Experience with a student-written wiki textbook supplement

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Abstract

As wiki usage becomes common in educational settings, instructors are beginning to experiment with student-authored wiki textbooks. Instead of reading textbooks selected by the instructor, students are challenged to read the primary literature and organize it for consumption by the other members of the class. This has important pedagogical advantages, as students are stimulated to take responsibility for their own learning and perform tasks similar to those in the real world. These benefits, however, come with an array of administrative challenges, including sequencing the material to be covered, and assigning other students to peer-review the submitted work. We are developing software to assist in this effort. This presentation discusses our experience with the process and the software in an advanced course on parallel computer architecture, where students were assigned to write supplements for each textbook chapter, describing how the theory covered in class was realized in state-of-the-art multicore processors.
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Introduction

In the last half-dozen years, the wiki has emerged as one of the leading collaborative tools on the Web. It has the advantage that editing is done in place, without the need to pass copies around by e-mail. This eases collaboration, by making it obvious which version is the most current. Moreover, changes become visible instantly to anyone who accesses a page, which means that no intervention by the instructor is needed to disseminate new versions to the rest of the class. These characteristics make it possible for students to work together to write text that is intended to be read by their fellow students.

Forward-looking instructors were quick to apply wiki-based collaboration to a task that would heretofore have been intractable: having students write their own peer-reviewed textbook for the class. The advantages are many: Rather than simply consume what is fed to them by the instructor and textbook author(s), students now have to take responsibility for their own learning (NRC 2005), determining what is worthy of being taught to the class. In so doing, the students are "constructing" their own learning. This meshes well with constructivism (Bednar et al. 1991)—the theory that in order to assimilate knowledge thoroughly, students must "build" it in their own minds rather than simply receive it from an external source. Assigned textbooks deprive students of the motivation to decide what topics are relevant and remove the need to evaluate different points of view. For this reason, they have been called "inconsistent with constructivist principles" (Cunningham et al. 2000).

Researching a wiki textbook forces students to read the primary literature--a skill that is very necessary in the outside world, and one that is rarely given thorough attention in undergraduate courses. If left to their own devices, students favor secondary research
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sourcing sources like Wikipedia (Rainie 2007). Ironically, this testifies both to the attractiveness of the wiki for constructing reference works, and the need to encourage students to do their own research.

Writing a textbook article is beneficial because it is expository writing. A broad body of knowledge supports the idea of "writing across the curriculum" (Barnett and Blumner 2008), which says that writing experience should be integrated into every academic discipline, rather than confined to writing courses. By contributing to the textbook, students gain experience writing up their thoughts for an audience of their peers. Feedback from their classmates helps them learn from their mistakes and improve their writing skills.

Finally, in a world where textbook prices are a significant component of the cost of education, student-authored textbooks have the ability to save students money. Surprisingly, there is little evidence that students benefit from what they pay for their textbooks. A four-year old English study found "no correlation between textbook purchase and the grade received" (Carpenter et al. 2006). While there is a developing body of research on student-authored wiki textbooks, little research has been done on the efficacy of most commercial textbooks, either before or after publication (Reys et al. 2004).

**The administrative burden**

Wikis take care of version control and dissemination of student writing, but many administrative issues remain. Writing a textbook is a series of different projects, which usually need to be spaced out throughout the semester. One must arrange for at least one student to choose each of the chapters or topics that need to be included. In a face-to-face
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class, this can be arranged by passing around a signup sheet, but in a distance-education class, software support is needed. Even in a face-to-face class, software support is useful, because choices made by students are registered automatically in the system, and students have an equal ability to sign up while there are still many topics available.

Appropriate deadlines must be assigned for each topic or chapter. Peer review requires separate deadlines for submission and review ... and, if authors are to revise their work in response to peer comments, there must be resubmission and final review deadlines as well. There is usually a precedence relationship between topics: Some topics must be learned before other topics can be presented. This means that the same four deadlines (submission, initial review, etc.) are applied to different work at different times during the semester. A topic may not be written on before all prerequisite topics have been completed. Getting all of these deadlines set is time consuming, and sending reminders to the students involved makes it more complex. Software support is clearly desirable. In the Expertiza system (Gehringer et al. 2007, Gehringer 2009), we have implemented support for signup sheets and staggered deadlines (Gehringer, Kadanjoth and Kidd 2010).

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Our software was first deployed in CSC/ECE 506, Architecture of Parallel Computers. This is a beginning masters-level course that is taken by all Computer Engineering masters students. It is optional for Computer Science students, but as it is one way to fulfill a core requirement, it is popular with them too. The recently adopted textbook for this course is the locally written *Fundamentals of Parallel Computer Architecture: Multichip and Multicore Systems* (Solihin 2009). It did not make sense to
have the students rewrite this excellent text, but the book concentrates on theory and
design fundamentals, without detailed application to current parallel machines. We felt
that students would benefit from learning how the principles were applied in current
architectures. Furthermore, they would learn about the newest machines in this fast-
changing field.

After every chapter covered in class, two individuals, or pairs of students were
required to sign up for writing the wiki supplement for that particular chapter. (That is,
we solicited two supplements for each chapter, each of which could be authored by one
or two students.) They were asked to add specific types of information which was not
included in the chapter.

Initially, students were not clear about the purpose of their wiki pages. The first
pages they wrote had substantial duplication of topics covered in the textbook. Students
were attempting to give a complete coverage of issues discussed in the chapter. We
wanted them to concentrate instead on recent developments. Upon seeing this, we
established the practice of having the first two authors of this paper (Gehringer and
Navalakha) review the student work, along with three peer reviews from fellow students.
A lot of review time was spent providing guidance on how to revise.

At the beginning we gave the students complete freedom to explore resources for
the topic they had chosen to write on. This was not very successful, as the students
seemingly chose to read the first few search hits, which tended to provide an overview of
the topic, rather than in-depth information on particular implementations. Sometimes
students were not aware that the information they found was already covered in the next
chapter, which they have not read yet. The first review which we gave students was
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mainly just making them aware of topics covered in later chapters. A lot of effort in writing the initial draft was thus wasted. After the first two sets of topics, we began to provide links for students to material that we wanted the students to pay attention to. Gehringer and Navalakha met weekly to discuss what to provide to students. We regularly consulted other textbooks, technology news, and Web sites of major processor manufacturers, such as Intel and AMD. As the semester progressed, the quality of the initial submissions improved, and the students realized better returns for their effort.

The quality of work seemed to improve as the semester progressed. A comparison of the grades for the wiki pages revealed that the average score for the first chapter written by each student was 82.8% while the average for the second submission was 82.7%. The quality of wiki pages had improved, but at the same time, the peer reviewers became more demanding. Students were given more inputs to improve their work via peer reviewing. Thus the improvement was seen in the final wiki page produced as against the grades received by students. The initial wiki pages provided randomly collected data cluttered by diagrams and graphs. This information reinstated facts given in the textbook. The later wiki pages focused on a comparative study of present-day supercomputers produced by Intel, AMD and IBM. For example while writing the wiki for cache-coherence protocols, the students examined which protocol was favored by which company and why. They also discussed protocols which have been introduced in recent two years e.g., Intel's MESIF protocol. Gehringer and Navalakha provided additional reviews which helped improve the quality of wiki pages. These reviews gave the students insight into what was expected of them. This led the peer reviewers to focus increasingly on current developments. It was observed that later
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versions of reviews included guidance similar to that received from Gehringer and Navalakha. The organization of the wiki pages and the volume of relevant data collected by students improved as the semester progressed.

At the end of the semester a twelve-question Web survey was sent out to 15 students who finished the class, 9 of whom responded.

**Table 1. Results from student survey**

<table>
<thead>
<tr>
<th>Question</th>
<th>Student Response</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>I had trouble understanding what was expected of me in writing a textbook chapter.</td>
<td>4 3 2 4 2 1 4 4</td>
<td>2.78</td>
</tr>
<tr>
<td>I put a lot of effort into writing my articles for the wiki textbook.</td>
<td>3 5 5 4 4 5 3</td>
<td>4.22</td>
</tr>
<tr>
<td>The material I read in order to write my chapter gave me new insight into the topic I was writing on.</td>
<td>4 4 4 5 4 5 4</td>
<td>4.22</td>
</tr>
<tr>
<td>The textbook articles I wrote are credible entries for a graduate textbook.</td>
<td>2 4 5 4 4 4 2</td>
<td>3.78</td>
</tr>
<tr>
<td>I am proud of my contributions to the wiki textbook.</td>
<td>3 5 5 4 4 4 2</td>
<td>4.11</td>
</tr>
<tr>
<td>Having students write a textbook supplement for a course like ECE/CSC 506 is a good idea.</td>
<td>4 2 5 4 4 4 2</td>
<td>3.78</td>
</tr>
<tr>
<td>I clearly understood what was expected of me in reviewing a textbook chapter.</td>
<td>3 4 3 4 5 4 3</td>
<td>3.67</td>
</tr>
<tr>
<td>The chapters I read that were authored by other students gave me new insight into the material they covered.</td>
<td>2 3 3 4 5 3 4</td>
<td>3.44</td>
</tr>
<tr>
<td>The reviews I received helped me to improve my work.</td>
<td>2 4 4 5 3 4 2</td>
<td>3.33</td>
</tr>
<tr>
<td>The scores assigned by the reviewers were fair.</td>
<td>2 4 3 4 4 2 4</td>
<td>3.44</td>
</tr>
<tr>
<td>There was too much rating required for this class.</td>
<td>3 5 3 3 2 4 3</td>
<td>3.11</td>
</tr>
<tr>
<td>I had trouble determining how to carry out the assigned activities in Expertiza.</td>
<td>3 3 1 3 2 1 4 3</td>
<td>2.44</td>
</tr>
</tbody>
</table>
None of the averages were unfavorable. Of the students who responded, on a scale of 5 (where 5 is strongly agree and 1 is strongly disagree), the average response was 4.22 to the question which asked them whether they had put a lot of effort in writing articles for the wiki textbook. Similarly, they rated at 4.22 a question that asked them whether the material they read in order to write their chapter gave them new insight into the topic they were writing on. Also, when they were asked whether they were proud of their contribution, students rated it a 4.11. Students used the electronic signup sheet for selecting their topic. So they were asked whether they had any trouble using it; students rated this question at 2.44, which means most of them were comfortable using the system.

All questions phrased positively received a score of at least 3.33. The only negatively-phrased question that was scored greater than 3 asked whether there were too many deadlines, and even in this instance, an average of 3.11 is close to noncommittal. Since then, the Expertiza system has been modified to send e-mail reminders when a task is due; this should help students meet their deadlines.

There seems to be most room for improvement in feedback from students—in the helpfulness of feedback, and the fairness of assigned scores. Both of these issues are being addressed by more comprehensive rubrics, which we are adapting from another wiki-textbook project.

Summary

Electronic peer-review systems have been widely used to review student work, but never before, to our knowledge, have they been applied to assignments consisting of multiple interrelated parts with precedence constraints. The growing interest in large
collaborative projects, such as wiki textbooks, has led to a need for electronic support for the process, lest the administrative burden on instructor and TA grow too large. Our Expertiza system assists in administration. We have been pleased with the accomplishments of students in this semester, and their survey responses reflect similar satisfaction with the textbook-writing assignments and peer-review system.

References


