Active Learning: A Key to Retaining Women in Engineering

Richard Felder & Rebecca Brent

March 7, 2013
Questions and Discussion

- **Host:** Diane Matt, Executive Director, WEPAN, Women in Engineering ProActive Network

- **Presenter:** Richard Felder, Hoechst Celanese Professor Emeritus of Chemical Engineering, North Carolina State University, rmfelder@mindspring.com

- **Presenter:** Rebecca Brent, President, Education Designs Inc., Cary, NC, rbrent@mindspring.com

- **Moderator:** Shawna Fletcher, Interim Director, Women in Engineering Program, The Ohio State University
General Info and Q&A

- The webinar uses Voice Over Internet. If your sound quality is not good, a teleconference line is available:
  - Phone: +1 (646) 307-1726, Access Code: 326-541-700
  - Audio Pin: Check your screen once you dial in.
- Participant microphones are muted for quality.
- Undock, expand “Questions” pane in control panel.
- We will stop for questions about half way through the webinar, at the end and the presenters will stay on the line for an additional 10 minutes after the webinar. Please post your questions as the webinar is going.
- Stay with us if we are temporarily disconnected.
- Download PowerPoint and link to recorded webinar at www.wepan.org Webinars.
WEPAN’s Core Purpose

- To propel higher education to increase the number and advance the prominence of diverse communities of women in engineering.
About WEPAN [www.wepan.org](http://www.wepan.org)

- **Core Values:**
  Knowledge, Collaboration, Inclusion and Leadership

- **800 members from 200 engineering schools, corporations, government and non-profits**

- **Support WEPAN’s work! Join and make a donation at [www.wepan.org](http://www.wepan.org)**
Goal: Increase the number, scope and effectiveness of initiatives to advance women in STEM.

• Catalogued and fully cited resources-1,300+
  Research, reports, data and statistics, agenda papers, bibliographies, best practices,
• Online Professional Community
  Network, collaborate, identify experts, share information
Active Learning: A Key to Retaining Women in Engineering

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Active Learning: A Key to Retention of Women in Engineering

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<www.ncsu.edu/effective_teaching>
As you enter a classroom ask yourself this question: If there were no students in the room, could I do what I am planning to do? If your answer to the question is yes, don’t do it.

(Ruben Cubero)
What’s coming?

• What is active learning? Why use it?
• Why might using A.L. improve retention of women in engineering?
• What are some A.L. structures and methods? What mistakes should be avoided?
• What does A.L. look like in an engineering class?
• Q & A
What is active learning?
Why use active learning?

- Full student engagement
- More & better responses
- Higher energy level
- Cognitive science
Experimental study: Gave 50-minute lecture, tested immediately afterwards. Results:

What do you think the curve looks like?
Poll
Retention vs. time in lecture

(a) (b) (c) (d) (e)
Results

70% % retained

20%

t = \text{time in lecture when information was presented}

Give active exercises or breaks

\[ t \text{ (min)} \]

0 \quad 50
Attrition of women from engineering

Q: Is % attrition higher for women than men?
A: No.

Q: Are the profiles of men & women leavers the same?
A: No.
Reasons for leaving engineering*

- Poor academic performance
- Dissatisfaction with climate, pedagogy, social change orientation of faculty

* Astin, *What Matters in College*; Seymour & Hewitt, *Talking about Leaving*; many others
Other reasons to use active learning

Use of A.L. correlates with

- student satisfaction with educational experience (effect greater for women)
- student perception of social change orientation of faculty (Astin, *What Matters in College*, p. 296)
Structures & methods
In-Class Teams

Form teams of 2-4, choose recorders. Give teams 30 seconds--3 minutes to

Recall prior material

Answer a question
Call on several individuals for responses first. Then take responses from volunteers. This always works, regardless of class size.
The three fatal mistakes of active learning

Mistake #1: Make the activities trivial

Wastes students’ time → resentment

Rule: *Make activities challenging.*
Mistake #2: Make the activities too long

Some groups finish quickly → waste class time. Other groups struggle the entire time & fail → get frustrated, waste class time.

Rule: *Keep activities short* (< 3 min).
Mistake #3. Call for volunteers after every activity

Students know someone else will provide the answer & don’t bother working or thinking.

Rule: *At least some of the time, call on individual students for the first few responses.*
Think-pair-share

Individual students think of responses

Exchange responses in pairs, create better ones

Pairs share responses with class

More time-consuming, more instructive than immediate group work.
Thinking-Aloud Pair Problem Solving (TAPPS)

- Get students in pairs—one explainer, one questioner.

- Assign task. Explainer explains, questioner asks questions, gives hints.

- Stop activity, call on students for responses, get volunteers to fill in. Have students reverse roles & proceed to next task.
TAPPS in an engineering class

- Intro ChE class – 100+ 1st semester sophomores
- Use TAPPS to go through major problem & solution. First step is to read problem statement, then explainer explains it to questioner.
- Stop activity, call on students for responses. Have students reverse roles & proceed to next task. Demonstration
- During activity, instructor can interact with students. Demonstration
• After the webinar, identify a challenging concept or method that will come up in your next class session.

• Think of an in-class activity that would help the students master it.

• Put the activity in your lesson plan and do it!
Want more?

- Other structures, clickers, flipped classrooms
- Fears
  - it will take too much class time
  - “ “ “ “ “ “ preparation time
  - I’ll lose control of the class
  - students will hate it/me
  - students won’t participate

and reassurances

- 12-minute active learning video by Richard Felder [http://www.youtube.com/watch?v=1J1URbdisYE](http://www.youtube.com/watch?v=1J1URbdisYE)
Asking Questions and Discussion

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Please feel free to contact Richard and Rebecca after the webinar with additional questions
Thank You for Attending
We Hope You Enjoyed the Webinar!

• Links to the PowerPoint and recorded webinar will be posted at [www.wepan.org](http://www.wepan.org) > Webinars

• Share with your colleagues!

• Survey following the webinar—please respond!

• Support WEPAN—make a donation at [www.wepan.org](http://www.wepan.org) > Donate

• Pay a personal tribute to someone who has made a difference to women in engineering