



## Electronic Response Systems

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### Electronic Response Systems

Electronic Response Systems (ERS) are designed to improve the interactions that take place within a classroom environment. An ERS provides the instructor with technology that supports student engagement, integrating seamlessly with many active and cooperative learning techniques. With an ERS, you now have the ability to poll the audience (your students) for their thoughts and opinions. Turnaround is almost instantaneous, allowing you to quickly canvas the entire class. Comprehension, interest, and engagement can easily be measured and improved using an ERS.

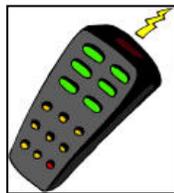
An ERS can be utilized in both formal and informal settings. Operating in a formal environment, one can take attendance, give quizzes, and assess student comprehension of classroom material. In an informal environment, it provides the instructor with timely feedback regarding the effectiveness of his/her presentation and student interest and beliefs regarding a specific topic or concept.

The technology associated with an ERS is rapidly changing. These systems are quickly becoming affordable for all institutions and have the potential to dramatically impact the student's educational experience.

### ERS Components

A basic ERS system consists of two components: the individual transmitters used by each student and a centralized classroom receiver that captures student responses.

The transmitters vary in complexity and ability, ranging from simple infrared devices (think TV remote) that transmit a limited set of responses (A, B, C, or D on a touchpad) to advanced R-F devices that are capable of more detailed response choices (some models contain a numeric keypad for entering data). These devices can either be secured to fixed locations at student desks within the classroom or purchased by the students and utilized in a number of classes. In this environment, ERS systems provide unique transmitter IDs to match specific students with responses.



Classroom receivers capture the signals sent by the student transmitters. In a large classroom, utilizing multiple receivers to ensure that all student input is captured correctly is not uncommon. These receivers, usually mounted to a wall or ceiling, are connected by standard network cabling and terminate into a specialized hub that typically plugs into the USB or serial port on a personal computer or laptop. Software on the computer drives the

ERS. A classroom projection system is necessary to display the ERS program's questions (and results) to the students.

### Sample Uses: Large Classrooms

In a large classroom environment, simple tasks can be time consuming. For example, a number of studies have linked classroom attendance to performance.<sup>1,2,3</sup> However, taking daily attendance in a classroom with several hundred students is quite time consuming. Likewise, daily quizzes and short in-class exercises help the individual student to better assess his/her own abilities and understanding of the material. Yet logistics associated with daily quizzes in large classes are not trivial.

Most ERS systems on the market today have software components that address these issues. Assigned seating and transmitters at each station permit attendance to be taken (and recorded) in a matter of minutes. In a similar manner, ERS systems that utilize personalized transmitters that are assigned or sold to each student accomplish the same feat, regardless of where the student sits in the class. Quiz questions can be displayed using the ERS software and answers recorded electronically. Grading is a simple matter of downloading the resulting file to the faculty member's local machine.

For instructors who utilize active and cooperative approaches to instruction, the ERS provides an efficient mechanism to capture student responses.<sup>4,5</sup>

### Sample Uses: Small Classrooms

Obviously, the formalized aspects of an ERS (attendance, quizzes, etc.) apply equally well to a small classroom environment. In this environment, the ability to ask informal, what-do-you-think type questions becomes more important. A faculty member can ask students to vote on the best passage in a novel or the least understood aspect of a derivation or any number of other questions, using the student answers to steer and guide the class discussion. No matter what the class size, you will always have students who would prefer not to speak in a public setting. An ERS helps these students express their thoughts in a classroom environment.

### ERS Software Bundles

A key component of any ERS is the software that accompanies the units. Most vendors provide software that integrates cleanly into a Windows-based environment. The software provides features for class management (class roles, attendance, etc.) as well as for interactive applications. Emphasis has been placed on building interfaces that permit faculty members to quickly and easily incorporate questions into their material. Most systems support graphics and equations as well as simple text-based questions. The software usually provides features that summarize the results of the interactions, showing how the students "voted." Records can be kept for formal quizzes, and results can be displayed (as desired) to the entire class.

## Factors to consider when moving to an ERS

### *Campus Technology Plans*

One significant issue that must be resolved before purchasing an ERS is how the individual classroom systems integrate together into an overall campus plan. This issue specifically impacts the selection of transmitters. Recall that most ERS installations allow you to set up either individual (student-owned) transmitters with unique IDs that can be used campus-wide (a single student uses his/her transmitter for all classes the individual is taking) or dedicated transmitters that are attached to the desks in a specific classroom (students have assigned seats and use a specific transmitter each class). Benefits exist to both approaches. The primary concern is to ensure that your individual classroom plans do not conflict with campus-wide implementations or require students to carry around multiple transmitters for use in their different classes.

If you implement a model where the students “own” the transmitters, the costs to the institution are reduced to simply those associated with wiring the classrooms with ERS receivers. This solution is much cheaper for the institution, as outfitting a classroom of several hundred students can be done for as little as a few thousand dollars (depending on the system selected). However, student costs must also be considered. Not only is there the cost associated with the initial purchase of the transmitter, but, if the system requires registration charges each semester to “enroll” students in the proper courses, then these costs must also be considered.

Finally, while an ERS is relatively simple, all faculty members may not immediately be able to use such a system with no support or training. The institution should provide not only software support but also assist faculty members who are transforming a traditional lecture-only environment through the adoption of an ERS.

### *Individual Classroom Security*

A common ERS system model includes a receiver, software to drive the system, and individual transmitters that are to be “fixed” at the student desks in the classroom. A variety of schemes exist for mounting these on the student desks, ranging from physically attaching them to the seat to honor systems. Depending on your students and infrastructure budget, this might (or might not) be an acceptable path. Replacement costs are not necessarily insignificant (depending on the transmitter selected), but this solution puts no extra costs on the student.

### *System Reliability and Response Time*

If the ERS is to be used for grading purposes (recording attendance, capturing quiz or exam grades, etc.), then care must be taken to ensure that these tasks are performed properly. A paper trail of a student’s attendance or quiz no longer exists. “But I was here that day” or “I know I took that quiz” can no longer be addressed by retrieving the appropriate paper document out of an instructor’s office, as these tasks are performed electronically.

As a result, the institution must ensure that the system is capable of handling the demands placed upon it. Most systems have the ability to attach multiple receivers so that a large classroom environment can better capture the signals of a number of students simultaneously. Care should be taken to ensure that the individual classroom layouts and configurations are capable of meeting the demands placed upon them.

Additionally, some systems provide the student (user) with feedback indicating that his/her input has been received and processed by the system; others do not. Student feedback is important when the ERS will be used to determine a portion of the student’s grade. System selection processes should also address this issue.

### **Workshops? Classroom designs? Cost Issues?**

Whether you’re just getting started or looking for additional ideas, the Foundation Coalition would like to help you incorporate technology into your engineering classes. We can share instructional materials, different pedagogical approaches, renewed courses and curricula, technology tutorials, classroom designs, and cost analyses. These materials are available via publications, Web sites, and workshops. If you’d like suggestions on where to start, see our Web site <http://www.foundationcoalition.org> or contact Jeffrey Froyd at [froyd@ee.tamu.edu](mailto:froyd@ee.tamu.edu) or 979.845.7574.

## Why consider Electronic Response Systems?

Instructors can gain immediate feedback regarding student comprehension, understanding, and opinions. With this information, instructors can tailor lesson plans and activities to the interests of the students. Examples and discussions are then directly related to the interests of the class population. Responses can be utilized to steer class discussions and/or formally record student progress. Faculty members are freed from a number of tedious, time-consuming activities associated with classroom management.

Students can actively participate in class discussions, indicate preferences and understanding regarding the topic at hand, and easily record attendance or quiz answers. When configured in a campus-wide setting, students can use one transmitter for communication in all of their classes.

Institutions can systemically address issues of concern to the campus as a whole. For example, student retention and success have been positively correlated to class attendance. Providing an infrastructure that promotes these activities in large classes is essential, as it is these classes that impact the greatest number of students—often early in the student’s academic career.

### Vendor Information

1. Classroom Performance System (CPS)  
<http://www.einstruction.com>
2. Fleetwood Reply Systems  
<http://www.replysystems.com/>
3. Group Response System  
<http://www.xtol.com>
4. Interactive Horizons  
<http://www.inthorizons.com>
5. Media Group Interactive Systems  
<http://www.mg-interactive.com>
6. Meridia Audience Response  
<http://www.meridia-interactive.com>
7. OTI Group Response System  
<http://www.optiontechnologies.com>
8. Personal Response Systems,  
<http://www.educue.com/Home.htm>
9. Quick Tally Audience Response System  
<http://www.quick-tally.com/>
10. Texas Instrument’s TI-Navigator  
<http://education.ti.com/us/product/tech/navigator/features/features.html>

The vendors listed alphabetically above illustrate a representative sample of the industry. This is not a complete listing of all vendors who actively manufacture products in this arena.

### References:

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2. Urban-Lurain, M., and Weinschank, D. (2000). Attendance and outcomes in a large, collaborative learning, performance assessment course, *Ann. Mtg. Am. Ed. Rsch. Assn.*
3. Romer, D. Do students go to class? Should they? *J. Economic Perspectives*, 7:167–174.
4. University of Texas, Physics Department, ClassTalk Interactive Teaching/Learning System [On line]. Available on the World Wide Web at <<http://www.ph.utexas.edu/~ctalk/>>.
5. Judson, E., and Sawada, D. (2002). Learning from past and present: Electronic response systems in college lecture halls, *J. Computers in Math. and Sci. Teaching*, 21(2):167–181.