



## Engaging and Motivating Students in Large Classes with “Clickers”

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### What I hope to illustrate...

- Student perceptions of clickers
- Correlations between grades & participation
- Some trends in lecture attendance
- Opportunities for peer mentoring

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### Personal Response Systems - PRS

- organised ways to involve all students in answering questions in class.
- Can be computer based or far simpler
- aka *student response system*
- aka *audience response system*
- aka *group response system*
- aka *electronic voting/polling system*
- aka *classroom communication system*

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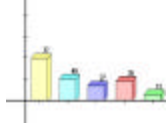
### How familiar are you with clickers?

- A. This is the first time I've heard about them.
- B. I've heard about them, but want to know more.
- C. I've seen/used them in a class/presentation.
- D. I've used the technology in my course.
- E. I could be giving this talk.

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### Basic Characteristics of the “Clicker”

- each student has a wireless handset, like a TV clicker, which transmits responses to multiple choice questions posed by their instructor.



- possible answers and a summary of the responses are displayed graphically on a computer screen (which can be projected so that all can see).
- Radio-frequency systems introduced in early 2005.

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### Hurdles

- Expense
- Instructor learning curve
- Time needs to be allotted for regular use
- Developing appropriate questions takes time
- Forgotten clickers
- Technical issues
- Cheating

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## Use is Growing...

- particularly large university science courses
  - as evidence for pedagogical value accumulates
  - as competition drives technical improvements
  - increasing user-friendliness
  - decreasing prices
- i>Clicker system adopted at University of Guelph January 2007

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## Getting to Know One Another

In what area do you teach?

- A. Humanities & Social Sciences
- B. Business
- C. Education
- D. Science, Math & Engineering
- E. Other

Class Size?

- A. ≤ 50
- B. ≤ 100
- C. ≤ 250
- D. ≤ 400
- E. > 400

What level do you teach?

- A. 1<sup>st</sup> year
- B. 2<sup>nd</sup> year
- C. 3<sup>rd</sup> or 4<sup>th</sup> year
- D. Multiple years
- E. Other

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## The Interactive Classroom

### Evidence That It Works

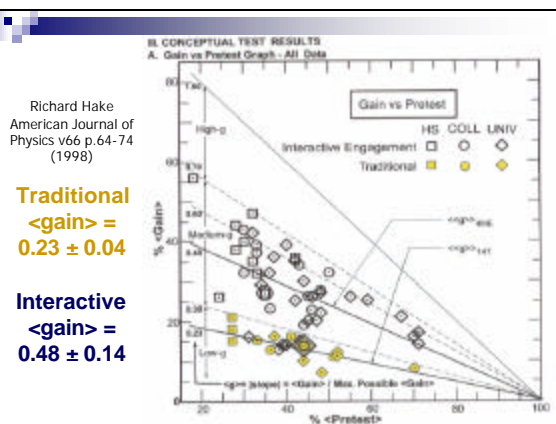
Richard Hake (Indiana U.-Bloomington)

- 6542 student study comparing traditional versus interactive lectures
- 62 introductory physics courses
- Pre- and Post-Instruction Testing
- Measured Normalized Gain

$$\langle g \rangle = \frac{S_{Post} - S_{Pre}}{100 - S_{Pre}}$$

American Journal of Physics v66 p64-74 (1998)

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## Pedagogical Justifications for Clickers

- Promotes active learning through interaction.
- Provides immediate feedback to the lecturer on how well students are understanding concepts
- Quick and easy formative feedback for student promotes deeper learning
- Can be used to grade, promote attendance.
- Can be used anonymously to collect information.

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## Uses vary widely

- Classroom quizzes on reading assignments,
- Spicing up standard lecture with periodic breaks,
- assessing student opinions or understanding related to lecture,
- increasing the degree of interactivity in large classrooms,
- Student predict results for demonstrations
- conducting experiments on human responses (e.g., in psychology courses), and
- managing cooperative learning activities.

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## Course Details for Research Study

- Enrollment: ~400 students (W'07)  
~450 students (W'08)
- First-year, second-semester students



- Blended course (face–2–face + on-line)

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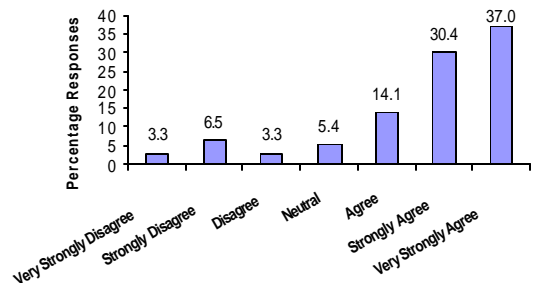
## Fall Course Structure & Evaluation

- Lectures – 3 hours/week
- Laboratory – 3 hours/alt. week (20%)
- 5 On-line Quizzes (10%)
- 3 On-line Lab Activities (7%)® 5% (W'07)
- Midterm Exam (25%)
- Final Exam (38%) ® 37% (W'07)
- W'07 In-class participation (3%)
- Online Homework in W'08

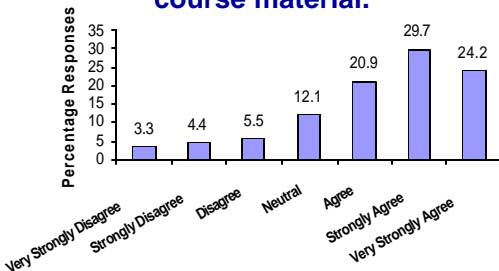


## SURVEY QUESTIONS

The use of clickers this semester made the lectures more interesting.



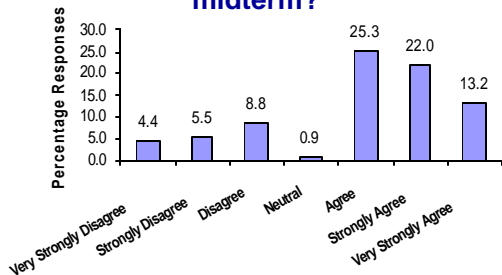
The use of clickers this semester helped me to better understand the course material.



## Student Feedback on Clickers

- “iclickers made a big difference in helping to understand and remember the things that were covered in the lectures.”
- “The clickers helped a lot by keeping us paying attention.”
- “...if there was something we did not understand in class we knew it right away and could look at it in more depth after that night when it was still fresh in our minds and not a week or two later when doing a quiz and then realize we don't understand it.”

**The use of clickers this semester helped me to better prepare for the midterm?**



Potassium perchlorate can be prepared by this sequence of rxns:



How many moles of  $\text{Cl}_2$  are needed to prepare 2 moles of  $\text{KClO}_4$ ?

- A) 8/3    7%
  - B) 4    14%
  - C) 6    11%
  - D) 8    64%**
  - E) 24    4%
- Midterm: Correct Ans  
 Clicker = 0    48%  
 Clicker = 1    65%
- W'08 MT – 61% correct ans  
 W'05 MT – 48% correct ans

**Question:**

Which has the highest 1<sup>st</sup> ionisation energy?

- A)  $^{16}\text{S}$     37%
  - B)  $^{13}\text{Al}$     5%
  - C)  $^{11}\text{Na}$     10%
  - D)  $^{15}\text{P}$     46%**
  - E)  $^{14}\text{Si}$     1%
- Midterm: Correct Ans  
 Clicker = 0    21%  
 Clicker = 1    44%
- W'08 MT – 39% correct ans  
 W'05 Final – 3% correct ans

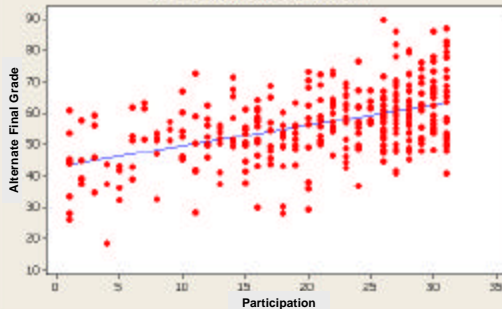
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**Results**

Participation Score	% of Class Participation	W'07 Ave. Final Grade	W'08 Ave. Final Grade
0	0 – 32%	-15%	-15%
1	33 – 59%	-7%	-5%
2	60 – 84%	+2%	0%
3	85 – 100%	+8%	+9%

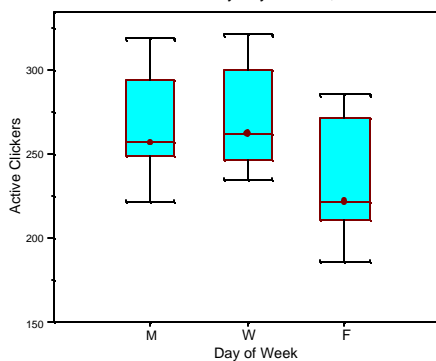
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W'08 Scatter Plot of Alternate Final Grade versus Participation

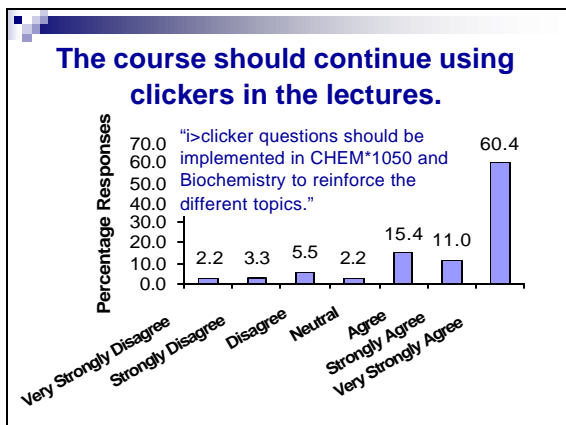
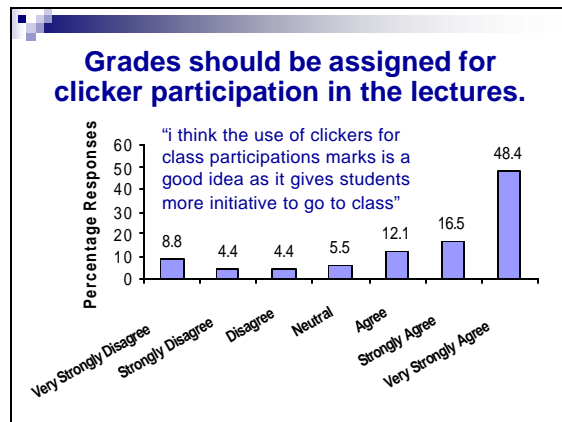
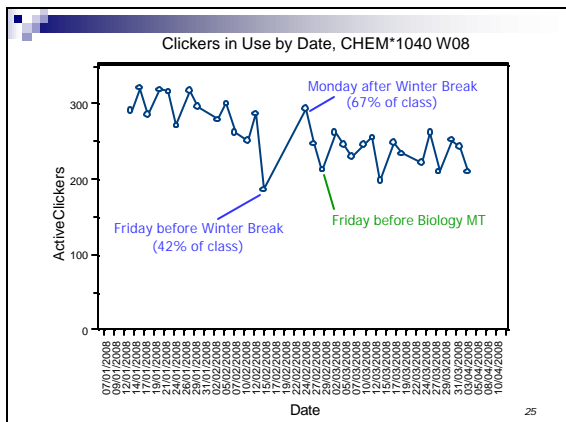


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Box Plots of Clickers in Use by Day of Week, CHEM\*1040 W08



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- ### Conclusions...
- Students were positive and often enthusiastic about the use of clickers in CHEM\*1040
  - Positive correlations were observed b/w grades & participation
  - Various factors influence attendance
- Future Work:** Peer mentoring may be used to positively influence future students

- ### Recommendations on Clicker Use
- Learn about the technological skills and pedagogical practices needed to use clickers effectively.
  - Establish clear goals for using clickers in class.
  - Use clickers in conjunction with teaching strategies (i.e., "Peer Instruction" or "Think-Pair-Share") to improve students' conceptual understanding, critical thinking, problem-solving, and decision-making skills.
- Reference: E. Zhu, CRLT Occasional Paper, 22, University of Michigan, 2007.  
Web Address: [www.crlt.umich.edu/publinks/CRLT\\_no22.pdf](http://www.crlt.umich.edu/publinks/CRLT_no22.pdf)

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