Expertiza: Reusable Learning Objects and Active Learning for Distance Education

The Expertiza platform is a divide-and-conquer approach to producing reusable learning objects through active-learning exercises. Students select from a list of tasks to be performed, with several students selecting each task. They prepare their work and submit it to an electronic peer-review system. The work is reviewed by other students, who offer comments to help the submitters improve their work. The best submissions for each task are selected for use in later courses. These learning objects can be improved iteratively; next year’s class can refine and improve the previous year’s contributions. Expertiza gets students working together to improve others’ learning experiences. It helps them learn; by making them think through the lecture material and apply it to a real-world situation, just as they might do on the job. Because the interactions are asynchronous over the web, distance education students can participate on the same basis as on-campus students. This paper briefly outlines the philosophy behind the system and walks the reader through a demo of the system.

The Expertiza Rationale

In the traditional classroom, homework serves to show that students are keeping up with the course material. Everyone is assigned the same homework, and once graded, it is "thrown away," never to be used again. Why is it done this way? Because there’s a certain economy of scale to grading many copies of the same thing. The first homework may take a half hour, 45 minutes, or even an hour to finish, but there’s a fairly steep learning curve, and after a dozen or so papers have been graded, the rest go much more quickly. Since all students have done the same work, the instructor may save the best submission to use as a “model” in later semesters, but there just isn’t much point in keeping redundant copies of the same work.

We know that students benefit from doing work that is more inductive, more like what they will do when they go out and get a job. And indeed, in some courses, faculty assign semester projects, where students work, possibly in teams, on different problems. But such exercises must be used sparingly, because there isn’t enough time to grade many assignments where the answers are all different and there are no economies of scale.

Peer review engages the whole class in giving feedback to each other. Instead of having dozens of papers to review, the student is assigned only a few other papers (usually no more than four). This overcomes the problem of not having enough time to give adequate feedback on custom projects. Of course, peer feedback is not the same as expert feedback, and quality-control measures must be taken. Toward this end, we employ rubric questions and reviews of reviews, as explained in the next section.

Electronic peer review is one step ahead, because not only does it facilitate copious feedback, but it also makes it possible to take the best submissions and assemble them together into a "learning object" that can be shared with other students—either later semesters of the same course, or courses at other institutions. For example, students might be asked to provide another example [GES 06] of one of the difficult concepts covered in the class. With different groups of students choosing different modules or different chapters from the textbook, good coverage of all the course material is assured.

Having students work with each other to improve their work is an example of active and cooperative learning. Students do not passively absorb what the instructor presents, but rather they use that knowledge to produce an example, a problem, a simulation, or a report, etc. that will help other students learn. They work with other students in creating that product. Many studies confirm that active and cooperative learning is more effective than individual learning [JMJJN 81, JJ 89], and it also has proved pivotal in improving the retention of nontraditional students [Wagn 02]. Valdivieso and Nicolau [VN 1992] suggest that active learning rewards initiative, rather than reinforcing a “factory worker/assembly line mentality” as traditional lecturing does.

Many active and cooperative learning exercises are performed in class, which makes them difficult to extend to a distance-education setting. Electronic peer review, because it is asynchronous, makes it possible for distance-education students to participate on the same basis as other members of the class. It should be noted that online discussions, too, allow distance-ed students to participate, but they need to be monitored and graded by the course staff, which is a lot of work, and makes it less likely that students will get the volume of feedback they need to improve their work.

An important side benefit of the Expertiza approach is that it makes it almost impossible to plagiarize. Because students have to submit their work, get reviews, and revise their work, it’s not possible to simply copy someone else’s Web page...
and turn it in as a final product. The fact that the work is divided up into small pieces (e.g., write an exercise for this chapter) with only a few students choosing each piece means that the pool of potential co-conspirators is very limited.

Expertiza facilitates better teaching too. The first reason is that the instructor has more learning objects at his disposal. Homework problems and tests questions can be commissioned. The instructor can then use the best of these in assignments and tests in future semesters. Our experience is that about 1/4 of student-authored problems are usable in some form.

Nowadays, multiple-choice tests are frequently administered by computer. Almost all learning-management systems have their own online learning tool. Dedicated applications such as LON-CAPA, Mallard, and WebAssign are also widely used for quizzes. This makes it possible for an instructor to assign “mastery” quizzes to a class, covering each lecture, or each week's work. The use of these quizzes to provide feedback to students, and to provide feedback to the instructor on the class's progress is called formative assessment [Bost 02]. Black and William [BW 98] reviewed 250 journal articles and book chapters on formative assessment to establish whether it raises academic standards. They found that the use of systematic formative assessment produced significant learning gains. With Expertiza, students can sign up for particular lectures and make up questions over those lectures. The best of the questions can be included in formative-assessment quizzes.

The ability to have students generate learning material is of particular benefit to courses on the cutting edge of technology. Of necessity, the body of knowledge covered in these courses changes frequently. On the newest material, few if any examples, homework problems, or test questions are available. The Expertiza approach helps to create them, so that the second time material is covered, there will be ample materials available.

Finally, Expertiza improves resource allocation. It offloads much of the grading work from the instructor and TAs, so they are free to spend more time working with individual students. The ideal class is often seen as a small class, because the instructor can interact most closely with the students. But with Expertiza, large classes produce more examples, more formative-assessment instruments, and more test questions, all of which help the students learn and make the class easier to teach. Expertiza makes teaching large classes an advantage!

The Expertiza Platform

The Expertiza platform actually consists of three separate, but related components. Each component performs a specific task to accomplish the final goal of producing reusable learning objects. The three components are:

- **Shimmer** – for signing up for assignments, allowing a task to be divided into individual parts
- **PG (Peer Grader)** – for submitting and peer-reviewing work
- **Conoscenza** – a web-based database that makes the best student's work accessible to registered users over the web.

**Peer-Reviewing Work with PG**

When entering into a review cycle, students will develop their homework in the form of one or more electronic documents. These documents can be in any format, as long as their peers will be able to download the file and view it on their personal computers. The first step with PG is for the student to submit their work to the system. This process is demonstrated in figure 1.

Once a student submits his/her work, that submission is copied to a new Web address, concealing the submitter's identity for the sake of anonymity. Once all submissions are received, the instructor can go into the system and create reviewer mappings. This is done semi-automatically, meaning that the instructor needs to tell the system when to create the mapping, but the mapping is randomly generated based on the students who have signed up for the assignment. The instructor tells the system the number of
reviews and reviews of reviews that each student should do, and the mapping is created. The instructor also specifies a rubric—a set of questions—upon which the submission will be evaluated.

A student logging in has a choice of whether to submit, review, or review reviews (see figure 2). At this point, students can log into the system and start reviewing their assigned submissions. This process is double-blind—the reviewer does not know the author, and the author does not know the reviewer. Author and reviewer can communicate through a shared Web page, sending comments and questions back and forth.

The review process is based on a rubric. This rubric consists of several questions designed to have the reviewer give meaningful and constructive criticism to the author.

The reviewer assigns a score to each question (e.g., on a scale of 1 to 5). The author’s grade is calculated from these scores. Optionally, the reviewer can provide prose feedback on each question. An example rubric is shown in figure 3. The grades that all reviewers have given this author are averaged, and this becomes the author’s grade for the submission. Note that PG allows for multiple submit-review cycles. Authors can resubmit their work, and be re-evaluated by their reviewers, as many times as the instructor specified when the assignment was created. We have typically used two or three review cycles per submission. When three cycles are used, the instructor usually reviews the students in one of these cycles.

The final step in the review cycle is to review reviews. In this step, students evaluate the reviews that other students have written. This is a critical step to ensure quality. The reviews of reviews constitute a fraction of the grade—usually about 20%—for the student. When students know that their reviews will be reviewed, they are much more likely to put thought into giving helpful feedback.
feedback. Without this step, students would have an incentive to give all their authors high scores and little feedback, since it is less work for them and authors would not object.

During any of the phases (submission, review and review of reviews), a student can view the grades given by his/her peers in the form of a report as shown in figure 4 and figure 5. Figure 4 displays a summary of grades at each stage in the review process. Figure 5 is a detailed report of grades given by a reviewer against each rubric question. The grade report not only helps a student evaluate his performance but also makes it clear how the final grades were determined. More importantly, by viewing the scores for each rubric question, a student can evaluate what is lacking or where there is room for improvement.

Using PG as an Instructor
As an instructor, it is important to be able to keep track of ongoing assignments, respond to questions, and give feedback to students regarding their submissions and reviews. PG provides a powerful interface for setting up assignments. This interface allows the instructor to create and modify assignments and rubrics, view summary reports of the reviews, view grade reports for each student, and manage review mappings. This interface also allows the instructor to impersonate a student (see figure 6). This feature allows the instructor to perform tasks as if he or she were the student without needing to know students’ passwords. We have found this to be a very useful tool when answering questions that students might have about their reviews.
Expertiza provides a platform to refine and reuse learning objects. Students learn by reviewing their peers’ work. By creating reusable learning objects, they help improve others’ learning opportunities in the course of doing their own homework.

Expertiza helps integrate active and cooperative learning into courses—techniques that have been proven their ability to help students rise faster on the learning curve. The materials that students create assist the instructor in teaching future courses. Thus, the Expertiza approach benefits the instructor, current students, and future students alike.

**References**


