

Using a Personal Response System to Engage Students

Melanie Butler and Laura Pyzdrowski

Institute for Math Learning

West Virginia University

Presentation Available at:

www.math.wvu.edu/~mbutler

Outline

- Institute for Math Learning (IML)
- College Algebra
- Personal Response System (PRS)
- PRS Research
 1. Quantitative Results
 2. Qualitative Results
- Future Research

Institute for Math Learning
(IML)

Institute for Math Learning (IML)

- The Institute for Mathematics Learning (IML) was established by West Virginia University to enhance significantly the teaching and learning of mathematics
 1. at West Virginia University,
 2. throughout the state of West Virginia,
 3. and across the Appalachian Region.

Institute for Mathematics Learning (IML)

- The IML has three core missions.
 1. Improving curriculum, instruction, and assessment in before-calculus classes through innovative and effective math learning models.
 2. Providing outreach to K-12 students and teachers.
 3. Restructuring math education courses for K-12 teachers.

Institute for Mathematics Learning (IML)

- Curricular change is based on the social constructivist theory of learning, which advocates actively engaging students in the exploration and discovery of mathematical concepts.
- Technology is employed as a tool in exploring concepts.

Institute for Mathematics Learning (IML)

- Multiple forms of assessment are used to measure student understanding.
- The IML focuses on research-based change.

Institute for Mathematics Learning (IML)

- Math 121: Liberal Arts Mathematics
- Math 124: College Algebra - Applications
- Math 126: College Algebra*
- Math 128: Plane Trigonometry
- Math 129: Pre-Calculus
- Math 150: Applied Calculus

College Algebra (3 Day a Week)

College Algebra at West Virginia University

- This course is taught in sections of 200, with two fifty minute lectures per week.
- The students are then broken into smaller groups of 40-80 students for one 50 minute interactive computer laboratory per week.

College Algebra at West Virginia University

- There is a College Algebra course coordinator who usually teaches one or two sections of the course per year.
- The other sections are taught by instructors with whom the course coordinator works closely.

College Algebra at West Virginia University

- The majority of students college freshman
- Spring 2005 semester: freshmen = 63%
- Many students go on to take Trigonometry and Calculus.
- Popular majors: business, economics, nursing, and education.

College Algebra at West Virginia University

- The course currently uses the text *College Algebra: Graphing and Data Analysis* by Sullivan and Sullivan and covers:
 1. polynomials,
 2. rational functions,
 3. exponential functions,
 4. logarithmic functions, and
 5. multiple representations of all of these – tables, graphs, and algebraic.

College Algebra at West Virginia University

- Course components:
 1. On-line quizzes,
 2. Interactive laboratories,
 3. Laboratory learning communities,
 4. Four exams and a final, and
 5. Lectures led by PowerPoint slides.
 6. NEW - PRS

College Algebra at West Virginia University

- The IML is interested in studying the outcomes of the changes that have been made in the below calculus level courses at WVU.
- Historically, College Algebra at West Virginia University had a D, F, or Withdraw (DFW) rate that fluctuated between 40% and 60%.

College Algebra at West Virginia University

- Past five years DFW rate between 30% and 40%
- Goal to stabilize the DFW rate at 30%
- Actively engage the students in the classroom

Personal Response System (PRS)

“It’s like a game show, right?”

Personal Response System (PRS)

- West Virginia University (WVU) purchased a PRS over the summer of 2004:
 1. 1000 transmitters coded with unique 6 digit identification numbers,
 2. 24 receivers, and
 3. software to be used in 4 classrooms of about 250 seats each.
- Six receivers were installed on the ceiling of each classroom and boxes were built to house 250 transmitters per room.

Personal Response System (PRS)

- Students in classes that use the PRS are assigned a transmitter that they pick up at the beginning of class and return after class.
- During class, the students use their transmitters to answer (usually multiple-choice) questions posed by their instructor.

Personal Response System (PRS)

- The PRS software keeps track of a time limit for each question, records the students' answers, and displays a graph of how many students chose each answer.
- After class, the instructor can use the PRS software to grade the sessions.

Personal Response System (PRS)



Personal Response System (PRS)

- The questions can be delivered within the PRS software.
- The questions can also be delivered in PowerPoint – add-in tool bar.
- Pre-written questions exist.



PRS Question

Can a real number be both rational and irrational?

1. Yes.
2. No.
3. Not sure.



PRS Question

Can the graph of a polynomial function have no x-intercepts?

1. Yes.
2. No.
3. Not sure.



PRS Question

We've been talking about the quadratic formula. What would you like to do?

1. See another example.
2. Review quadratics in general.
3. Move on to next topic.
4. Do an application.
5. See where the quadratic formula comes from.

PRS in College Algebra

- On average 3 PRS questions were asked during a class.
- Usually between 1 and 2 minutes was given to answer a question, but this time limit was adjusted as the instructor observed the students answering.
- A mix of questions types was asked.

PRS Research

PRS Research Design

- Surveyed students with some yes/no and some short answer questions.
- Outside person tallied the quantitative results.

PRS Research Design

- Outside person also typed up qualitative results.
- Both authors read the student responses individually to find idea blocks.
- After discussion, both authors agreed on the main ideas pulled from student responses to each of the short answer questions.

Quantitative Results

- *Question 3:* This question asked the students if they would like to use PRS in future classes.
- 67 students answered this question.
- 48 (approximately 72%) answered yes.
- 19 answered no.

Quantitative Results

- *Questions 5 and 9:* Questions 5 and 9 asked if students thought PRS use opened communication in the classroom.
- Question 5 - PRS allowed the students to communicate more effectively with the instructor
- Question 9 - PRS gave a sense of a community in the classroom.

Quantitative Results

	Q5: Communication	Q9: Community
Yes	36	35
No	32	29

- The results seem to suggest that these questions should be reworded for future surveys.
- “the teacher knew whether or not people were understanding”

Quantitative Results

- *Question 6:* In question 6, students were asked if they would like to see confidence levels incorporated more in PRS use.
- Of the 64 students that answered, over 78% said no.
- Confidence levels were not emphasized in the class.

Quantitative Results

- As an instructor, it is valuable to see whether students are guessing or are sure of their correct and incorrect answers.
- Instructor could reflect on confidence levels after class, rather than discussing in class.

Quantitative Results

- *Questions 7 and 8:* Question 7 asked whether the number of PRS questions posed during the course was about right, too many, or too few.
- 64 students answered
 - 51 - about right
 - 9 - too many
 - 4 - too few

Quantitative Results

- On question 8, students were asked if the amount of time given to PRS questions was about right, too long, or too short.
- 67 students answered
 - 41 about right
 - 21 - too short
 - 5 - too long

Qualitative Results

Qualitative Results

- *Question 1:* Question 1 on the survey asked students what they think the advantages of using the PRS are.
- Students overwhelmingly thought that the practice and feedback from the system was an advantage.
- There is evidence that students using a PRS are essentially twice as likely to actually practice with examples in class (Cutts, *et al* 2004).

Qualitative Results

- Another idea that was shared by many students was that the PRS increased their attendance by offering them more points.
- In the IML, we have often thought that the students could be considered “point gatherers,” and this result helps to confirm this conclusion.

Qualitative Results

- It is also interesting to note that at least one student mentioned “more points” in response to each short answer question.
- While it would be ideal for students to participate in PRS questions in order to learn, knowing that part of the motivation to participate is grade dependent allows instructors to set up the class accordingly.

Qualitative Results

- Students also thought that being able to compare themselves with the rest of the class was an advantage to PRS:
 1. “Getting to see how other people respond”
 2. “knowing what the rest of the class is thinking”

Qualitative Results

- Instructors might be able to use this idea to help motivate students to spend more time on material with which they are struggling.
- Many students also noted this increased knowledge on the part of the instructor as a benefit of the PRS.

Qualitative Results

- The final idea block that was identified in response to question 1 was the idea of participation.
- For example, one student said, “you’re involved in the lecture.”
- Another student noted that the PRS questions helped to keep her interested.

Qualitative Results

- It is interesting to note that very few students mentioned the immediate feedback as an advantage of the PRS.
- Perhaps students took this immediacy for granted.
- As an instructor, the immediate feedback offered by a PRS is immeasurably useful in helping tailor the rest of the class to the students' needs.

Qualitative Results

- *Question 2:* For the second question, students were asked what they think are the disadvantages of using a PRS.
- Many students noted technical difficulties:
 1. “hard to see your number on the screen”
 2. “not sure if you pushed the correct number”

Qualitative Results

- Two other strong idea blocks on question two are:
 1. not enough time to answer PRS questions, and
 2. too much class time spent on PRS questions.
- different learning styles?
- different backgrounds?

Qualitative Results

- It is also important for instructors using PRS to be aware of students that are learning disabled.
- Students with some types of disabilities might find PRS questions intimidating, while other students might find the questions useful.

Qualitative Results

- *Question 4:* On question 4, students were asked if they think it is beneficial to discuss the PRS questions with a classmate.
- Two strong idea blocks from student answers to this question are that students think
 1. talking with a classmate helped their understanding, and
 2. collaboration and communication are important.

Qualitative Results

- Some quotes to support this are:
 1. “if one doesn’t understand a problem, the other might,”
 2. “2 heads are better than one,” and
 3. “helps communication throughout the classroom.”

Qualitative Results

- Some students did answer question four negatively.
- These students seemed to think that
“it should depend on one’s opinion and not affected by others views.”
- Perhaps these students have a different learning style or just a personal preference to work alone.

Qualitative Results

- *Question 11:* On this question, students were asked if they thought PRS use helped their understanding of concepts in the course.
- One student answered
“*no- computerized quizzes and lab...helped*
MORE.”

Qualitative Results

- Since PRS is unlikely to reach all students with all learning styles, hopefully the other course components can.
- Want to hook the students in through one course component and then encourage them to grow through others.

Future PRS Research

Future PRS Research

- Triangulation of data
- Learning Styles
- Better survey
- Quantitative – Pre and Post Math ACT tests
- Matched pairs study
- Suggestions?