I. Cover Page

A. Project Title:

A Wireless Polling System for Lush Auditorium
Providing Immediate Feedback to Students and Faculty.

B. CAC Priority: 1st priority – campus-wide proposal.

C. Proposers: Brian Hornbuckle (project leader), Ray Arritt, and James Correia Jr. (graduate student).

D. Responsible College: College of Agriculture

E. Participant Signatures:

Brian Hornbuckle (Department of Agronomy) ______________________________

Ray Arritt (Department of Agronomy) ______________________________

James Correia Jr. (Department of Agronomy) ______________________________

Cinzia Cervato (Department of Geological & Atmospheric Sciences) ______________________________

Russell Mullen (Department of Agronomy) ______________________________

Mary Wiedenhoef (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) ______________________________

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

A. Description and intended purpose:

We propose to use CAC funds to purchase a wireless polling system (EduCue PRS) for Lush Auditorium in Kildee Hall (382 students), and a smaller (up to 132 students), mobile system that could be used in any classroom. We believe that these polling systems would improve student learning by providing both students and faculty with immediate feedback on student mastery of course concepts. Installation of a wireless polling system in Lush Auditorium will positively impact the learning environment of a large number of students on campus because of the auditorium’s size and frequent use. The availability of a mobile system would encourage 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.

A schematic of a wireless polling system (WPS) is shown at right. 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.

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. Breaking up a lecture into smaller pieces and providing short periods of active learning activities is one way to increase student involvement and increase student learning. The presence of a WPS makes it easier to include active learning activities such as group problem solving exercises and individual quizzes. Although these activities do not necessitate the presence of a WPS, a WPS can increase the impact of these activities and also conserve classroom time.

Often faculty would like to gauge students' understanding of specific concepts that have been described in class. By posing a question through a WPS, the faculty member can immediately see the number of students who do and do not answer the question correctly and 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 to determine their level of understanding in relation to the rest of the class. A WPS can also encourage participation, allowing students to respond anonymously to faculty questions.

Classroom time can be used more effectively with a WPS. For example, in order to record quiz scores in the class we teach in Lush Auditorium, each student must complete a scantron sheet. This process takes several minutes of useful education time away from our lecture each time a quiz is administered. Scantron sheets must be both handed out to students as well as collected. Out-of-class time is also spent sorting through the scantron sheets, transporting them to and back from the Durham facility where they are scored, and entering the data into our grade book. A WPS would eliminate all of this busy work that takes time away from teaching efforts.

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). The students in the class represent a cross-section of the campus. Fifteen percent of the students were Business majors, 28% Engineering or Physical Science, 25% Agricultural or Biological Science, 23% Arts and Humanities, and 10% majors in Social Science. An overwhelming majority of students, 88% of the respondents, either agreed or strongly agreed with the statement “I would learn better if I could know the correct answers for quizzes immediately after submitting a quiz.” Seventy-six percent agreed that “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. 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 for use in other classrooms in the Department of Agronomy. The mobile system will consist of transmitters, four receivers, an LCD projector, a cart, and storage boxes for the transmitters. 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 on campus.
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

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<thead>
<tr>
<th>Item Description</th>
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<th>Unit Cost</th>
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### Table 2: Minimum Feasible Budget

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IV. Appendix

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

“I would learn better if I could know the correct answers for quizzes immediately after submitting a quiz.”

“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?”
“What year in college are you?”

- First
- Second
- Third
- Fourth
- Fifth

“What is your major?”

- Business
- Engineering or Physical Science
- Agricultural or Biological Science
- Arts and Humanities
- Social Science
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 half 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/zoology/jwgerst.htm
Jeff Gerst <jwgerst@earthlink.net> (other related)
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 Phone: (919) 660-2689
Lecture Demonstration Coordinator FAX: (919) 660-2525
Department of Physics, Duke Univ. e-mail mcnairy@phy.duke.edu
Box 90305
Durham, NC  27708-0305
***********************************************************************

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: 1-510-642-6687
University of California  FAX: 1-510-642-8369
Berkeley, CA 94720-1460  http://www.cchem.berkeley.edu/~demolab
USA  http://socrates.berkeley.edu/~lmartin