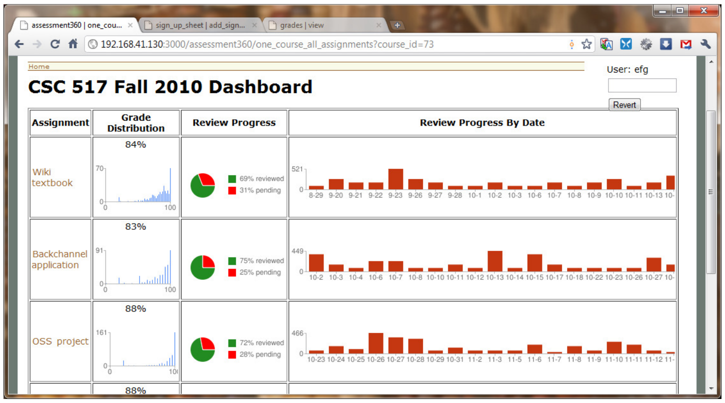
file:///E:/Documents/NCSU/Expertiza/Screenshots/grades_view.htm

	Submitted work		Reviewing		Author Feedback		Teammate Review		
+ Team A	94.29%				88% - 100%				
+ Team B	97.71%				88% - 100%				
+ Team C	94.00%				92% - 100%				
− Team D	88.67%				76% - 100%				
Contributor	Average	Range	Average	Range	Average	Range	Average	Range	Final Score
Student A show submission	88.67% show reviews	76% - 100% email reviewers	---	---	93.33% show author feedbacks	93% - 93% email authors	100.00% show teammate reviews	100% - 100% email authors	88.67% edit score
Student B show submission	88.67% show reviews	76% - 100% email reviewers	95.00% show metareviews	90% - 100% email metareviewers	100.00% show author feedbacks	100% - 100% email authors	100.00% show teammate reviews	100% - 100% email authors	88.67% edit score
Student C show submission	88.67% show reviews	76% - 100% email reviewers	95.00% show metareviews	90% - 100% email metareviewers	100.00% show author feedbacks	100% - 100% email authors	100.00% show teammate reviews	100% - 100% email authors	88.67% edit score
Student D show submission	88.67% show reviews	76% - 100% email reviewers	80.00% show metareviews	80% - 80% email metareviewers	100.00% show author feedbacks	100% - 100% email authors	100.00% show teammate reviews	100% - 100% email authors	88.67% edit score
+ Team E	98.00%				92% - 100%				
+ Team F	97.71%				88% - 100%				
+ Team G	97.33%				92% - 100%				
+ Final									

Figure 2. Peer-review grade display in Expertiza

2. *Reviewer- author communication*. Reviewers frequently have trouble understanding an article, or simply do not invest the time to understand it. Authors find such reviews unhelpful or insulting. It is far better to allow the author to contact the reviewer through the system, than for the author to complain to the instructor. Expertiza allows author and reviewer to communicate as frequently as desired, in double-blind fashion. Expertiza provides the author with a rubric to evaluate the review, just as it presents a rubric for the reviewer to evaluate the author's work.

3. *Staggered deadlines*. In a technical course, it is not possible to write all of the chapters in the same timeframe. Some chapters depend on material in earlier chapters. Students should be able to read the material in prerequisite chapters before they begin to write later chapters. This means that the chapters need to have separate sets of due dates—due dates for signing up, submission, review, resubmission, etc. Managing this many due dates is a significant burden on the instructor. Given the due dates for the first chapter, and a precedence chart of the prerequisites for each chapter, Expertiza automatically calculates due dates for later chapters based on a rule—that each due date for each chapter is say, two weeks, later than the corresponding due date for the latest prerequisite chapter. Thus, if Chapter 1's resubmission deadline is, say, on Sept. 3, and Chapter 1 is a prerequisite for Chapter 2, then Chapter 2's resubmission deadline will be on Sept. 17. The system sends an e-mail reminder to each student a day or two before the deadline for submitting or reviewing (the instructor determines how far in advance the e-mail is sent).



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Home

User: efg

Revert

CSC 517 Fall 2010 Dashboard

Assignment	Grade Distribution	Review Progress	Review Progress By Date
Wiki textbook	84%	69% reviewed 31% pending	
Backchannel application	83%	75% reviewed 25% pending	
OSS project	88%	72% reviewed 28% pending	
	88%		

Figure 3. Expertiza's dashboard

4. *Dashboard for monitoring wiki textbook construction.* The instructor needs to be able to keep close tabs on the process of writing and reviewing, to see how many reviews have been done, how students are interacting with each other, and what scores have been assigned. Expertiza provides a

tableau (Figure 2) that shows the average and range of scores for each user or team for submitted work, for reviewing, and for participation on the team. This tableau is currently being extended to graph statistics such as grade distribution and number of reviews submitted per day (Figure 3). This information gives the instructor an overview of the process that would simply be unavailable without specialized software.

3. The courses and assignments

Spring 2010: Parallel computer architecture. We used the wiki-textbook features of Expertiza in two courses in 2010. The spring course was a small (15-student) advanced undergraduate/beginning graduate course on parallel computer architecture. This course uses a locally written textbook [11]. We did not desire to supplant this textbook, but rather to extend it by adding material on topics it didn't cover (e.g., data-parallel architectures) and show how concepts covered in the text (e.g., locking constructs) were realized in specific systems.

In this course, students were assigned to supplement individual chapters of the textbook. They were allowed to work either individually or in pairs. There were two slots for each chapter, meaning that two individuals or teams could sign up for each. Each student was required to work on two chapters during the semester. Chapters were due approximately two weeks after the previous set of chapters.

At the outset, students had trouble understanding what was expected of them. Several of them simply rewrote the material that was covered by the textbook, perhaps including different examples. They didn't realize that they could assume that their readers were *already* familiar with the textbook chapter. We wanted them to cover different topics, or more recent developments. We attempted to set the students right by having the instructor and his assistant review the student work, along with three student peer reviewers. We sought to provide adequate guidance to the students on how to review their work.

Another challenge was motivating the students to search for material that covered the topic in depth. The first few search hits would usually provide an overview of the topic. Unless the student examined additional sources in search of implementation details, the resulting supplement had a superficial tone. At other times, students would include material that they thought was supplementary, only to discover that it was covered in the next chapter of the textbook. Rather than make students aware of these problems in our initial review of their work, we thought it was better to anticipate them by providing students with better guidance on what we wanted. We began to post links to articles, manuals, etc. that we wanted students to read when researching their topic. We met weekly to discuss what to provide to students. When we wanted them to write about implementations, we looked at Web sites of leading chipmakers like Intel and AMD. When we wanted the students to update coverage of a topic, we looked in technology news. When we wanted them to provide greater depth on a topic glossed over in our textbook, we consulted other textbooks. As the semester wore on, we became more pleased with the students' initial drafts. The final version of the text seemed to be improved too. However, the peer reviewers became more demanding, with the result that the scores received by students were practically unchanged: 82.8% for their

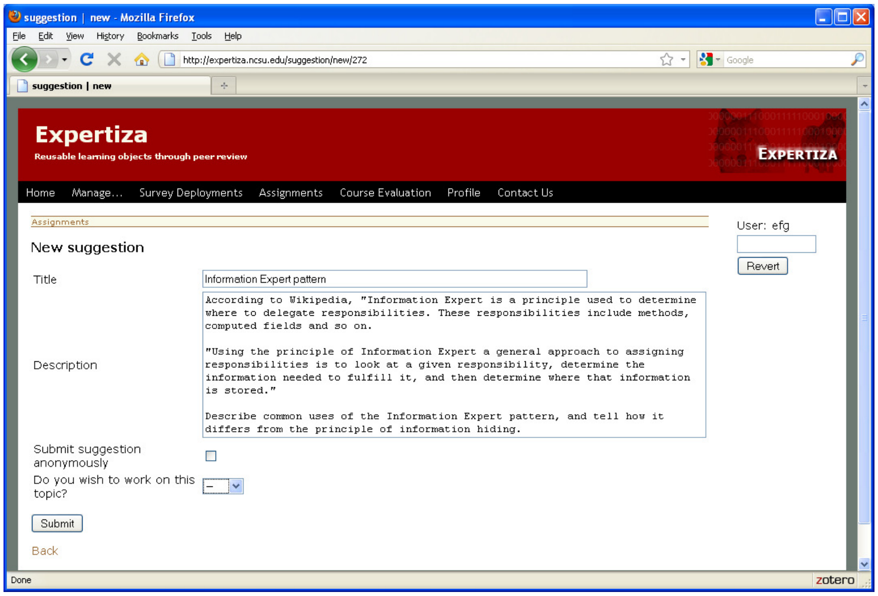
Page 22.676.5

first submission, 82.7% for their second. (If the reviewers agreed to within about 10%, the instructor accepted the average of their ratings as the student's grade; otherwise, outliers were removed, and the instructor made a decision on the final grade, taking into account reviewers' text comments.)

Fall 2010: Object-oriented design. The author assigned wiki-textbook chapters to his students again in Fall 2010. The level of the course was similar—a mixture of beginning masters students and advanced undergraduates. But the course was nearly 10 times larger, beginning with about 140 students and finishing with about 110. Unlike the spring semester, four textbooks were used for different parts of the course, so many of the wiki writing assignments were used as "glue" to compare and tie together the treatments of related topics in the different books. Other assignments served to fill in the gaps in topics covered by the textbook (e.g., the GRASP patterns for assigning responsibilities to classes and objects in a program).

Because of the size of the class, it was not possible for the instructor and TAs to personally review all of the student contributions. Counterbalancing this to some extent was the fact that most topics were not trying to go into greater depth than the textbook, but rather to cover more breadth. Students had less trouble accomplishing what they were assigned to do.

To avoid needless duplication of effort, each topic was limited to three slots (only three students, or pairs of students, were able to select it). This meant that a very large number of topics were required, 62 in total. The instructor, with some help from the TAs, specified most of them, but students were also invited to suggest topics through Expertiza (Figure 4). These topics were presented to the instructor, who could then approve them (in which case they went on the signup sheet and became available to students), reject them, or defer them for consideration at a later time. About a dozen of the 62 topics were originally suggested by students.



New suggestion

Title: Information Expert pattern

Description:

According to Wikipedia, "Information Expert is a principle used to determine where to delegate responsibilities. These responsibilities include methods, computed fields and so on.

"Using the principle of Information Expert a general approach to assigning responsibilities is to look at a given responsibility, determine the information needed to fulfill it, and then determine where that information is stored."

Describe common uses of the Information Expert pattern, and tell how it differs from the principle of information hiding.

Submit suggestion anonymously ☐

Do you wish to work on this topic? –

Figure 4. "Suggest and approve" in Expertiza

4. Evidence of learning

At the end of each semester, we had the students fill out a survey on their experiences during the wiki-textbook project. Response rates were 60% in the spring course, and 54% in the fall course.

Table 1. Results from student survey

Question	Spring course (15 students, writing for depth)	Fall course (110 students, writing for breadth)
I had trouble understanding what was expected of me in writing a textbook chapter.	2.78	2.63
I put a lot of effort into writing my articles for the wiki textbook.	4.22	4.13
The material I read in order to write my chapter gave me new insight into the topic I was writing on.	4.22	4.20
The textbook articles I wrote are credible entries for a graduate textbook.	3.78	3.80
I am proud of my contributions to the wiki textbook.	4.11	4.11
Having students write a textbook supplement for a course like [this course] is a good idea.	3.78	3.80
I clearly understood what was expected of me in reviewing a textbook chapter.	3.67	3.73
The chapters I read that were authored by other students gave me new insight into the material they covered.	3.44	3.71
The reviews I received helped me to improve my work.	3.33	3.49
The scores assigned by the reviewers were fair.	3.44	3.30
There was too much rating required for this class.	3.11	3.75
I had trouble determining how to carry out the assigned activities in Expertiza.	2.44	3.04

In both classes, students were most positive on the insight they gained from the writing assignment, with averages well above 4 on a scale of 1 to 5. They also put a lot of effort into the assignment, and were proud of the results. Students in the fall class seemed to be slightly more positive on what they learned from reading other students' work. The most negative score was registered by the fall students, on the question that asked whether too much rating was required. This is probably due to differences in the homework between the spring class (problem sets, simple programming assignments and writing assignments) and the fall class (extensive programming assignments and writing assignments). In the fall class, students peer-reviewed each other's programs, as well as each other's writing. In the spring class, only writing was peer-reviewed.

5. Lessons learned

Our support for wiki textbooks in Expertiza was designed after talking to several instructors who had assigned wiki-textbook projects in their classes. Many of the decisions were based, however, on what we thought would be the mode of usage by faculty and students. In order to find out whether we were right, we needed to build the software support and use it in actual classes. What we found was in some cases quite different from what we expected.

Handles are not necessarily a win. We assumed that students would want double-blind review, so we gave them the option of writing on the wiki using a "handle" instead of their university username. Only about half of the students chose a handle, however; for the others, hiding their identity was evidently not important. We thought that students should be allowed to change their handle from one assignment to the next, so that their partner for one assignment would not know whether or not they were reviewing their former partner. Some students forgot that they changed their handle, and went back to writing with their own handle. Then when the review system looked for contributions under the new handle, it found none, and reported to the reviewers that the work had not been done. The ensuing confusion probably more than outweighed the benefit of using handles.

Students want to submit their work explicitly. Normally, when students do homework, they expect to submit it for grading. That's not necessary on a wiki, because software can search for all pages edited by a user, and thus find a student's work, without the student ever having to submit it. We thought it would be easier for students not to have to submit. In fact, it led to many questions asking, How do I submit my work? Worse, when multiple assignments were done on the same wiki, the system had no way to tell the submissions to different assignments apart, except by the date that the page was last edited. This resulted in late fixes to pages from one assignment being counted as part of the next assignment. Again, the resulting confusion clearly outweighed the benefit of not having to submit work.

Precedence constraints on assignments are not really needed. Since some chapters are prerequisites for other chapters, we thought that should be represented in the system, so that a chapter would not be due before its prerequisite chapters were completed. However, in both semesters it was so much work to specify what we wanted in a chapter that we never got around to writing it up before the prerequisite chapters were finished. Automated calculation of due dates, based on a two-week interval (for example) between chapters is still nice, but in the cases we've seen, it has not been necessary to specify precedence constraints within the system.

Rarely can student-initiated topics be approved without discussion. The idea of having students suggest chapter topics is a good one; it helps expand the perspective of the instructor as well as the students. But only once or twice did a student write a topic description that was appropriate to give to the students. Students were not aware of all the other topics that had been created, or were going to be created, and often their description overlapped with these. Or, their topic was interesting, but not sufficiently ambitious. In almost every case, the instructor needed to edit the topic and send it back to the proposer before approving it for students to work on. The system should support revision of suggested topics.

Students need e-mail reminders and a task list to stay on track with their work. In a wiki-textbook project that spans the semester, students are writing at different times, and reviewing at different times. There is never a single deadline that applies to the whole class. Students need to be reminded of deadlines that pertain to them. That is why we have recently added a facility to send students a reminder e-mail before each deadline, with the instructor selecting how far in advance the reminder is to be sent. We have also just added a task list to Expertiza, so that a student, upon logging in, will see a list of his/her upcoming deadlines. The student need only click on one of the deadlines to be taken to the page related to the particular task (signup, submission, review, etc.).

These observations underline the fact that experience with wiki textbook-writing is still in its infancy. In 2011, we will be working with several outside instructors to improve the support that the system provides. Our goal is to build a system that is friendly to both students and instructors, and one that can enable more collaboration and new pedagogical strategies using wiki textbooks.

5. Related work

Wiki textbooks in many fields, including engineering, can be found at wikibooks.org. It is not easy, however, to determine how many have been authored by students. The Michigan Process Controls and Dynamics Textbook [8, 12] is a student authored wiki text run from the University of Michigan chemical engineering program. The text was created as a central element of the senior engineering course work in the 3 credit hour class. Students for the past 5 years have worked in small groups adding, editing, and reviewing content on the public site www.controls.engin.umich.edu. Currently the text is over 1000 printed pages, and receives on the order of 2000 visits per day from around the world.

6. Conclusion

Student-authored wiki textbooks have proven their value in disparate fields over the past five years. Our students were very positive about the insight they gained from the experience. Peer-reviewed wiki-textbook assignments engender much student-to-student communication: between teams of authors, from reviewer to author(s), from author(s) to reviewers, and from readers to authors. A specialized peer-review system can keep track of this communication and give the instructor a very good idea of the contributions made by each student. It can also help manage a process that inherently has a large number of deadlines, which can vary from student to student. We look forward to exploring the pedagogy of wiki-textbook writing, and hope to support further innovation through special-purpose software.

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