Teaching Acoustics on the Internet

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Abstract

We teach an introductory course in acoustics using a system called Blackboard. Students in this course can access audio and video materials as well as printed materials on our course website. All homework is submitted online, as are tests and examinations. The students also have the opportunity to use synchronous and asynchronous chat rooms to discuss the course with each other or with the instructors.

1. Introduction

The World is our classroom! The Internet provides an excellent opportunity to teach classes to students on and off campus at the same time. It allows students flexibility in scheduling their classes and planning their study time. It allows the transmission of audible as well as visual demonstrations and other material directly to the student in downloadable format. It allows close interaction between teacher and student. The teacher can help the student at any hour of the day or night.

We offer an introductory course in acoustics using the textbook Science of Sound, 3rd ed. by T. D. Rossing, F. R. Moore and P. A. Wheeler [1]. This textbook, which uses a minimum of mathematics, is well suited to Internet teaching, since its 8 parts or modules (Vibrations, Waves, and Sounds; Perception and Measurement of Sound; Musical Instruments; The Human Voice; Electroacoustics; The Acoustics of Rooms; Electronic Music Technology; and Environmental Noise) are designed to be used more or less independently.

2. Acoustics, Music and Hearing

Physics 180 Acoustics, Music and Hearing is an introductory course in acoustics which fulfills a general education requirement in science. It carries 3 semester credits, and a one credit laboratory course (Physics 181) is generally given the same semester. About one third of the students taking Physics 180, and a few others besides, also take the laboratory course. The text for the laboratory course (Acoustics Laboratory Experiments by T. D. Rossing) includes 52 experiments on both the elementary and intermediate levels, and we encourage the students to select experiments appropriate to their levels of study and experience.

The Acoustics, Music and Hearing course covered the first four modules in Science of Sound at the rate of about a chapter per week. Each chapter began with a reading quiz, which the students were required to submit on the Internet before the chapter was discussed in class. The homework assignment was to be submitted before the second class period. The optional class periods were devoted to discussing the reading quiz and homework, demonstration experiments, and discussing the Questions for Thought and Discussion in each chapter. Attendance at the optional class sessions was a little above 50%, which is not too much different from other general education courses at our university.

Examinations were given at the end of each module. These were also done on the Internet but they were password protected, so the students were required to take them in a monitored computer laboratory.

We have put online both streaming audio clips and streaming video clips that students can play using Real Player. These clips are usually played during our class discussion sessions, but the students can review them at their leisure. Among the audio clips are Auditory Demonstrations from a compact disc [2]. The video clips include demonstrations of the acoustics of musical instruments and modal analysis of instruments from our Acoustics Laboratory. We are preparing a DVD that will include the audio and video clips along with other instructional material.

3. Blackboard

Blackboard, a widely used e-Learning software platform, is the one currently supported by our university. Our Blackboard course Web site includes the following areas: Announcements, Course Information, Staff Information, Course Documents, External Links, Assignments, Communication, Tools, and Control Panel (for the instructor).

Upon login, students are presented with the Announcements area, so that they can immediately be
brought up to date with any changes made to the class. The Course Information area holds the class syllabus. The Staff Information area contains contact information and office hours for the instructor(s) and teaching assistant. Course Documents holds the links to the streaming media files described above. External Links lists off-campus websites related to acoustics.

Homework, quizzes, and exams are handled in the same way: as assessments accessed from the Assignments content area. Blackboard allows the following types of assessment questions: multiple-choice (one correct answer), multiple-answer (multiple answers), fill in the blank, true/false, matching, ordering, and short answer/essay. All except the short answer/essay are automatically graded. The instructor is allowed to create a question bank, so tests can be individualized. The student can have a single chance to answer the questions or can be given multiple attempts.

Numerical problems are not easy to handle. Problems can be given as multiple choice questions, of course, but this does not always maximize the learning experience. Alternatively, they can be given as short answer questions, which are manually graded by the instructor. We have also tried giving them as fill-in-the-blank questions, but the numerical answer and the units must be typed in exactly the same as one of the possible answers in order for the computer to recognize it. Numerical matching questions are a possibility.

We have an electronic message board in the Communication area which allows students to communicate asynchronously with each other outside of class. As the semester progresses, students find using the message board to be a convenient way to schedule study sessions. Students also have the ability to use a synchronous chat room to communicate with other students and instructors, although we have not made extensive use of this feature.

The other two areas, Tools and Control Panel, are used primarily for configuring settings within Blackboard. Students can make changes to default settings assigned to them by the system, such as their email address and contact information. Students are also able to keep track of their scores for all assessments given throughout the semester in this area.

The Control Panel is where the instructor configures all of the content areas for the course. In addition to building assessments, posting announcements and adding content, the instructor can access a continuously updated gradebook from within the Control Panel.

4. Web-CT and WebAssign

In 2000 we taught a similar course using WebCT on a remote computer at Utah State University. The use of a remote computer was no great problem, since Professor Paul Wheeler from that university was spending his sabbatical leave at Northern Illinois University. He regularly teaches an acoustics course using the same text, Science of Sound. WebCT is probably more suitable than Blackboard for a physics or mathematics course, because it has more capability for numerical problems.

Web-Assign is a system for handling and grading homework, quizzes, and exams online. It was specifically designed for physics courses, and thus is much more friendly toward numerical problems. We have not used it for teaching a physics course, but one of our graduate students has, and he liked it. One attractive feature of Web-Assign is that homework problems from most standard general physics books have already been entered into the system, which saves the instructor many hours of typing.

5. Our Experience

It is clear from our experience that teaching a physics course online has both good features and bad features. The students like the flexibility that results in their being able to do their homework any hour of the day or night and submit it from their dormitory room (or even from a bar in Chicago) and get immediate feedback. As instructors, we can also benefit from the immediate grading of homework, quizzes and exams. A convenient feature is automatic updating of the online gradebook. At the same time, we have experienced considerable frustration when the network connection fails and a student’s submission is lost in cyberspace.

We plan to make web courses available to students at community colleges and other colleges that are not able to offer courses in acoustics and other areas of interest. We hope to offer these courses to students in other countries and to adult learners. The World is our classroom!

6. Conclusions

We have had considerable success in teaching acoustics online. The greatest benefit is the flexibility it offers. We plan to continue teaching online, and to expand our audience worldwide.

7. References
