I. Cover Page

A. Project Title:

Interactive Classrooms for the College of Agriculture That Provide Immediate Feedback to Students and Faculty

B. Proposing Unit: Department of Agronomy.

C. Participant Signatures:

Brian Hornbuckle (Department of Agronomy)  
Ray Arritt (Department of Agronomy)  
James Correia Jr. (Graduate Student, Department of Agronomy)  
Cinzia Cervato (Department of Geological & Atmospheric Sciences)  
Russell Mullen (Department of Agronomy)  
Mary Wiedenhoeft (Department of Agronomy)  
Steven Fales (Chair, Department of Agronomy)  
Matthew Darbyshire (Instructional Technology Center)  
Susan Yager (Center for Teaching Excellence)  
Carl Arbuckle (University Bookstore)  
Kathleen Baumgarn (Facilities)  
Bea Awoniyi (Accessibility)

D. Project Leader: Brian Hornbuckle, 3007 Agronomy Hall, 294-9868, bkh@iastate.edu.
II. Project Overview and Expected Benefit

A. Description and intended purpose:

A number of research studies have found that the traditional lecture method may be one of the least effective methods of teaching, particularly in large classes. Lecture is mainly a passive experience for the student, and can require minimal involvement in the class. We have found this to be the case in the class we teach, Agron 206: Introduction to Meteorology, in Lush Auditorium in Kellett Hall (pictured at right). Breaking up a lecture into smaller pieces and providing short periods of active learning activities would be one way to increase student involvement and subsequently increase student learning.

Furthermore, often faculty would like to gauge students' understanding of specific concepts that have been described in class. For example:

“In the NORTHERN HEMISPHERE, air rotates COUNTERCLOCKWISE around an upper-level LOW: True or False”

This is a true statement. If the faculty member could immediately see the number of students who answered “TRUE” and the number who answered “FALSE,” s/he could use this information to guide activities during the rest of the class. If the majority of the class answers correctly, then the next topic can be covered. Otherwise time can be used to address the problem immediately. Students can use this information as well to determine their level of understanding in relation to the rest of the class.

We propose to transform Lush Auditorium and other smaller classrooms throughout the College of Agriculture into interactive classrooms enabled to:

a) encourage student participation through active learning activities; and

b) provide immediate feedback on student learning to both students and faculty.

We believe this can be accomplished through the acquisition of a wireless polling system (EduCue PRS) for Lush Auditorium (382 students), and a smaller (up to 132 students), mobile “on-a-cart” system that could be used in any classroom. A schematic of a wireless polling system (WPS) is shown below. Students are able to respond to multiple choice questions shown on a display (D) by pressing a number on a pocket-sized wireless transmitter (T). Signals broadcast by the class are processed by a receiver (R) and sent to a personal computer (PC). Student answers to the questions can then be summarized immediately after the response period on the display (D). Answers may be submitted anonymously or recorded for each student by using a unique fixed ID number associated with each transmitter.

Installation of a wireless polling system in Lush Auditorium will positively impact the learning environment of a large number of students in the College because of the auditorium's size and frequent use. The availability of a mobile system would encourage College faculty who do not teach in Lush Auditorium to try wireless polling in their classrooms and perhaps lead to more widespread use of wireless polling on campus. The mobile system would be maintained by the Department of Agronomy but available to all ISU faculty and staff within the College of Agriculture.

To determine student interest, we recently conducted a (traditional)
poll of 126 students in Meteorology 206, a class meeting this semester in Lush Auditorium (see Appendix for complete results). An overwhelming majority of students, 76% of the respondents, either agreed or strongly agreed with the statement “I would learn better if I could give immediate feedback to the instructor on topics that are unclear to me.”

The fixed system in Lush Auditorium would consist of the following equipment: ten receivers permanently installed in pairs throughout the auditorium, along with wireless links connecting a dedicated podium computer to each pair of receivers. Software will be made available through the Instructional Technology Center (ITC). We will require students to purchase their own transmitters through the bookstore at a cost of approximately $30 per transmitter. Each transmitter has a fixed ID number which will be linked to the student. Student purchase is the only practical way in large lecture classes to ensure that each student has a working transmitter.

If use of WPS spreads on campus, students could potentially use their transmitter in several classes throughout their academic career. Students will also have the option of selling their transmitter back to the bookstore. Prentice Hall / Pearson, publishers of the textbook we use in our class in Lush Auditorium, have a deal that makes purchase of student transmitters much less expensive. If students buy a new textbook, they will also get a transmitter rebate coupon for $20, making the net cost of the transmitter only $10. In addition, for every 100 books ordered by the bookstore Prentice Hall will provide one receiver. We plan to use these receivers to populate other classrooms in the Department of Agronomy.

The mobile system would consist of four receivers, an LCD projector, a cart, a set of student transmitters, and storage boxes for the transmitters. In smaller classrooms, checking out transmitters to students for each class meeting is reasonable. We would also like to add audio-visual equipment to make the mobile system significantly more useful for a nominal cost.

The particular WPS system we propose has been used successfully in large lectures (see Appendix for testimonials) and will integrate well with present efforts on campus. Two other departments have already purchased similar systems from the same manufacturer. A group in Materials Science and Engineering successfully purchased a mobile system last year with CAC funds. Two lecture halls in the Department of Physics also use this particular WPS. Any student transmitter purchased through the bookstore could be used with any one of these three campus systems. Cinzia Cervato, Department of Geological & Atmospheric Sciences, teaches a class in Lush Auditorium and has indicated she would use the WPS. Russell Mullen, Department of Agronomy, has indicated that he would use the mobile system. The Center for Teaching Excellence (CTE) endorses the use of this technology to improve student learning, and invites the faculty participating to report their experiences through CTE workshops or the CTE newsletter. The University Bookstore has been contacted and details of the ordering of transmitters are being worked out. Facilities has also been contacted in anticipation of system installation during the summer of 2004.

B. Student Availability:

1. Hours available for student use: regular instructional time, in addition to other times arranged during the evening and weekend.
2. Number of students served per day: potentially 3560 students (Spring 2004 semester enrollment in classes that use Lush Auditorium).
4. Dissemination of methodology: ITC will coordinate software distribution and training.

C. New technologies: No special new technologies are required to use the WPS system. It is compatible with all computer systems (interfacing through the RS-232 COM port) and both Windows and Macintosh operating systems.

D. Involved university facilities: Lush Auditorium, 125 Kildee Hall, various classrooms in the College.
III. Support and Maintenance

ITC has agreed to install, support, and maintain the WPS and the podium computer. Matthew Darbyshire, Manager of Classroom Services, is the ITC contact. Sixteen professional staff hours have been included in the budget to create a WebCT-based instruction module on how to use the WPS. Links to software and other informational sites will be included. There are no restrictions on the use of the software: once a system has been purchased by the university, the software may be used by anyone at the university.

The mobile unit would be stored in the Department of Agronomy and administered by the Department of Agronomy Teaching Panel (Mary Wiedenhoeft, chair). Additional receivers obtained through textbook sales will be given to the Teaching Panel for distribution within the Department of Agronomy. The Baker Lab in the Department of Agronomy will support and maintain the mobile system.

We will be aware, and seek to accommodate, students with disabilities who may use the WPS. We have contacted Bea Awoniyi in the Division of Student Affairs and will work with her on designing a plan.
**IV. Budget**

### Table 1: Full Budget

<table>
<thead>
<tr>
<th>Item Description</th>
<th>No.</th>
<th>Unit Cost</th>
<th>Total Costs</th>
</tr>
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<tr>
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**+$1,800 = $5,760**

### Table 2: Minimum Feasible Budget

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<tr>
<td>Total</td>
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</table>
IV. Appendix

Responses to Poll of 126 Students in Meteorology 206, Spring Semester 2004

“I would learn better if I could give immediate feedback to the instructor on topics that are unclear to me.”

“I would learn better if I could give anonymous feedback to the instructor on topics that are unclear to me.”

“Do you use a cell phone on a regular basis?”

“I would learn better if I could know the correct answers for quizzes immediately after submitting a quiz.”
“What year in college are you?”

“What is your major?”
Testimonials Supporting EduCue PRS Technology

From Jeffery.Gerst@ndsu.nodak.edu Fri Mar 12 08:21:56 2004
Date: Thu, 11 Mar 2004 13:26:09 -0600
From: Jeffery W Gerst <Jeffery.Gerst@ndsu.nodak.edu>
To: Brian Hornbuckle <bkh@iastate.edu>
Cc: Melissa Stotz <Melissa.Stotz@ndsu.nodak.edu>, Nancy Lilleberg <Nancy.Lilleberg@ndsu.nodak.edu>
Subject: Re: EduCue PRS

Hello Brian,

Here is a "bird's eye view" of our setup in Stevens Auditorium.

The red circles are arrayed overhead above the two aisles. Each dot represents two receivers (for a total of 12). Each is partially hooded (folded black paper) to limit admittance angle and is roughly pointed down and to the right or left. I had planned on having 16 receiver in the room but somehow the installers and their supervisor experienced an "miscommunication." So, the ratio of transmitters:receivers is about 39:1, but we have not experienced any problems. (There are 465 fixed seats in the room.) The two strings of transmitters are powered separately and use their own COM port. It may not be necessary, but I was worried what might happen if one part of the system failed. It hasn't been a problem.

I toggle between application programs (PowerPoint, simulations, avi movies, etc.) and the PRS using Alt Tab and represent the question in the beneath the response grid. I could choose not to use the lower have of the screen and so have the Response Grid fill the entire area. However, I have not received any "user complaints" so I display the question. I read the question and the responses and then I start the clock. I typically give them one minute and tens seconds.

I give the students an incentive to come to class and to take part in the PRS polling. Students are awarded 2 points for each correct and, 1 point for incorrect answers. Online quizzes and inclass PRS polling accounts for about twenty-two percent of a student's points total. I ask five or six questions per class period. About half of the question require the students to analyze a situation, reach a conclusion, make a prediction, select a course of action, or explain how things are related.

I may ask a question twice and ask students to consult with their neighbor to before transmitting their answer. I may ask them to consult their neighbor and then answer a question. Regardless, the students have been overwhelming in their praise for the system and I could provide a copy if you would like.

So, good luck and please let me know how else I be of help.

Sincerely,
Jeff

Jeffery W. Gerst, Ph.D. phone: 701-231-7207
Professor of Biological Science fax: 701-231-7149
jeffery.gerst@ndsu.nodak.edu (work related)
http://www.ndsu.edu/zoolgy/jwgerst.htm
Jeff Gerst <jwgerst@earthlink.net> (other related)

From mcnairy@phy.duke.edu Fri Mar 12 08:22:07 2004
Date: Thu, 11 Mar 2004 14:02:28 -0500
From: William McNairy <mcnairy@phy.duke.edu>
To: Brian Hornbuckle <bkh@iastate.edu>
Subject: Re: EduCue PRS

Dear Brian:

Thank you for your email-- it's a pleasure to respond to your request for a testimonial.
I have no concerns about the level of support you will receive from EduCue, nor about the quality of their hardware/software products. We have used approximately 190 transmitters over 3 years (including summer sessions) in four locations within the department. I have had only two units 'walk away' that needed replacement-- and only 10 or so that failed for some abuse reason that were happily replaced by EduCue. You do need to check the batteries periodically-- I generally do so between terms. I guess I've had to replace the batteries, on average, once in those three years as the lower numbered units are used more frequently than those nearer the bottom of the box.

A great benefit of working with EduCue is the level of support that they provide **after** the sale in updated software and patient consultation over the telephone. Although the company is relatively small, this is a strength because this is 'what they do and what they want to do best'. In addition, they are not a fly-by-night operation-- they are committed to their product and their customers.

I have no hesitations in recommending EduCue. Two years ago Arts and Sciences Computing at Duke installed about 1,500 transmitters in five locations on campus. I understand that their use is increasing rapidly across campus.

Go to AAPT meetings to learn more about the impact that in-class polling is having on Physics instruction. Ray Burnstein, Kandiah Manivannan and I will be running a workshop on the Sunday of the Summer meeting in Sacramento where we will compare various technologies in an unbiased way. But I’ll stick with PRS....

bill

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***********************************************************************
Dr. William McNairy, Lecturer
Lecture Demonstration Coordinator
Department of Physics, Duke Univ.
Box 90305
Durham, NC  27708-0305
Phone: (919) 660-2689
FAX: (919) 660-2525
E-mail mcnairy@phy.duke.edu
***********************************************************************

From lmartin@socrates.Berkeley.EDU Mon Feb 16 09:42:56 2004
Date: Fri, 13 Feb 2004 16:20:19 -0800 (PST)
From: Lonnie C. Martin <lmartin@socrates.Berkeley.EDU>
To: Brian Hornbuckle <bkh@iastate.edu>
Cc: Mark Kubinec <mkubinec@uclink4.berkeley.edu>
Subject: Re: PRS questions

Hi Brian,
...
> faculty considering the acquisition of a PRS system. We're a little
> concerned about using it in a large lecture class, for graded quizzes,

We (Chemistry) use PRS with about 540 students in a classroom. I've cc'd Dr. Kubinec, who may have more to say about grading and other issues, but from my perspective - operational and quality control basically - grading, while I would say is feasible, requires a lot of care and close supervision. We found that it is amazingly easy to lose a session of data at the most inconvenient times. I believe that this is a problem with a solution, but it requires substantial attention.

> i.e. issues of making sure all students who want to respond are able to
> submit their responses. This involves a certain number of receivers, and

This should be possible, but it will help for students to understand the system to a degree. They need to understand that the transmitter is directional, and that the IR receiver must be aimed at, and that their transmission might not be received on one attempt. My opinion is that a sufficient amount of time should be spent to ensure that the students all know how to effectively use the system.

We use 16 IR receivers, in two banks of 8 per RF clients. We use one RF server and one laptop PC. I would say this is a
minimum number of IR receivers, though it should be adequate.

> more importantly, a way for the student to verify their response has been recorded. Do you have any insight here? If it is easier to converse on the phone, please email a time I could call and your phone number.

I think we've been using 150 of the "cells" or whatever that's called. Our students seem to be able to deal with that, though we have heard of some having a problem - but not many. Once they know their color and number, they seem to be ok with that part of the system. Just a guess, but I suppose it's possible that about 3-5% of the class never quite gets the hang of it, but even most of those end up transmitting their data successfully.

Overall, my impression is that the system is sound, and that almost all students will use it effectively. It is somewhat bothersome that a few students may not communicate their adequate knowledge of the subject matter due to an inability to communicate by this new method - especially in cases where the technology fails to function properly - even if this is infrequent. It is for this reason that I mentioned above that time should be allocated for learning how to use the system.

Best wishes - Lonnie

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Lonnie C. Martin e-mail: lmartin@socrates.berkeley.edu
College of Chemistry phone: 1-510-642-6887
University of California FAX: 1-510-642-8369
Berkeley, CA 94720-1460 http://www.cchem.berkeley.edu/~demolab
USA http://socrates.berkeley.edu/~lmartin