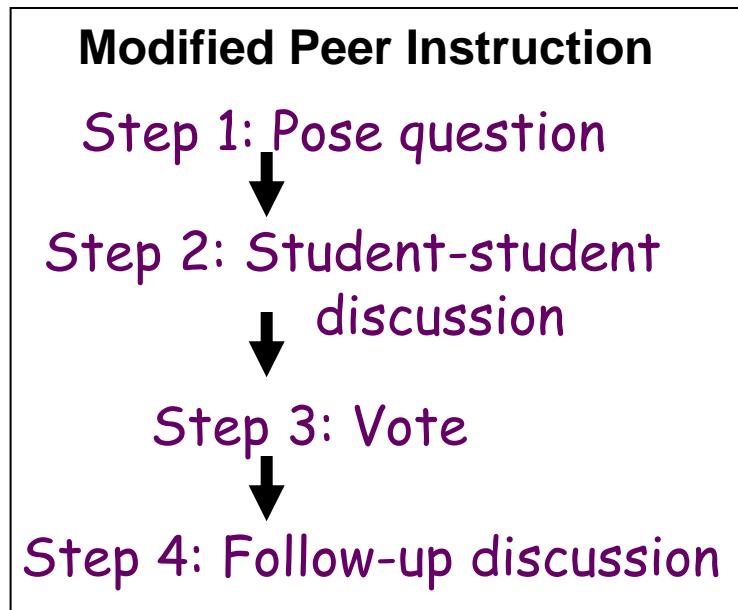# How clicker technology affects students' voting behavior and attitudes

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Or, if you do this:

Modified Peer Instruction

Step 1: Pose question

Step 2: Student-student
discussion

Step 3: Vote

Step 4: Follow-up discussion

Do you really need this?

A Faculty question: Clickers or raising hands: is there really a difference?

Others are asking this question too:

Clickers or Flashcards: Is There Really a Difference?
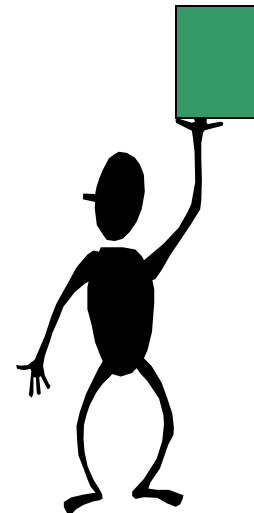
THE PHYSICS TEACHER ◆ Vol. 46, April 2008

N. Lasry, John Abbott College, Montreal Canada, and Harvard School of Engineering & Applied Sciences, Cambridge MA

Found no difference in learning gains between flashcards cards and clickers, and concludes:

"These data show that clickers do not provide any additional learning benefit to students."

*Key message: Pedagogy is major factor*

A unique teaching situation: can we do an experiment testing this question?

2 sections of Geology 1: introduction to physical geology, Spring 2007

Both sections:
Same instructors *
Identical lectures (including in-class questions)
Identical assessments
Same classroom

"clickers" section:
Voted by individual clicker
Participation credit for voting
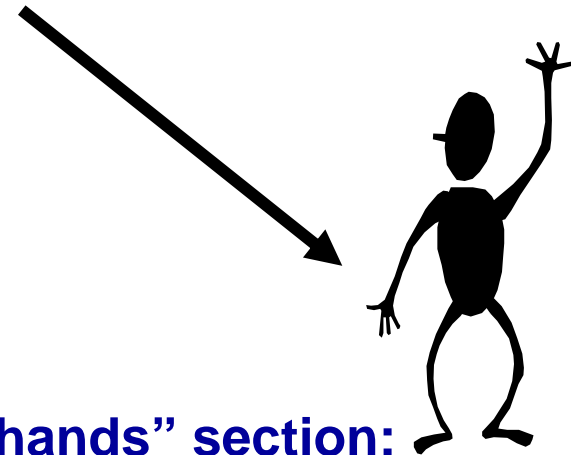
"raising hands" section:
Voted by raising hands
Attendance measured periodically

*Instructors traded off teaching both sections 4x over the semester.

Methodology

Qualitative data (thematic content analysis):
(Focus on student behavior and attitudes; question implementation)
>   Periodic classroom observations (two observers)
>   Student interviews and informal conversations

Qual/Quant data:
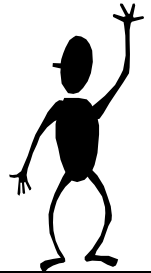**Student behavior and attitudes**
>   Student survey (multiple choice and open-ended responses, built
>   off of observations, student interviews, and informal conversations)

(we also examined **Performance** via course and exam scores, and a measure
of **Learning Gains** on a concept inventory)

Clickers　　　　　　　　　　　**Raising hands**

Observed differences in student behavior

Most students in attendance voted (as judged by seats in room) Students voted for multiple answers (simultaneous) Most students answered on their own (instructions for peer discussion ~50% of time)	Students appeared to vote in much lower proportion Students usually voted for a single answer (sequential) Some students glanced around at their peers before voting, and voted with the majority

Observations on faculty behavior

Wait time fairly easy for faculty to judge Easy and fast to get aggregate student votes– instant histogram	Wait time more difficult for faculty to judge Takes longer to estimate student votes, and not very accurate

In student interviews and informal conversations, major themes emerged as to student perceptions of the difference between voting methods, as well as their impacts:

1. **Anonymity**: primarily impacts participation and honest voting
2. **Accountability**: primarily impacts participation
3. **Feedback** to students and instructors on student thinking is more useful with clickers (get instant accurate vote tally, display histogram)

Example of part of a student interview:

Student 1: *I guess its* [using clickers] *better than having people raise their hand in class because of the whole flock mentality, like if nobody is going to raise their hand for D but if you thought it was right like you aren't going to raise your hand either.*

Interviewer: Ok

S1: *So its more individual and private, which I like, yeah. I would say I like it better than raising your hand, because everyone is going to raise their hand with the majority, so they don't look stupid.*
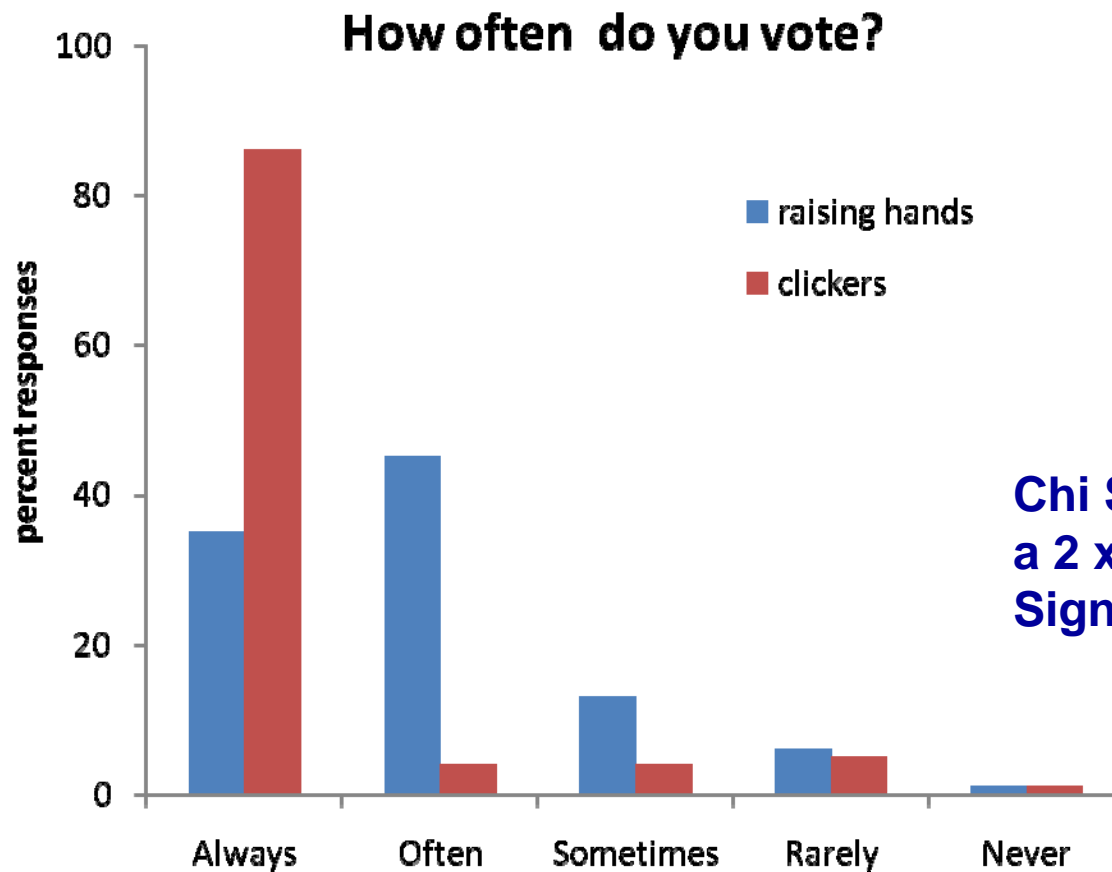
Theme and impact:

Anonymity leads to **honest voting**

Behavior/attitudes survey

Student self-reported participation

Students behaved differently in the two treatments: fewer students voted in the "raising hands" section, and tended to vote with the majority.

**Chi Square test for consistency in a 2 x K table:
Significant difference (p<0.005)**

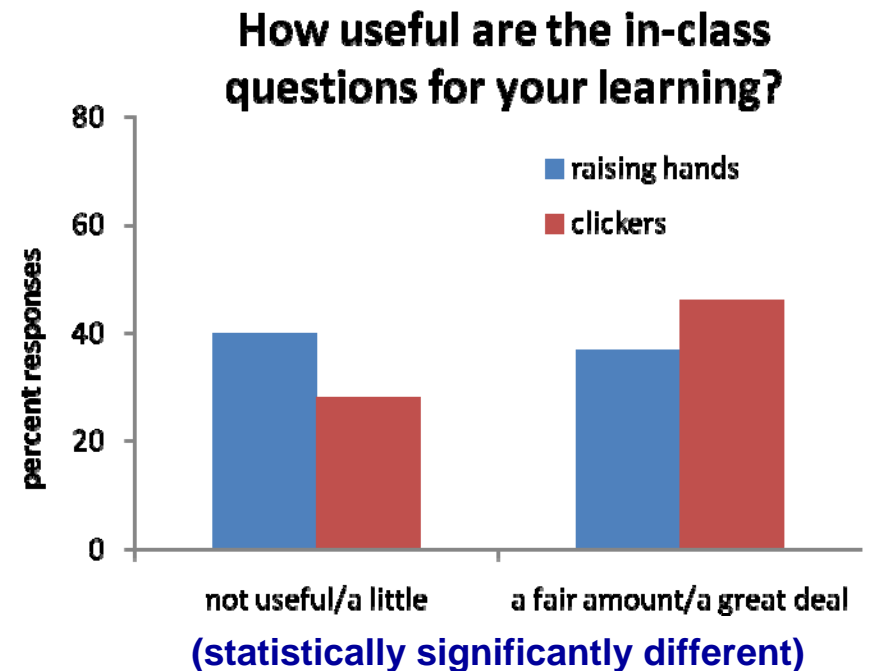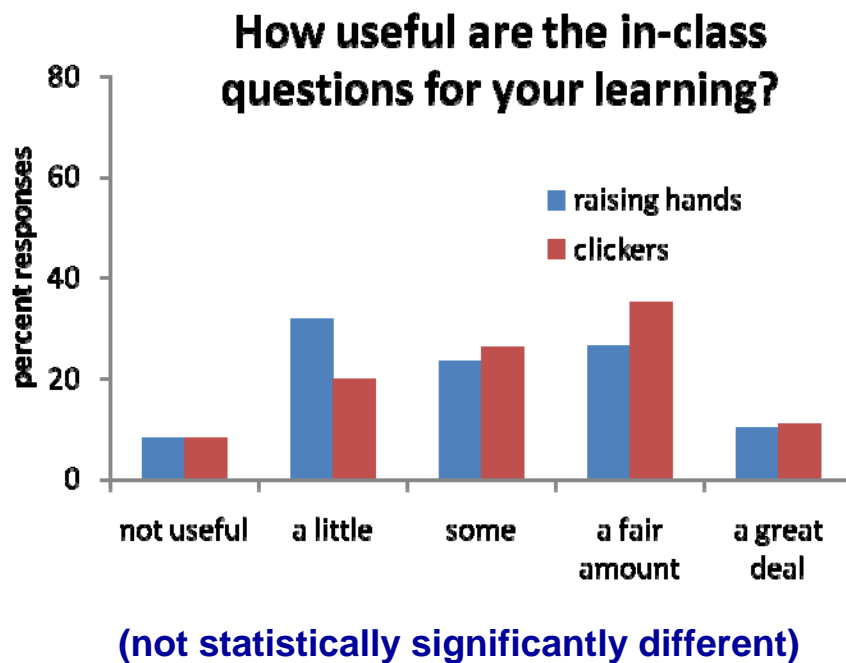# Why do fewer students participate in the "raising hands" section?

The anxiety of appearing "wrong" in front of the instructor and fellow students was a significant factoring preventing students from voting honestly and in at least some cases, from voting at all.
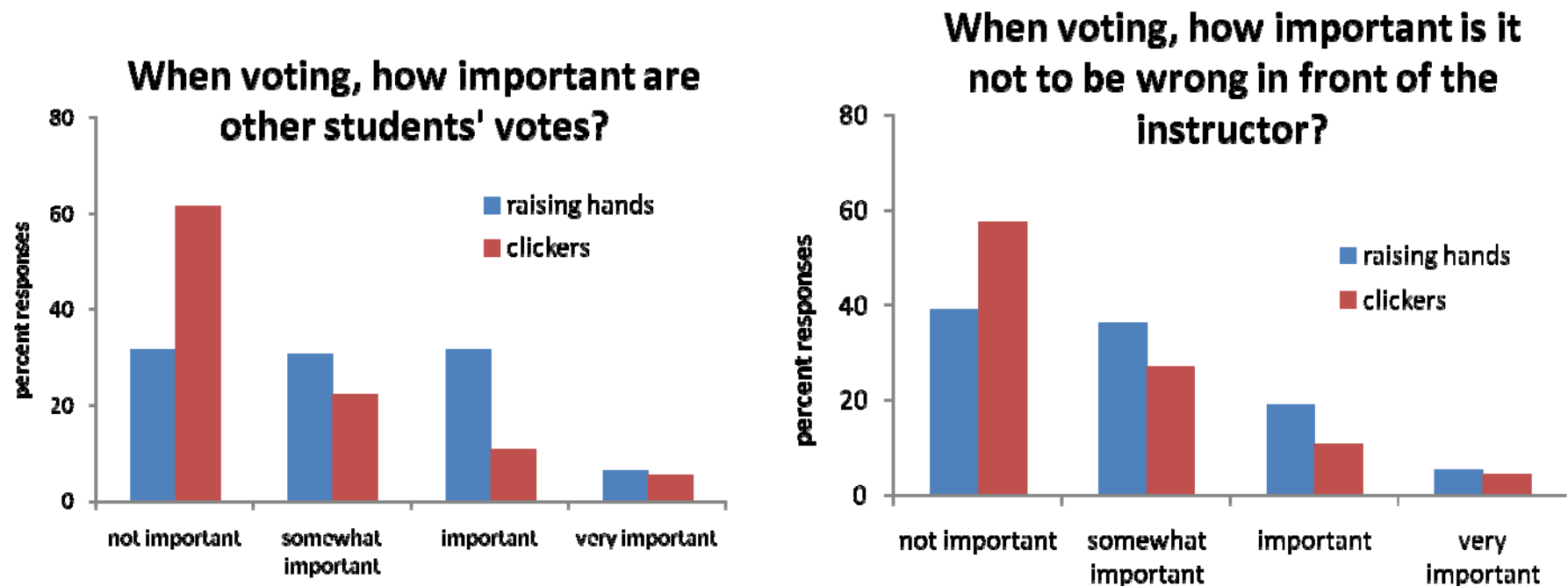
(both statistically significantly different)

Students value questions+clickers more than questions+raising hands (when questions are identical!)

How useful are the in-class questions for your learning?

(raising hands, clickers)

not useful / a little / some / a fair amount / a great deal

(not statistically significantly different)

How useful are the in-class questions for your learning?

(raising hands, clickers)

not useful/a little / a fair amount/a great deal

(statistically significantly different)

Individual students noted WHY they thought clickers were preferable

Representative student responses   **Theme**

"Voting was done by raised hands, so people rarely voted different than the majority. I didn't have a problem really, but I'm sure it played a part for some others."

Anonymity

"I thought that clickers were helpful. It made it easier for the teacher to see how many people actually understood what we were talking about without embarrassing anyone and picking on them."

Anonymity
Instant feedback on aggregate student responses

"i think it would be better to use clickers instead of hand raising so it would be more obvious if all the students understood the topic"

Instant feedback on aggregate student responses

"Clickers would have been nice because then people would be forced to answer and the voting results could lead to better discussions"

Individual accountability
Histogram generates discussion

Discussion

The clicker technology offers four characteristics that can substantially improve student engagement over other voting methods:

1.High degree of public anonymity (peers and instructors can't identify individual answers during voting).

2.Private accountability (students receive course credit for voting – automatically recorded).

3.Automated, instant tallying of aggregate student responses allows more meaningful and effective feedback to instructor .

4.Aggregate student responses can be quickly displayed to students.

(Note: these clicker features could be overridden, not used, or used against best practice implementation, but can be easily exploited to SUPPORT best practice)

This supports previous work highlighting the importance of a subset of these characteristics.

Clicker technology offers three attributes that are difficult (if not impossible) to achieve with other voting methods.

Voting/feedback method	Public anonymity	Accountability	Student response counting
Clickers	High	High	Instant, accurate, automatic
Flashcards, Communicube	Moderate	Low	Short delay, estimated, manual*
Raising hands	Low	Low	Short delay, estimated, manual
Written response	High	High	Long delay, accurate, manual

*but reportedly training/extra instructors can give highly reliable counts (Bostock et al. 2006) modify this: add the instant feedback forms – immediate response to students on their own answer, but no sense of rest of class and delayed feedback to instructors.