

Richard Felder & Rebecca Brent



Transforming Culture in Engineering Education

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, <u>rmfelder@mindspring.com</u>



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



Moderator: Shawna Fletcher, Interim Director,
 Women in Engineering Program, The Ohio State
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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 <u>www.wepan.org</u> 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 <u>www.wepan.org</u>

• 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 <u>www.wepan.org</u>



WEPAN Knowledge Center

http://wepanknowledgecenter.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





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Active Learning: A Key to Retention of Women in Engineering



Rebecca Brent Education Designs, Inc.

Richard M. Felder N.C. State University <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?



Does Active Learning Work? A Review of the Research

MICHAEL PEPCE Dependency (Chasse Exploring Belled Column) After develop is granully default as any instructional method that suggest statutes as the learning process. In sites, aster learning in programs toolked to do scoreingful instructing activities are donal dread what they are along [2]. While this defaultion could exclude the solution of the transmission investion with a basis



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







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









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 <u>Rule</u>: *Make activities challenging*.

Mistake #2: Make the activities too long



Some groups finish quickly \rightarrow waste class time. Other groups struggle the entire time & fail \rightarrow 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.

<u>Rule</u>: 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.
 <u>Demonstration</u>
- During activity, instructor can interact with students.
 <u>Demonstration</u>



- 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?

- R.M. Felder & R. Brent. "Active learning: An introduction." <u>www.ncsu.edu/felder-public/Papers/ALpaper(ASQ).pdf</u>
- 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 <u>http://www.youtube.com/watch?v=1J1URbdisYE</u>

Asking Questions and Discussion

- Participant microphones are muted for webinar quality.
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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!

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- Share with your colleagues!
- Survey following the webinar—please respond!
- Support WEPAN—make a donation at <u>www.wepan.org</u> > Donate
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