THINK-PAIR-SHARE AND CLICKERS IN THE CLASSROOM
More students entering in science majors\(^1\)

More students leaving science majors\(^1\)

Reasons for leaving science:

1. Loss of interest in science
2. Growing interest in other majors
3. Poor teaching

90% students leaving science and 75% of those staying in the sciences are concerned about poor teaching\(^2\).

\(^1\)Higher Education Research Institute, 2010
\(^2\)Seymour and Hewitt, 1997
POOR TEACHING IN THE SCIENCES

- “Coldness” of classroom
- Lack of student-faculty interaction
- Poor organization and lack of preparation by lecturer
- Dull presentations

- Typical lecture class has little to no interaction

- Freshman class experience most important for retention

- “a single positive interaction, excitement about a course’s teaching and/or content . . . cause a student to confirm his or her choice to stick with engineering”

1Strenta et al., 1997
2Lichtenstein et al., 2007
STUDENT BRAIN ACTIVITY OVER A WEEK

Day 4
- Lab
- TV
- Study
- Sleep
- Class

Day 3
- Lab
- Chores
- Social
- Sleep
- Relax
- Lab

Day 2
- Lab
- Homework
- Sleep
- Class

Day 1
- Lab
- Homework
- Sleep
- Class

Poh, 2012, MIT Media Lab
PEER INSTRUCTION (PI)

- Students teaching students
- Interactive courses
- Think-pair-share activities
- White boards
- Clickers or flash cards
Colored flash cards

Wireless handheld devices (clickers)

No significant difference in learning between the two\(^1\)

Flash card advantages:
- Cheaper
- Easily see vote distribution in the classroom by seating

Clicker advantages:
- Save vote distribution
- Attendance/quiz taking
- More anonymous
- You can tell when students have made a decision

\(^1\)Lasry, 2008
Students are given a conceptual question based on a recent lecture and time to consider it on their own.

\[ t = \sqrt{\frac{2a}{\Delta x}} \]

“Two objects of the same size and shape but different masses are dropped off the roof of a dorm. Which one hits the ground first?”

(a) The heavier one.
(b) The lighter one.
(c) They hit the ground at the same time.
(d) I have no idea.
THINK-PAIR-SHARE

\[ t = \sqrt{\frac{2a}{\Delta x}} \]

- 30 – 80% with the correct answer – have the students talk amongst themselves.
- < 30% with the correct answer – revisit topic
- > 80% with correct answer – clear up misunderstandings and move on

“Try to convince the person next to you that your answer is correct.”
THINK-PAIR-SHARE

- Follow up with discussion
- Takes 2-5 minutes of class time
- Is it worth the time?
Percentages of students switching out of STEM majors by year. PI = Peer Instruction.

Watkins and Mazur, 2013
Choose one of the five choices that best expresses your feeling about the statement. If you don't understand a statement, leave it blank. If you have no opinion, choose "Neither Agree nor Disagree", the middle option.

The multiple choice, or Think-Pair-Share, questions used in (your class) reinforced the concepts covered in class.

Modified Class Survey distributed by the Quantitative Learning Community, 2013
STUDENT INTERACTION

- Increases interaction and engagement of all students in the classroom.
- Students become invested in the material by taking a stance on a question and supporting it.
- Students discuss the problem amongst themselves and teach each other the material.
- More ‘ah ha!’ moments
CONCEPTUAL GAINS IN INTRODUCTORY PHYSICS AT RWU

- Force Concept Inventory (FCI)
- 30 multiple choice question conceptual test
- Given at the beginning and end of an introductory physics 1 class (mechanics)

- PHYS 109 (no TPS, no PI)
  - Average gain 0.53 ± 2.94

- PHYS 201 (no TPS, yes PI)
  - Average gain 3.67 ± 3.38

- PHYS 202 (yes TPS, yes PI)
  - Average gain 4.00 ± 3.70
Use the clickers to focus their attention on particular aspects of a subject.

What style did this artist employ?

(a) post-modern

(b) impressionism

(c) pointillism

(d) abstract
Use clickers to drive the conversation in a particular direction and encourage discussion.

Which single factor most contributed to Obama’s first election?

(a) economics

(b) health care reform

(c) end of the war

(d) social values
Use clickers to solicit responses to uncomfortable or contentious viewpoints.

Should creationism be taught in elementary schools?

(a) No
(b) Yes, along with evolution
(c) Yes, replacing evolution

How often do you get drunk?

(a) Never
(b) Once a month
(c) Once a week
(d) Several times a week
Hand out white boards and markers to groups of 2-4 students
Pose a quantitative question
Allow them to solve it in small groups
Discuss results

Student-student interaction
Easily see what they are doing
Forces them to discuss with each other
“Using white boards in (your class) reinforced the concepts covered in class.”
Peer instruction can improve student understanding of material and attention during class.

Students teaching students increases their own comprehension of the material and most easily addresses concerns.

Both clickers and flash cards can be utilized to incorporate peer instruction into the classroom.

Student conceptual understanding and overall satisfaction with the course increases with peer instructional methods.