Advanced Practice Teaching: Implementing your Active Learning Plan
Assignment

Sessions: You can implement your active learning plan at one of the following sessions
- Session 1: Wednesday, October 2, 2013 from 3:15 – 5:30 pm
- Session 2: Wednesday, October 2, 2013 from 5:45 – 8:00 pm
- Session 3: Thursday, October 3, 2013 from 3:15 – 5:30 pm
- Session 4: Thursday, October 3, 2013 from 5:45 – 8:00 pm

Registration: http://crlte.engin.umich.edu/aptregistration/

Assignment: For this session, you will present a 10-minute lesson that includes one of the 6 active learning strategies listed below to a small group of your peers (about 4 other people). You may want to teach a lesson that other engineers outside of your field can grasp because you will likely be in a practice teaching session where multiple engineering disciplines will be represented. In addition, the rooms will have markers/chalk, whiteboard/blackboard, and pens. Some rooms may have a data projector, but you will need to bring your own laptop. After you present your lesson and interact with your “students”, you will receive feedback from your peers and a trained practice teaching facilitator about your use of active learning. The goal of this exercise is to give you practice actively engaging students to learn concepts from your field. Research studies have shown that active learning (like the six options shown below) increases student retention and performance.

Tips: Successful active learning takes careful planning. Here are some steps to take:
- **Determine your goals** for the lesson – what do you want students to know or be able to do?
- **Plan a short introduction** to stimulate interest and thinking. You are encouraged to prepare a handout or any other relevant visuals to help clarify things.
- **Plan an activity** to get students to use or think about the material you’re teaching in a meaningful way. Decide precisely what you want them to do, and plan clear instructions for the task. **You must select ONE of the following six teaching strategies** (see back for more information on these techniques):
  - Minute paper
  - Think-Pair-Share
  - Thinking Aloud Paired Problem Solving
  - Brainstorming
  - Case Studies
  - Cooperative Groups
Be sure to experiment with your teaching approach and try to design an activity that goes beyond asking students general questions like, “Do you have any questions?”
- **Design meaningful checking questions** you will ask. Write down precisely how you can state them, and then paraphrase them, so that you are prepared with more than one way to ask the questions. Try to predict the answers your questions will generate.
- **Plan how you will conclude** the lesson, using students’ work.

Resources: When creating the lesson, consider giving students opportunities to work together. You can ask them to collaborate to answer a question, solve a problem, compare notes or ideas, and to put their work on the board and explain it. You may want to speak with an engineering teaching consultant for more ideas (http://crlte.engin.umich.edu/gsi_serv/etc/).

For information on lesson planning, go to:
http://www.crlt.umich.edu/gsis/p2_5

For more information about active learning, go to:
http://www.crlt.umich.edu/tstrategies/tsal

For videos of GSIs teaching using active learning, go to:
http://crlte.engin.umich.edu/gsi_serv/gsitraining/practiceteaching/

Afterwards: Use the information you gathered from your presentation, your reflection, and the audience to think about your teaching assignment. Keep in mind that Engineering Teaching Consultants (http://crlte.engin.umich.edu/gsi_serv/etc/) and CRLT-Engin staff will be ready to assist you with any teaching question you have during the term.

CRLT-Engin
Active Learning in the Engineering Classroom

What is active learning?

“‘Active Learning’ is, in short, anything that students do in a classroom other than merely passively listening to an instructor’s lecture. This includes everything from listening which helps the students to absorb what they hear, to short writing exercises in which students react to lecture material, to complex group exercises in which students apply course material to ‘real life’ situations and/or to new problems.” (Paulson & Faust, n.d.)

Why use active learning?

“As we have seen, a major problem with the lecture is that students assume a passive, non-thinking, information-receiving role. Yet, if they are to remember and use the information, they need to be actively engaged in thinking about the content presented.” (McKeachie, 2005)

How can you incorporate active learning into engineering classroom?

There are many ways to use active learning in the classroom. The following brief list summarizes some simple approaches described by others (Active learning, n.d.; Felder & Brent, 1994; Felder & Brent, Fall 2003; Felder & Brent, Summer 1994; Paulson & Faust, n.d.).

- **The “Minute Paper.”** At an appropriate point in the lecture, ask the students to take out a blank sheet of paper. Then, ask the topic or question you want students to address; for example, “Today, we discussed conductive heat transfer. List as many of the principal features of this process as you can remember. You have two minutes – go!”

- **Think-Pair-Share.** Have students first work on a given problem individually, then compare their answers with a partner and synthesize a joint solution to share with the class.

- **Thinking Aloud Paired Problem Solving (TAPPS):** In pairs, students describe in detail how they would solve a problem, approach a case study, or interpret data. Taking turns, one student would serve as the “explainer,” while the other student listens and asks clarifying questions. After a while, the students switch roles to solve a new problem.

- **Brainstorming.** Introduce a topic or problem and then ask for student input. Give students a minute to write down their ideas, and then record them on the board. For example, “What are possible safety (environmental, quality control) problems we might encounter with the process unit we just designed?” could be a brainstorm topic in an engineering class.

- **Case Studies.** Use real-life stories that describe what happened to a community, family, school, industry or individual to prompt students to integrate their classroom knowledge with their knowledge of real-world situations, actions, and consequences.

- **Cooperative Groups in Class.** Pose a question on which each cooperative group will work while you circulate around the room answering questions, asking further questions, keeping the groups on task, and so forth. After an appropriate time for group discussion, ask students to share their discussion points with the rest of the class.

More examples of active learning teaching methods can be found at [http://www.crlt.umich.edu/tstrategies/tsal](http://www.crlt.umich.edu/tstrategies/tsal)

Does active learning work?

“In short, if you start using active learning in your classes, you can expect to see some initial hesitation among the students followed by a rapidly increasing comfort level, much higher levels of energy and participation, and above all, greater learning. Check it out.” (Felder & Brent, Fall 2003)

References


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<th>Type</th>
<th>Description</th>
<th>Example</th>
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<td>Minute Paper</td>
<td>At an appropriate point in the lecture, ask the students to take out a blank sheet of paper. Then, ask the topic or question you want students to address; for example, “Today, we discussed conductive heat transfer. List as many of the principal features of this process as you can remember. You have two minutes – go!”</td>
<td>In AE 550, Linear Systems, the instructor says, “Today, we discussed the controllability of linear time-invariant (LTI) systems. Without looking at your notes, list all of the equivalent ways to test for the controllability of an LTI system. You have two minutes.”—Amor Menezes (Former EGSM)</td>
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<td>Think-Pair-Share</td>
<td>Have students first work on a given problem individually, then compare their answers with a partner and share ideas with the class.</td>
<td>In IOE 310, Introduction to Optimization, the professor puts an optimization problem on the projector and asks the students to come up with the objective function and the constraints. When they have written down their answers, the students are asked to compare their solution to their neighbors. Then the instructor goes over the example for the entire class. —Arleigh Waring (Former EGSM)</td>
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<td>Thinking Aloud Paired Problem Solving</td>
<td>In pairs, students describe in detail how they would solve a problem, approach a case study, or interpret data. Taking turns, one student would serve as the “explainer,” while the other student listens and asks clarifying questions. After a while, the students switch roles.</td>
<td>A computer programming instructor could show a code on the board and asks the one of the students in the pair to describe aloud what the code will do. The task would be repeated with another example code for the second student to describe. Afterwards the code is implemented and the results are observed. The instructor then asks why the program behaved in the expected or unexpected way.—Adapted from Fernando Tavares (Former EGSM)</td>
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<td>Brainstorming</td>
<td>Introduce a topic or problem and then ask for student input. Give students a minute to write down their ideas, and then record them on the board. For example, “What are possible safety (environmental, quality control) problems we might encounter with the process unit we just designed?” could be a brainstorm topic in an engineering class.</td>
<td>During a biomedical design course, the students are presented with a problem how to help patients with severe tremors (e.g. from Parkinson’s disease) be able to do common tasks, such as eating and writing. The students break up into groups of 4-5 and write down ideas on a board, and then follow-up by further developing those ideas on a CTools wiki. —Matt Gibson (Former EGSM)</td>
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<td>Case Studies</td>
<td>Use real-life stories that describe what happened to a community, family, school, industry or individual to prompt students to integrate their classroom knowledge with their knowledge of real-world situations, actions, and consequences. (See <a href="http://sciencecases.lib.buffalo.edu/cs/">http://sciencecases.lib.buffalo.edu/cs/</a> for sample cases)</td>
<td>In ChE 466 (Process Dynamics and Control) the instructor provides the students with a news-piece about an explosion in a chemical plant and asks students to brainstorm reasons for the accident using the concepts learned from this course. He further asks them act as investigators and to make a list of questions they would like to ask the plant operators to find out the actual cause of the accident. —Tabish Maqbool (Former EGSM)</td>
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<td>Cooperative Groups</td>
<td>Pose a question on which each cooperative group will work while you circulate around the room answering questions, asking further questions, keeping the groups on task, and so forth. After an appropriate time for group discussion, ask students to share their discussion points with the rest of the class.</td>
<td>Vehicle Dynamics: Provide each group with a toy car whose front and rear wheels are selectively lockable. Ask them to experimentally investigate the stability differences between rear wheel brake lockup and front wheel brake lockup.—Mark Hoffman (Former EGSM)</td>
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