

## Assessment of Microbiology Students' Progress With an Audience Response System

M. Ahmad Chaudhry

*Department of Medical Laboratory and Radiation Sciences, University of Vermont, Burlington, VT 05405*

**The development of new approaches to teaching of large lecture courses is needed. Today's classroom has a wide range of students including high-achieving motivated learners, students struggling to understand basic concepts, and learning-challenged students. Many of these students can be lost in large classes under the shadow of the high-achieving extroverted students who dominate classroom question-and-answer sessions. Measuring a student's understanding and achievement of content standards becomes difficult until an assessment has been done. To close this gap, an audience response system was introduced in an introductory Principles of Microbiology course. This technology specifically addressed the goal of individualizing instruction to the needs of the students. The evaluation of this project indicated an overall positive impact on student learning.**

### INTRODUCTION

Increasing student achievement can be accomplished by integrating technology in the classroom. An audience response system offers such an approach. This technology involves a software application installed on the instructor's laptop computer, and remote control devices or clickers that are used by the students in the classroom. The technology allows the instructor to ask the class a question, and each student then gives a response. The teacher is then able to see if the class achieved understanding. These devices engage the learner, provide a nonthreatening environment allowing all students to participate, and ensure each student gives a response. This approach offers a variety of means of gathering information, including yes/no responses, multiple choice questions, true/false questions, and surveys. After students respond, the answers can quickly be shown on a graph so students see the results.

Assessing for understanding is a key element in teaching. Audience response devices provide instant feedback to help meet student needs. As class sizes grow, it becomes important to see instantly how students comprehend the instructional material. Instructors often are not able to talk individually with every student during the lesson. With these devices, the teacher receives a response and can see the results immediately. Today's students are more engaged when electronic devices are used. As students stay focused, learning continues to increase. Class instruction is matched to the understanding and achievement of the students. Simply raising hands, asking for questions, or waiting for a

final assessment cannot achieve this level of individualized teaching for every student in the classroom. The use of an audience response system allows the instructor to measure the understanding of each individual student on an immediate and on-going basis. The integration of technology into the curriculum is another means of achieving this goal. The implementation of an audience response system as an assessment tool engages students in learning and is a great value for the instructor in evaluating learning through the use of technology (1). These devices should become standard equipment in today's classrooms.

The use of audience response system has been exploited previously, particularly in a microbiology class setting (2). In the current study, this technology was employed in an undergraduate classroom. Large numbers of students are enrolled in an introductory microbiology course at the University of Vermont from many different majors including biology, animal sciences, nutrition, business administration, medical laboratory science, continuing education, and post-baccalaureate premedical. The large and diverse student population enrolled in the class poses a challenge to the instructional strategies. During classroom discussions, typically only a handful of students end up participating. The goal of this project was to increase student participation in classroom discussions with a view to enhance their academic performance by introducing an audience response system in the microbiology class.

### PROCEDURE

The hardware (Response Card RF receiver) and software (Turning Point) was purchased from Turning Technologies LLC (<http://www.turningtechnologies.com/>) and installed on a designated laptop computer. The remote control devices (Response Cards) were also purchased and distributed to the students.

---

Corresponding author. Mailing address: College of Nursing and Health Sciences, University of Vermont, 302 Rowell Building, Burlington, VT 05405, USA. Phone: 802-656-0569. Fax: 802-656-2191. E-mail: mchaudhr@uvm.edu.

The audience response system from Turning Technologies, LLC is a computer-based system in which each student has a small remote control or “clicker” that is used to respond to questions presented via computer and a projector. Questions were presented during the lecture, after completion of an individual reading assignment, or following a group discussion. Students used the clickers individually to choose responses to the questions presented on the screen. When all students had responded, the results were shown in the form of a graph. The correct answers and class results were shown. After the lecture, the software allowed the instructor to review individual student answers for follow-up. Students who missed an excessive number of questions received further instruction to address the concepts that were not understood. This was done in review sessions in small groups after the class.

Initially students showing a gap in achievement were targeted for this initiative. Using the clicker technology, students were actively involved, continually questioned, and silently assessed as they responded to questions in classroom lessons. Whether questions were offered as a focusing activity at the beginning of a lesson, embedded artfully throughout the lesson, or placed at its conclusion to check for understanding, students benefited from vigorous mental and physical participation in lessons. Students also benefited from the constant questioning, the cognitive retrieval of information studied, and the immediate feedback. Many of the students in the target population were often reluctant to answer questions in class. This tool required them to become an active participant in class in spite of learning barriers. In a sense, they had a free pass to participate without fear of embarrassment. The instructor benefited from a tool that visually focused students, provided immediate feedback as to whether the desired learning had been effective, and provided embedded assessment in order to analyze the needs of individual students. The audience response system allowed students to take an active role in monitoring their own learning. This allowed all students to become confident in their abilities and promoted success. The very nature of science is conducive to the use of technology and the implementation of this project was no exception.

## CONCLUSION

The goal of this project was to increase student interest and participation in class. Nearly 50 students were directly impacted by this initiative. There was an increase in student participation in the classroom discussions soon after this technology was introduced. Students liked using these devices and stayed more focused knowing they would be expected to respond during the presentation. The project

was assessed by the analysis of homework completed by the students, and their overall performance on tests and quizzes. After the start of the project, the percentage of work completed was substantially increased (from 87% to 94%) and the grades were improved, indicating overall gains. A comparison of final grades for students attending Introductory Microbiology class in 2007 and 2008 indicated marked increase in performance (Fig. 1). The percentage of students scoring an “A” was higher in 2008 class where clicker technology was implemented. There were fewer students scoring “C” in the 2008 class compared to the previous year. In conclusion, the introduction of this technology had a positive impact on the overall success of the students.

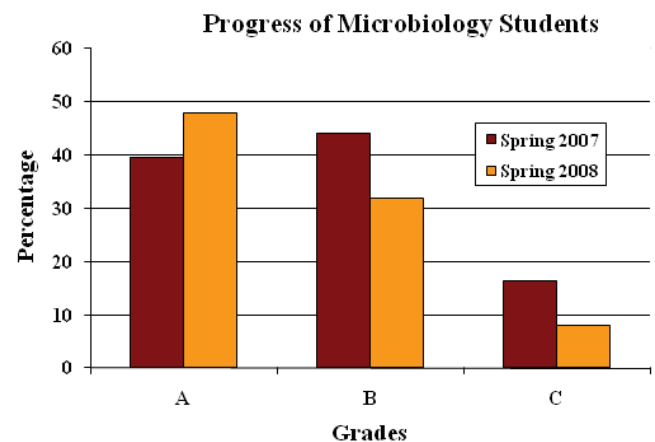


FIG. 1. Percentage of students receiving various grades in Microbiology class during 2007 and 2008. In spring 2007, students were not exposed to the audience response system. The students in spring 2008 used the audience response system in the classroom.

## ACKNOWLEDGMENTS

This work was supported by an instructional incentive grant from Center for Teaching and Learning, University of Vermont. The author declares that there are no conflicts of interest.

## REFERENCES

1. **Pradhan, A., D. Sparano, and C. V. Ananth.** 2005. The influence of an audience response system on knowledge retention: an application to resident education. *Am. J. Obstetrics and Gynecology* **193**:1827-1830.
2. **Suchman, E., K. Uchiyama, R. Smith, and K. Bender.** 2006. Evaluating the impact of a classroom response system in a microbiology course. *Microbiol. Educ.* **7**:3-11.