OpenSeminar: A Web-Based Collaboration Tool for Open Educational Resources

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Abstract

Today, it is common for university instructors to compile links to online resources for the courses they teach, either as a supplement to a textbook, reading packet or, in some cases, as a replacement. Finding resources and keeping them up to date is time consuming. Instructors who teach similar subjects at different universities might benefit from working together to compile and share online resources for their courses. This paper describes a tool for sharing instructional materials called OpenSeminar. The purpose of OpenSeminar is to facilitate the structured compilation of open, online resources among a group of collaborators who share a common area of interest. Using OpenSeminar, the selection of resources can be customized and deployed to meet the specific needs of each professor. OpenSeminar adopts an editorial peer review framework to ensure content quality control. An illustration of OpenSeminar in the field of software engineering is provided.

1. Introduction

Currently, online course resources at most major universities are maintained by individual course instructors who find, create, and edit the resources. Course resources, or courseware, can include readings, websites, tutorials, lecture notes, assignments, labs, and plug-ins [2]. There are many openly-available on-line course resources, and more instructors may be motivated to share courseware to enhance their visibility [2] and share new knowledge about a subject. However, searching for resources and keeping these resources updated is time consuming. Additionally, instructors may have little time for keeping a course updated once designed. Professors and university students would benefit from having the most current, clear, and relevant expertly-chosen resources for their courses.

To leverage the investment made by individual instructors, to avoid duplicate work, and to provide the best permanently-located resources for students, we have created OpenSeminar[1]. OpenSeminar is a customizable, web-based, open courseware platform[2] for collaboration and selection of course resources between and by course instructors. A group of experts in a given subject can collaborate to create a specific installation of OpenSeminar to provide resources for a given subject.

OpenSeminar is designed to enable a group of member professors to collaborate on material for similar courses by sharing links to content. Each professor can then use OpenSeminar to create an aesthetically pleasing course site. The types of courses that we see OpenSeminar replacing are upper-level university seminar courses. An installation of OpenSeminar in a given subject is in effect an expert-maintained repository or database of links to organized online information that is openly available on the Internet. As innovations occur in a subject, courseware materials will be updated, and OpenSeminar users will always benefit from the most current resources. As a result, students taught by a member professor—or any student searching the Internet—can gain from the resources provided on an OpenSeminar.

In this paper, we present the OpenSeminar in Software Engineering (OS/SE)[3], the first active OpenSeminar. The repository of course resources for OS/SE was populated through an extensive search of the Internet for openly-available, relevant materials and by development of course materials by the second and fourth authors. OS/SE provides the resources for two courses taught in the computer science department at North Carolina State University (NCSU). Currently, the advisory and editorial boards for OS/SE have been formulated; board members are recognized experts from many institutions. These boards will provide the infrastructure for increased multi-institution collaboration centered on the OS/SE and will enhance the credibility of the resources posted on the OS/SE.

The rest of this paper is organized as follows: Section 2 covers related work on courseware platforms, including

[1] http://openseminar.org
[2] An open courseware platform is distinct from a course management system, in that it only provides course materials rather than management tools for course enrollment, grades and other administrative tools.
[3] http://www.openseminar.org/se

comparisons of the collaborative abilities. Section 3 provides an overview of the OpenSeminar platform. Section 4 describes the OS/SE, and Section 5 provides an overview of the technology used to run an OpenSeminar. Section 6 describes our conclusions and future work.

2. Related Work

On college campuses, commercial courseware systems are ubiquitous, and are adopted at the institutional level. These systems include WebCT and Blackboard, though the authors' experiences at NCSU involve mainly WebCT. These systems provide a framework for professors to build course websites for the duration of a class, and provide a complete course management framework, including grade books, email lists, online quizzes and assignments, and discussion forums. However, access to course information is limited to students in the course during the timeframe that the course is being taught. After that semester, students cannot refer back to the course materials. Furthermore, there is no method for collaboration between courses. These tools are not designed as information dissemination systems, but instead function as complete course management systems.

For these reasons and others, there has been a burgeoning movement towards open courseware systems. Over the past decade there have been a number of organized efforts to create web-based platforms for openly sharing course materials. Some of these include the MIT OpenCourseWare Initiative[4], Carnegie Mellon's Open Learning Initiative[5], Harvard University's H2O[6], and Rice University's Connexions[7]. OpenSeminar shares a philosophy of openness and common features with all of these projects, with some important differences.

The MIT OpenCourseWare Initiative (OCW) is an ambitious effort aimed at making materials from the entire catalog of MIT courses openly available online. Typically this means providing a course syllabus with a reading list (though usually not the actual readings themselves), class notes, problem sets, and tutorials. The scope of the MIT effort necessitates a standardized format and a dedicated staff of developers who web-enable the content. Once created, the courseware remains an archival record of what was taught by an instructor in a given semester. [6] An affiliated project, MIT World[8], provides free and open video streams of lectures by MIT faculty and others.

Carnegie Mellon's Open Learning Initiative (OLI) has developed interactive course materials for a limited number of basic subjects, including economics, chemistry, and statistics. These materials are sophisticated electronic textbooks with expository text, graphing applets, tests, and computer tutors. Although most of the content is made free and openly accessible, each course comes in a fee-based version that includes access to online experiments and graded exams. Collaboration is not explicitly built into the software, but instructors are able to customize content for course delivery. [7, 8]

The Harvard University Berkman Center's H2O project is one of the earliest efforts aimed at fostering a learning community by enabling anyone to upload and share educational materials. H2O allows for this material to be shared across courses created using the platform. In addition to content sharing, H2O has also made much use of discussion forums (called "rotisseries") as a method for communal interaction. The software code for the H2O platform is made available under the GNU General Public Licence[9]. [4]

The focus of Connexions at Rice University is to share instructional content across a single platform. Instructors are invited to create educational materials and then make that content available over the Web using Connexions, which is a standardized wiki-like platform (Plone[10]). Instructors contribute "modules" of knowledge, which can be aggregated into a course of his or her own or those of others. By providing the ability to make modules available to all of the instructors registered the system, Connexions promotes multi-disciplinary sharing of knowledge. [3]

Outside the realm of courseware platforms knowledge base systems, such as wiki systems, are also gaining popularity. Wikis are a special in that they allow complete access to both view and edit materials. While this allows for complete openness, a problem arises for courseware systems because the information cannot be trusted. [5]

These projects and others have demonstrated a growing trend towards openness in the creation of courseware. More recent projects have placed greater focus on collaboration as well. Less of a focus in these projects has been how to directly engage professors in using open courseware and in ensuring quality control of content. The purpose of OpenSeminar is to address these issues.

3. Overview of OpenSeminar

The motivation behind OpenSeminar stems from the establishment of the first author's course at NCSU, *Managing the Digital Enterprise*, a graduate-level survey of managerial topics in e-commerce.[11] Development of resources to support the course began in 1998, culminating in a complete course website that has been used each semester since its creation. Because of the rapidly changing subject matter, the use of a textbook was

[4] http://ocw.mit.edu
[5] http://www.cmu.edu/oli
[6] http://h2o.law.harvard.edu
[7] http://cnx.rice.edu
[8] http://mitworld.mit.edu
[9] http://www.gnu.org/copyleft/gpl.html
[10] http://www.plone.org
[11] http://digitalenterprise.org

undesirable; industry and technological change outpaced textbook publishing lag. Instead, the site makes use of the fact that there are many high-quality resources throughout the Internet; Managing the Digital Enterprise stores and organizes links to those resources in topic modules. Becuase it is an openly accessible resource, the site has been adopted for use by over 500 university instructors worldwide. Over the years, some of these users have expressed a desire to add and modify content on the site. However, the design of the site, as a static HTML website updated manually by one professor, does not easily facilitate collaborative interaction.

OpenSeminar was designed with certain specifications in mind that were not filled by other courseware systems. OpenSeminar is not meant to completely replace course management systems in that it does not provide gradebooks, forums, and other course management tools. Instead, OpenSeminar aims to provide a collaborative environment for the aggregation of course content in a specific subject therefore reducing course preparation time for instructors by providing open, moderated course materials.

OpenSeminar provides a *collaborative* environment for the development of course content in a specific subject. Individual instructors are able to customize the collaboratively contributed materials to suit the needs of both the timeframe and curriculum of each course they teach. Thus, OpenSeminar is a hybrid system that replaces textbook content and basic course scheduling information. The majority of that content is in the form of links to other high-caliber resources on the Internet. However, because an OpenSeminar installation is designed to be a canonical knowledge base on a given topic, any user can also browse that content independent of any professors' courses.

Many courseware systems also lack another important requirement: *moderated openness*. A scholarly community functions best with open information and communication. Knowledge base systems, especially wiki systems, offer open mechanisms for information exchange. However, to be authoritative, information must come from or be endorsed by a trusted source. To achieve this, OpenSeminar utilizes a model similar to that of a scholarly journal. Just as the editorial board in a journal controls what content is worthy of publishing in the journal, the chief collaborators of a specific OpenSeminar act as editors, deciding what content becomes a part of the repository.

3.1. Managing Content in OpenSeminar

OpenSeminar content consists of links (author, title, and URL) to externally located educational materials about a particular subject. These links are organized into a hierarchical structure of modules and sections. *Modules* represent a unit of information or a sub-area of a given discipline. Modules may be nested to provide a content hierarchy. We further divide modules into sections. A *section* is a category of resources being provided by the module. For example, a section called “Readings” may hold links for papers about the module topic. An editor creates the modules and organizes the links within the hierarchical module structure. Figure 1 shows the editor workspace.

Running an OpenSeminar is like running a professional journal. Members of the OpenSeminar Editorial Board collaborate to direct the creation and maintenance of link content in an OpenSeminar. The system has four editorial positions that a participant may take in an OpenSeminar: editor-in-chief, managing editor, contributing editor, and advisory board member. A participant may hold one or more of these positions depending on his or her needs and abilities. The positions on the editorial board and their associated OpenSeminar system roles are described in more detail below. Figure 2 shows the current editorial board of the OS/SE.

3.1.1. Editor-in-chief. The editor-in-chief is the head of an OpenSeminar editorial board. The editor-in-chief has three main responsibilities: 1) directing the initial identification and organization of the information to cover in his or her OpenSeminar, 2) selecting the managing and contributing editors, 3) defining and guiding the collaboration between the editorial board members.

3.1.2. Contributing Editor. Contributing editors create and maintain the content (links) for one or more modules, in an OpenSeminar. He or she is usually knowledgeable in one or more areas of the field covered by OpenSeminar. Part of the responsibilities of a contributing editor will be to find and add materials to the OpenSeminar repository. After material has been added, a contributing editor should periodically check the materials to ensure the high-quality standard of a reviewed OpenSeminar. A contributing editor will hold the OpenSeminar system role of editor.

3.1.3. Managing Editor. Managing editors perform administrative tasks in an OpenSeminar beyond the role of contributing editor. This includes enforcing the membership guidelines and collaboration policies of an OpenSeminar. When a professor wishes to add a new course, he or she makes a request to the managing editor(s), who will check the validity of the prospective professor’s request and add the new user and his or her course to an OpenSeminar.

3.1.4. Advisory Board Member. Advisory Board members provide feedback to OpenSeminar collaborators about the growth and direction of an OpenSeminar, and may provide suggestions about content and organization.

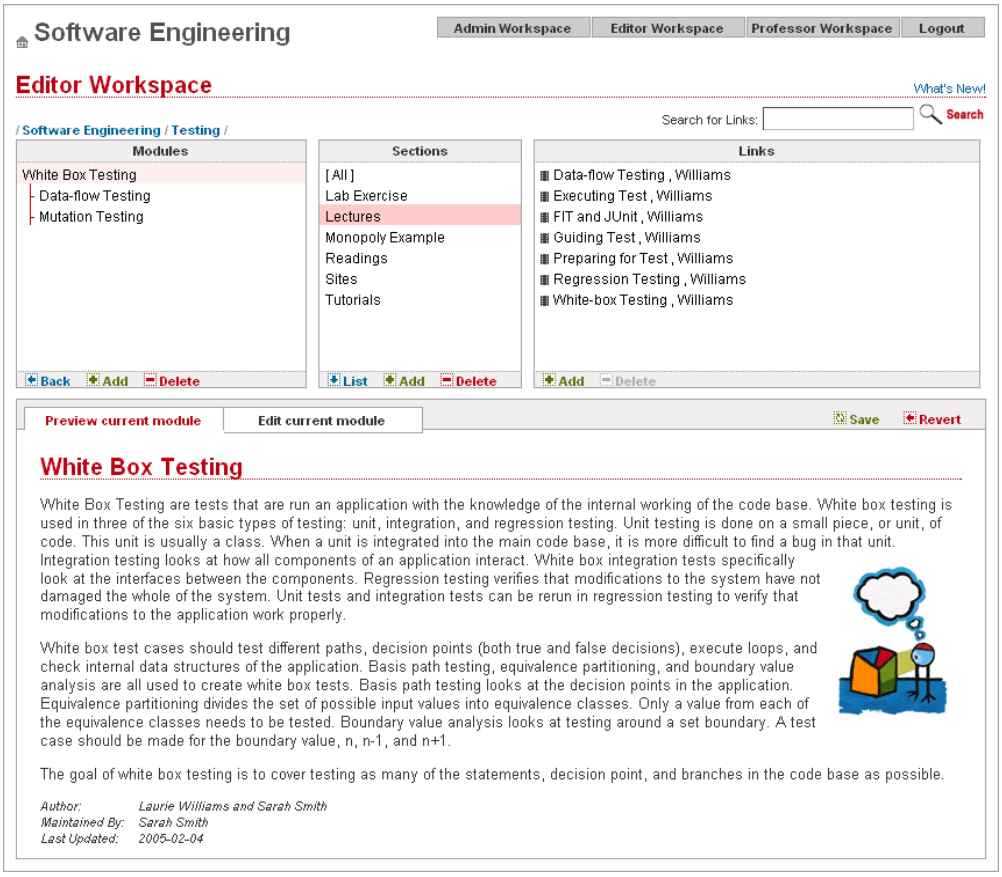

Figure 1: Editor Workspace

A member of the advisory board is knowledgeable in the field of a given OpenSeminar. All members of the advisory board are listed on the main page of an OpenSeminar.

3.2. Customizing Content in OpenSeminar

This collaboration leads to a repository of courseware that is endorsed by the editorial board. Professors may then join an OpenSeminar and create a course with the provided information. A member professor is given access to an OpenSeminar by the managing editors, depending on the editor-in-chief's membership requirements.

A professor creates a course by selecting a subset of the content approved by an OpenSeminar's editorial board. When designing a course, a professor may choose any number of the provided modules. The professor can schedule modules based on his or her course timetable. Therefore, OpenSeminar is able to support courses of varying timeframes. In addition, a professor can add a link to a course syllabus, as well as to an external forum.

After scheduling a module, the professor can select a subset of the content available in that module. This content appears to the student in the scheduled module as assigned reading (or viewing or listening, depending on the content of the link) on the module topic. OpenSeminar allows professors to designate these assignments as either required or optional. Figure 3 demonstrates this functionality.

A professor may further customize a course by creating events. Events are open-ended content that a professor can use to add in-class assignment due dates, test dates, and special events, such as a guest speaker, to the course calendar. An event generally contains content that only applies to an individual course. Course modules can also be tied to an event. For example, a midterm test event may have all of the modules taught during the first half of the course associated with the event.

Once a course is created, a student in that course can visit a dynamically generated OpenSeminar that displays only the information that the professor deems important for the course. The student sees a schedule showing when each module and event is assigned, and within those modules and events, the links the professor has chosen to assign. All course information is presented to the student in a uniform format. Since all links exist outside of OpenSeminar, all course materials are displayed in a new browser window. Figure 4 shows a module from a student's perspective.

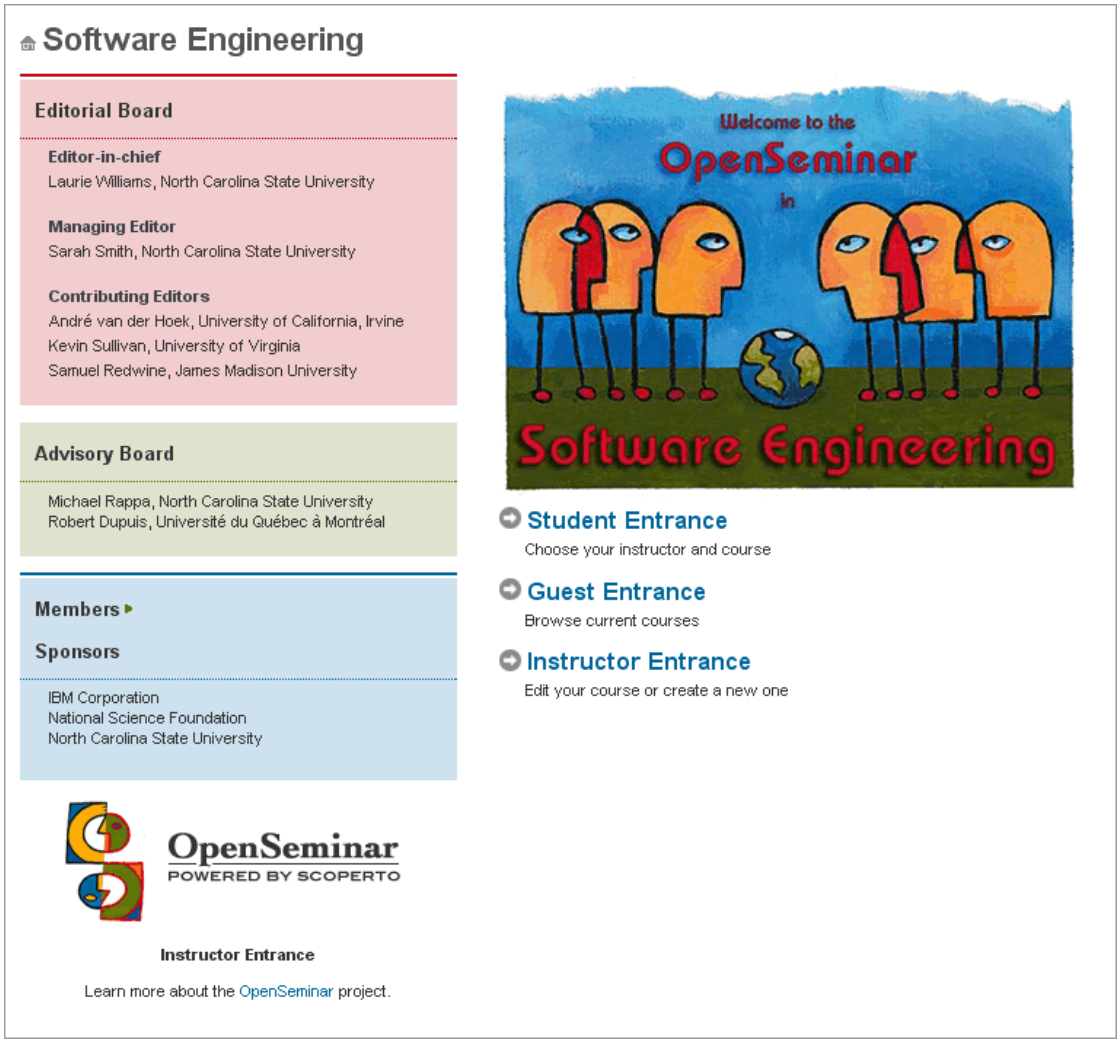

Figure 2: Editorial Board and OS/SE home page

3.3. Limitations

While OpenSeminar serves many needs, it has certain limitations. One limitation (by design) is the lack of authentication systems for courses on OpenSeminar. Certain courseware systems restrict access to courses to student enrolled in a class. OpenSeminar, however, is built on ideals of openness and collaboration. Furthermore, since all the information is freely available, external of OpenSeminar such protection is unnecessary. Authentication is reserved for editing content to maintain expert review of material. Technically, the details of providing authentication for a seemingly unlimited amount of students in various timeframes are daunting, as well. By only authenticating a small group of professors and editors, OpenSeminar protects the value of the information while maintaining availability.

The success of an OpenSeminar in any topic depends on the availability of high-quality source information openly accessible on the Internet. However, this does not pose a large problem because of the proclivity of professors and teaching institutions for hosting their own courseware on the Internet. Furthermore, attempts by many universities, such as MIT, to put course material online in a freely available manner only increases the amount of information available to OpenSeminar editors.

As the Internet is a constantly changing medium, there is a question of whether it will be too difficult for an editors to maintain the functional integrity of the links in an OpenSeminar repository. In developing *Managing the Digital Enterprise*, the first author has found that high-quality information tends to stay constant and accessible. Those who create the information understand the importance of availability and make efforts to keep links constant. For every thousand links, the first author has found that less than 1% of the links experiences problems

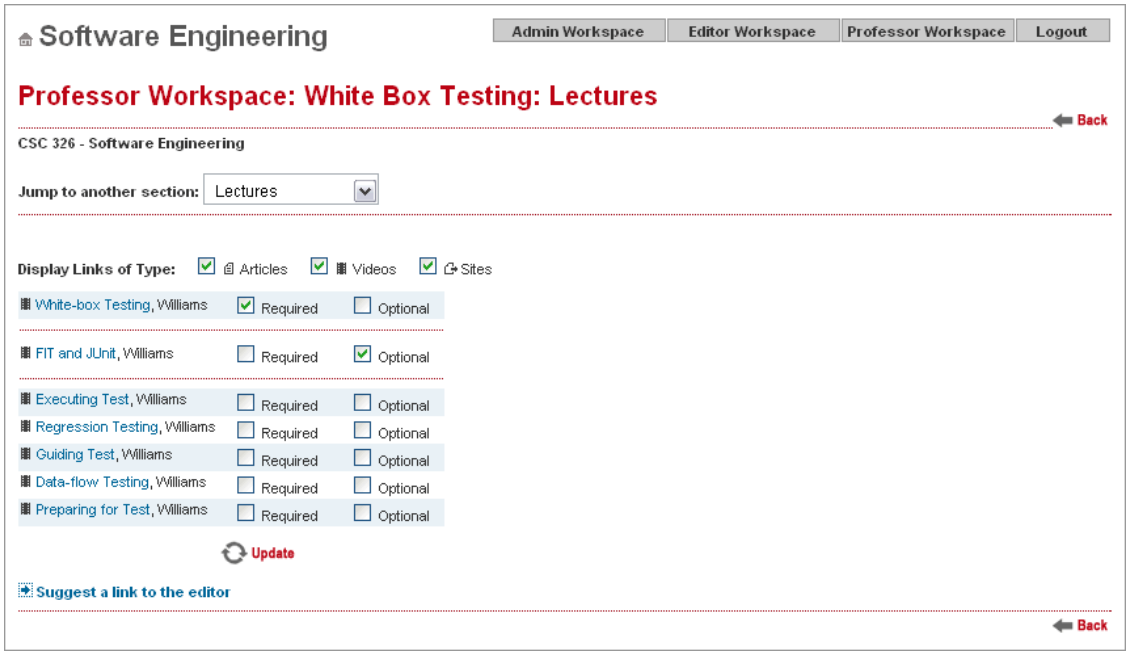

Figure 3: Professor View – Requiring and Recommending Links

in a given week, the majority of which are due to temporary server problems or to site reorganizations. In addition, OpenSeminar has built-in link validation to alert the editors when links go dead.

OpenSeminar lacks an automated process for professors to suggest content to contributing editors. The collaboration and communication activities for such suggestions now exist only outside of OpenSeminar. We are currently designing a system for professors to submit new content. The contributing editor role will be extended to include review and moderation of suggested resources. The addition of events in courses also gives professors the opportunity to add items that may not be of interest to other professors.

Just as there is no automated way to submit new content, there is also no method for communicating changes that editors make to the content, both to professors and other editors. At the time of submission of this paper, we are testing rudimentary support for notifying editors and professors of newly added content. Currently, we are in the early design stages of a complete internal communication system for OpenSeminar to address this concern.

4. OpenSeminar in Software Engineering

The OS/SE is the first OpenSeminar to be created and used in the classroom, and is based on an undergraduate Eclipse-based[12], software engineering class[13] taught by the fourth author in prior semesters. This course covers the "application of product engineering methods to software" [1], particularly in the area of agile software development [9]. The content of OS/SE was initially developed for use in this class, and contains components that are relevant to software development in the Eclipse integrated development environment (IDE).

OS/SE was subsequently extended to accommodate a more specialized course that comprised a subset of the software engineering curriculum. The graduate-level course in software testing and reliability[14] provides an advanced introduction into the specialized topics and covers theory, current practice, and application of software testing and reliability techniques.

OS/SE consists of 42 modules and over 400 links to external courseware about software engineering. Some of the courseware was created by the second and forth authors, while the remaining courseware was discovered through searching the Internet for relevant, openly available materials. The rest of the section describes instructor experiences with using OS/SE the expansion of the collaboration by adding members to the editorial board.

4.1. Instructor Experiences

In the fall of 2004, the OS/SE existed separate from the course website already in use by the fourth author. The two sites were closely coupled together. However, the course website contained all the information the students needed (syllabus, schedule, assignments) and pointers to

[12] http://www.eclipse.org
[13] http://www.openseminar.org/se/courses/1/index/screen.do
[14] http://www.openseminar.org/se/courses/41/index/screen.do

Figure 4: Student View of Module

OS/SE while OS/SE had only the resources. As a result, the students were more likely to first use the course website which might then direct them to OS/SE. Later versions of OpenSeminar ameliorated the need to go to two websites by allowing professors to create events that could be used to provide exam, homework, and lab information, which is scheduled independently of the module structure.

Adoption of OpenSeminar in the graduate-level course included the addition of several sub-modules to provide more depth to the general overview modules that were initially created. The graduate course was a special topics course in software testing and reliability. Six modules were added, five as sub-modules of the Testing module, and a new module in Reliability, which is not covered in the undergraduate software engineering curriculum. Overall student use of the OS/SE was higher in the graduate level course because OpenSeminar was used as the primary course website, and more of the graduate coursework was related to materials that existed online.

4.2. OpenSeminar in Software Engineering Expansion

With OS/SE being used successfully in two courses, we are working on expanding the user base of OS/SE by bringing more instructors into the collaboration. There are three areas of expansion: 1) adding members to the editorial board and extending editorship to experts in different areas of software engineering, 2) adding professors and courses, and 3) adding new course resources. The editorial board has recently been named; these editors will be adding content for the fall 2005 semester. This collaboration will allow us to refine the initial offering of course resources and add new resources to the repository.

5. OpenSeminar Development

As the philosophy behind OpenSeminar is one of fostering collaboration and openness, while creating a

more effective learning environment, the development model of OpenSeminar appeals to those same ideals. OpenSeminar leverages many open standards and opensource technologies in creating a web-based application. The development is done by a team of students under the direction of the first author. The students use OpenSeminar as a testbed and showcase for new technologies and development methodologies, while understanding the necessity of providing a stable software platform for course usage.

On average, the software team has four developers at any given time. We also have design students on the team to help with the usability and graphic design of OpenSeminar. Student teams, by nature, are transient. Over time, students graduate and new ones enter the university and join the development team. In addition, students are less likely to meet daily, as in a normal commercial work environment. Much of OpenSeminar development is done by a virtual team from a remote locations. For these reasons, our focus is on designing a system and a development method that takes advantage of team synergy and that can function with turnover. Among the tools that help create this collaborative environment are internal documentation (both in the code base and in internal wiki systems), a version control system (CVS[15]), a bug tracking system (Bugzilla[16]), a Java-based build system (Ant[17]), and automated testing (JUnit[18] and JCoverage[19]).

We feel that collaboration is only improved by opening up the information to as many users as possible. From the technological side, we use open standards whenever possible both in information presentation, and in the code itself. All of the information stored in the OpenSeminar is available in its raw XML form straight from the Internet. The courses themselves are also available as RSS feeds. These features allow any third party to build tools on top of OpenSeminar to make novel uses of the information, without access to the underlying system. We compare this to the interesting uses that arose from the new Google Maps[20] platform: by giving users open access to the information in its raw form, users will customize the information to fit their needs. These customizations can benefit the entire community. An open and documented format is needed to allow others to make good use of that information.

The philosophy of openness and collaboration extends to the code of OpenSeminar as well. OpenSeminar is a database-backed web application written in Java on top of many open source frameworks. Because we identified stability as a necessity from the outset, we chose to use many of the projects under the Apache Foundation[21] umbrella, most of which already have a strong developer community and a significant user base. Likewise, we plan to release OpenSeminar to the community under an open source license.

6. Conclusions and Future Directions

OpenSeminar is a collaborative platform that provides a repository for the best resources on a subject to be shared. Because experts in a field keep this repository updated, OpenSeminar alleviates the problem of finding and maintaining courseware for a class. Extension of a particular OpenSeminar will occur through collaboration with other professors. Though communication among users within OpenSeminar is currently limited, we foresee our future design of an internal communication and notification system as a way to further increase cooperation. Overall, we have created a framework for collaboration and sharing of resources that maintains the scholarly mores of education in sharing knowledge with everyone.

The goal of OpenSeminar is to provide a place where professors and students can go to find the best information on a subject to teach and to learn. To maximize the effect of OpenSeminar, collaboration must be extended to professors around the world so that others may use and add to the repository of courseware available on OpenSeminar. Evaluation of the current classes in OS/SE and future classes in OS/SE or other OpenSeminars will be conducted via an online survey that will provide qualitative and quantitative data. These data will be used to determine future upgrades to OpenSeminar and provide feedback on the user interface. Professors are invited to create their own OpenSeminar or join existing OpenSeminars, such as OS/SE. The OpenSeminar software will be released as open source for professors to install on their own servers.

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[15] http://www.cvshome.org
[16] http://www.bugzilla.org
[17] http://ant.apache.org
[18] http://www.junit.org
[19] http://www.jcoverage.com
[20] http://maps.google.com
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are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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