THINK-PAIR-SHARE AND CLICKERS IN THE CLASSROOM

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Teaching Innovations

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STUDENTS LEAVING THE SCIENCES

- 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

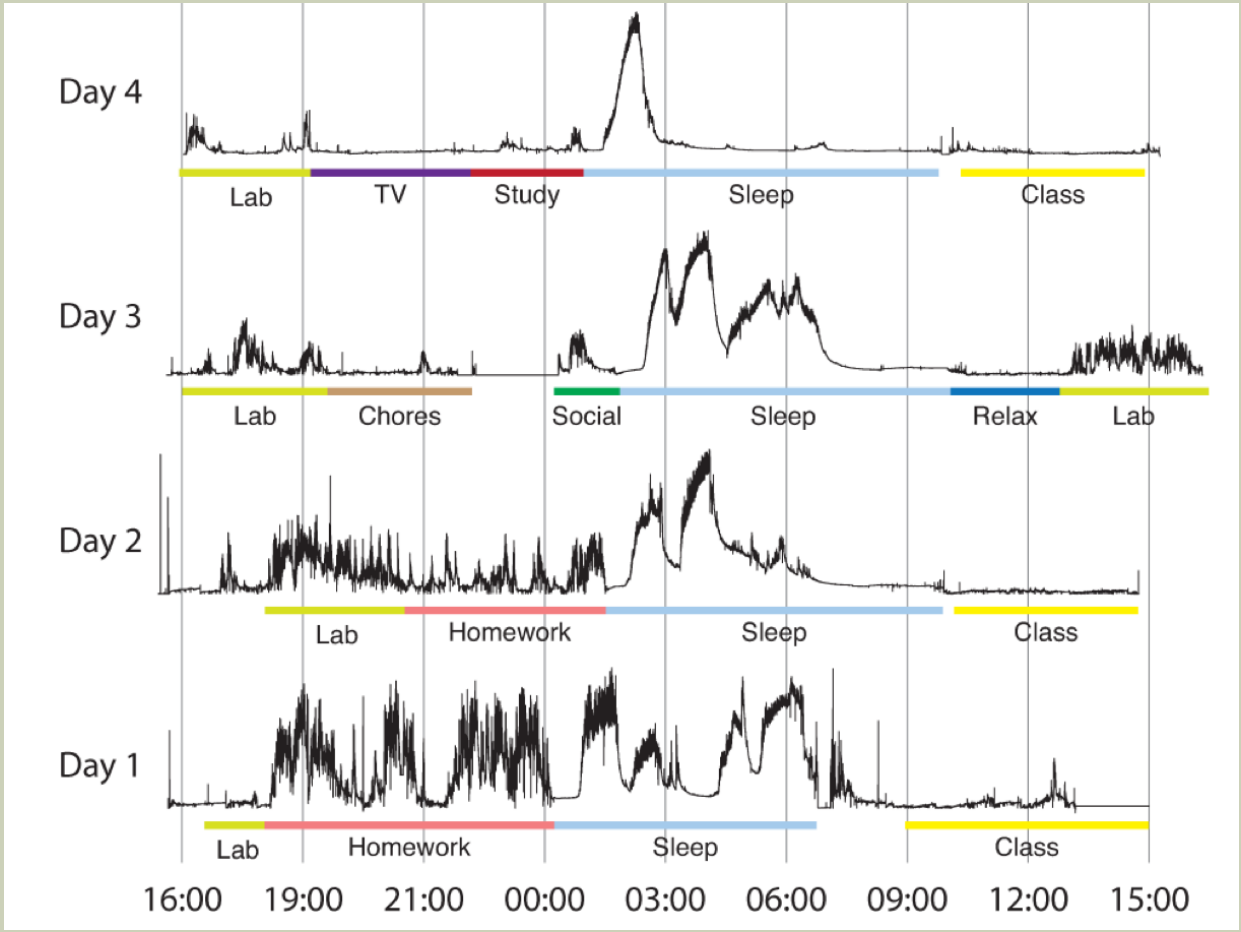
- Freshman class experience most important for retention[1]

- "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"[2]

[1]Strenta et al., 1997

[2]Lichtenstein et al., 2007

STUDENT BRAIN ACTIVITY OVER A WEEK



Poh, 2012, MIT Media Lab

PEER INSTRUCTION (PI)

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

FLASH CARDS VERSUS CLICKERS

- 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

THINK-PAIR-SHARE

- Students are given a conceptual question based on a recent lecture and time to consider it on their own.

$$t = \sqrt{\frac{2\,a}{\Delta x}}$$

- "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

$$t = \sqrt{\frac{2\,a}{\Delta x}}$$

- 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.”

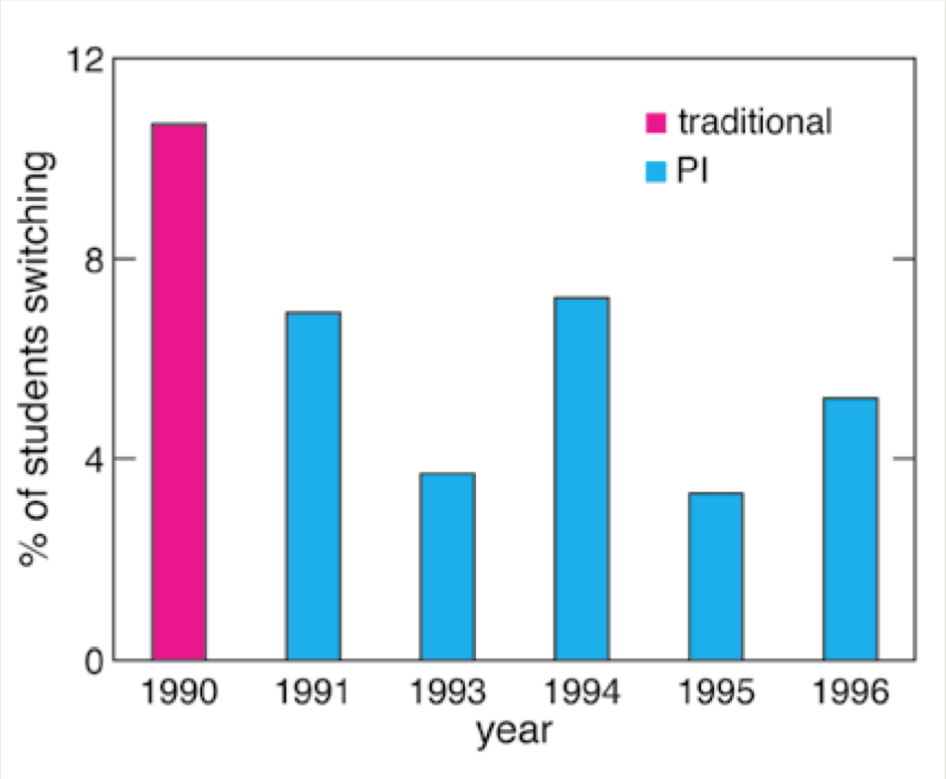
THINK-PAIR-SHARE

- Follow up with discussion
- Takes 2-5 minutes of class time

- Is it worth the time?

SCIENCE STUDENT RETENTION

Percentages of students switching out of STEM majors by year. PI = Peer Instruction.

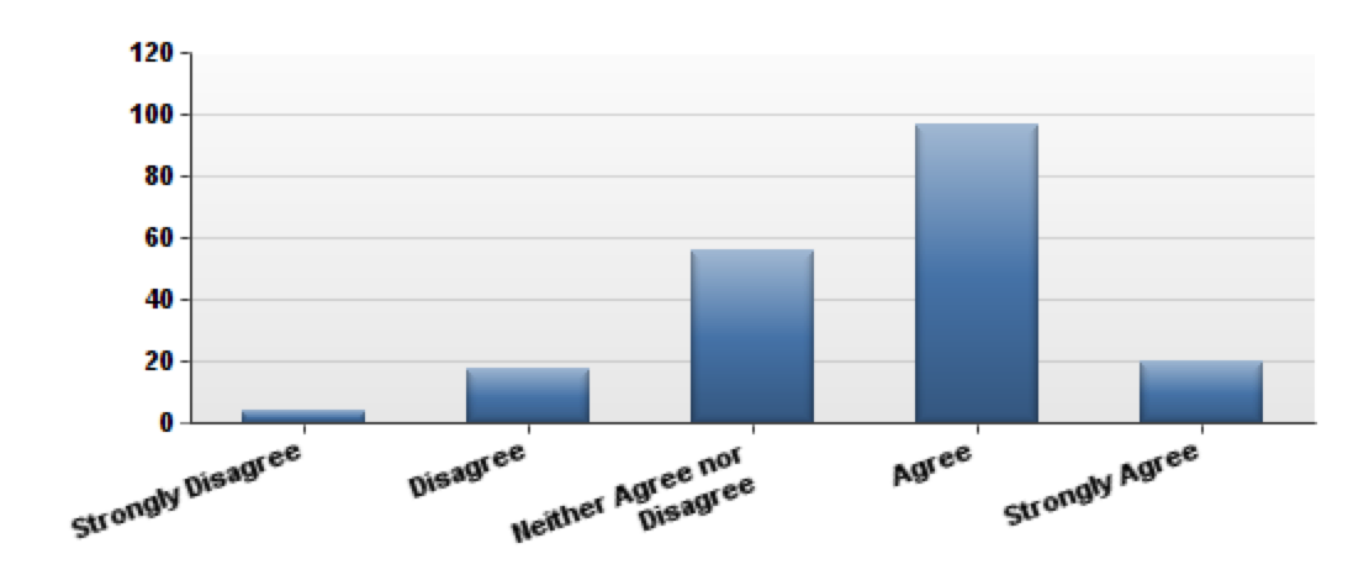


Watkins and Mazur, 2013

STUDENT INTEREST

- 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

PI IN THE ARTS AND HUMANITIES

- 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

PI IN THE ARTS AND HUMANITIES

- 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

PI IN THE ARTS AND HUMANITIES

- Use clickers to solicit responses to uncomfortable or contentious viewpoints.

- Should creationism be taught in elementary schools?

  (a) No

  (a) Yes, along with evolution

  (b) Yes, replacing evolution

- How often do you get drunk?

  (a) Never

  (b) Once a month

  (c) Once a week

  (d) Several times a week

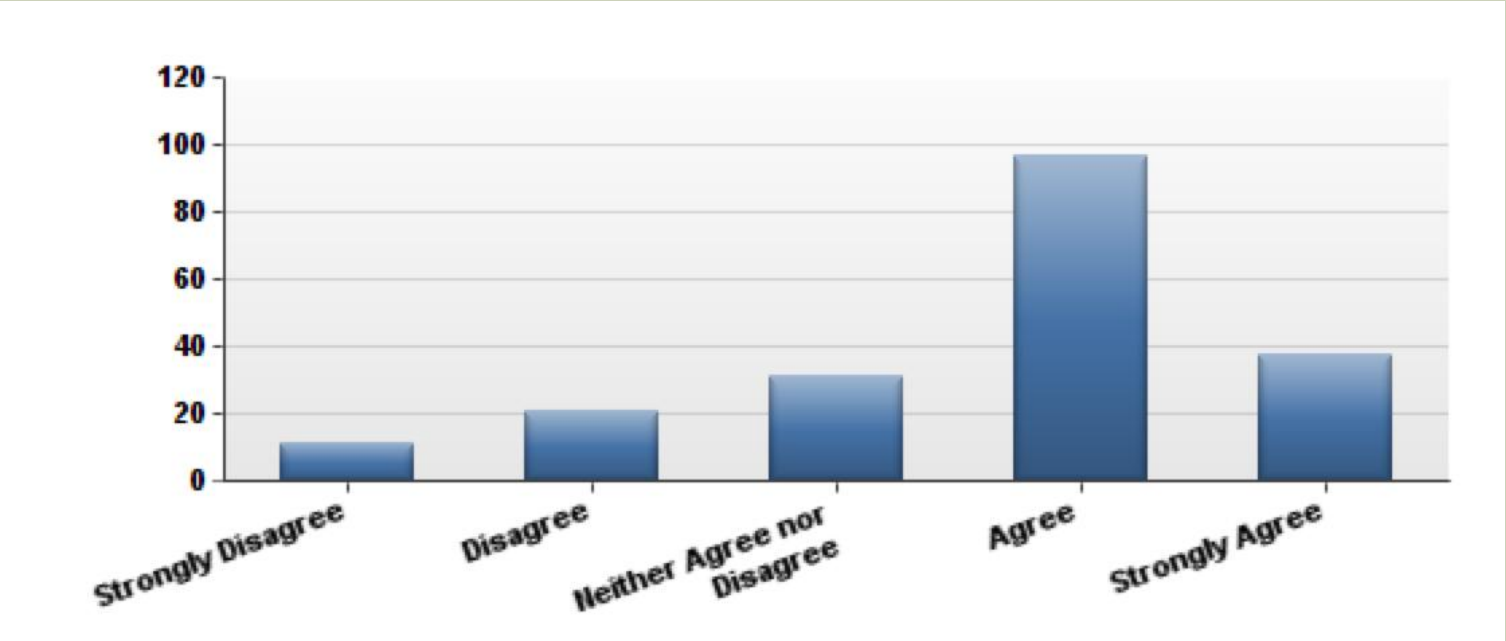
WHITE BOARDS

- 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

STUDENT INTEREST

- "Using white boards in (your class) reinforced the concepts covered in class."



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CONCLUSIONS

- 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.