

Strategies for Active Learning

Exercises for Individual Students

Because these techniques are aimed at individual students, they can be used without interrupting the flow of the class and are useful in providing the instructor with feedback about understanding and retention of material or attitudes and values.

1. The "One Minute Paper" - This checks understanding of the material and reactions to it. Pose a question (either specific or open-ended) and give them one (or two) minute(s) to respond. For example: "What is 'scientific realism?'" or "What was the main point of today's class material?" This tells you whether or not the students are viewing the material in the way you envisioned.

2. Muddiest (or Clearest) Point - A variation on the one-minute paper, here you ask (at the end of a class period or at a natural break in the presentation), "What was the 'muddiest point' in today's lecture?" or "What (if anything) do you find unclear about the concept of 'personal identity'?"

3. Affective Response – Ask students to report their reactions -- emotional or evaluative responses to the material. For example, ask what students think of Dr. Jack Kevorkian's activities before presenting what various moral theorists would make of them. By having several views "on the table" before the theory is presented, you can help students to see the material in context and explore their own beliefs. It is also a good way to begin a discussion of any other scientific area in which the general public often has views contrary to current scientific thinking, such as paper vs. plastic packaging or nuclear power.

4. Daily Journal - This combines the three techniques above and allows for more in-depth discussion of or reaction to course material. Set aside class time or assign as homework. Feedback will not be as instant as with the one-minute paper, but students have time to answer more complex questions, such as, "Do you think that determinism is correct or that humans have free will? Explain your answer." Or you can ask students to find and discuss reports of scientific studies in popular media on relevant topics, such as global warming or the ozone layer.

5. Reading Quiz - This is one way to get students to read assigned material! Active learning depends upon students coming to class prepared. By asking the same sorts of questions on several reading quizzes, you will give students guidance as to what to look for when reading assigned text. Instead of literal questions ask for motivations that highlight deeper thinking.

6. Clarification Pauses - This technique fosters "active listening." Throughout a lecture, particularly after stating an important point or defining a key concept, stop, let it sink in, and then wait and ask if anyone needs to have it clarified. You can circulate around the room during these pauses to look at students' notes and answer questions. Students who would not ask questions in front of the class will ask questions during a clarification pause as you move around the room.

7. Response to a Demonstration or Other Teacher Centered Activity - The students are asked to write a paragraph that begins with: "I was surprised that..." "I learned that..." "I wonder about ..." This allows the students to reflect on what they actually got out of the presentation.

Questions and Answers

While most of us use questions as a way of prodding students and instantly testing comprehension, there are simple ways of tweaking our questioning techniques which increase student involvement and comprehension.

8. Wait Time – After posing a question, wait about 15 seconds before calling on someone to answer it. Insist that no one raise his/her hand (or shout out the answer) before you give the OK, in order to discourage the scenario in which the students in the front row immediately volunteer to answer the question, and everyone else sighs in relief. Waiting forces every student to think about the question rather than passively relying on those students who are fastest out of the gate to answer. When the wait time is up, the instructor asks for volunteers to answer the question.

9. Student Summary of Another Student's Answer - In order to promote active listening, after one student has volunteered an answer to your question, ask another student to summarize the first student's response. Many students hear little of what their classmates have to say, waiting instead for the instructor to either correct or repeat the answer. Having students summarize or repeat each others' contributions to the course fosters active participation and promotes the idea that learning is a shared enterprise. Given the possibility of being asked to repeat a classmate's comments, most students will listen more attentively *to each other*.

10. The Fish Bowl - Students are given index cards and asked to write down one question concerning the course material. They should ask a question of clarification regarding some aspect of the material that they do not fully understand or a question about how to apply course material in a practical way. At the end of the class (or at the beginning of the next meeting if assigned for homework), students deposit their questions in a fish bowl. The instructor then draws several questions out of the bowl and answers them or asks the class to answer them.

11. Quiz/Test Questions - Students become actively involved by constructing some (or all) of the questions for quizzes and tests. This exercise may be assigned for homework and evaluated for extra credit. It encourages students to think more deeply about the course material and explore major themes, comparison of views, applications, and higher-order thinking skills. You may use them as for review sessions and/or to model the most effective questions. You may ask students to discuss the merits of the questions or discuss aspects of two different questions on the same material, including degree of difficulty, effectiveness in assessing learning, or scope.

Immediate Feedback

These techniques are designed to give the instructor an indication of an understanding of material presented during the lecture itself. This allows the instructor to stop at appropriate points to give quick tests of the material in order to slow down to spend more time on the concepts students are having difficulty with or move more quickly with concepts students are grasping.

12. Finger Signals - students hold up the appropriate number of fingers immediately in front of their chests (so others can't see their responses). [One finger means 'true', two 'false' and 1-5 for multiple choice questions.]

13. Flash Cards - A variation of the Finger Signals approach, the instructor might flash the diagram of a chemical compound and ask "Does this compound react with H₂O?"

14. Quotations - After students have read several opposing theories or schools of thought and the relevant concepts have been defined and discussed, give students a quotation by an author they have not read in the assigned materials and ask them to figure out what position that person advocates. This tests comprehension of the material presented and also develops critical thinking and analysis skills. This might be useful in discussing the various aspects of evolution.

15. Quick Thinks – These are used to get students to stop and think about the content you have explained in a lecture. Doing this every 10-15 minutes can result in increased attention and learning. Students can record their responses individually and explain their answers to a neighbor, discuss with a neighbor, or be asked to think silently about a response. The instructor needs to provide feedback so students can hear or share correct answers.

- Select the Best Response – similar to a multiple choice test question, present a question or scenario and ask students to choose one of three responses that best answers it. The task can require recall of information just covered or application of that information.
- Correct the Error –create an intentional error based on information just discussed and ask students to correct that mistake.
- Complete a Sentence Starter –create a sentence stem that needs completion to reflect an accurate statement based on information just explained. It should require reflection that goes beyond recall to levels of application, analysis, or evaluation.
- Compare or Contrast – identify two important parallel elements from the lesson and ask students to focus on similarities or differences; this is most effective if the comparison has not already been provided and the elements have been simply presented separately.
- Support a Statement – create a statement for which students must locate support from their lecture notes or homework. They can be asked to generate their own reasons or data to support the statement, thinking about why a statement might be justified.
- Reorder the Steps – present a series of steps in a mixed order and ask students to re-order them in the correct sequence; this is for review or to anticipate learning new information.
- Reach a Conclusion – ask students to make a logical inference about the implications of facts or principles they just learned, such as probable results, causes, or outcomes.
- Paraphrase the Idea – ask students to rephrase an idea using their own words; it is often helpful to have students target their paraphrase to a specific audience

Critical Thinking Motivators

Sometimes it is helpful to get students involved in discussion of or thinking about course material either before any theory is presented in lecture or after several conflicting theories have been presented in order to generate data or questions prior to mapping out the theoretical landscape; the students learn to assess the relative merits of several approaches.

16. The Pre-Theoretical Intuitions Quiz - To get students interested in a topic and answer the question, "what use is this?" or "what good will this do for me?" give a quiz to get students to assess their views on a controversial topic in the subject field. After students respond, have them compare answers in pairs or groups and discuss the ones on which they disagree. This may also be used to assess student knowledge of the subject matter in a pre/post-lecture comparison.

Share in Pairs

Grouping students in pairs is less time consuming than assigning people to groups. Working in pairs makes it difficult for students to avoid participating, making each person accountable.

17. Discussion - Students are asked to pair off and to respond to a question either in turn or as a pair. This can easily be combined with other techniques such as those under "Questions and Answers" or "Critical Thinking Motivators." In science classes students can be asked to explain some experimental data that supports a theory just discussed in the lecture. Students should be given explicit directions, such as "Tell each other why you chose the answer you did."

18. Note Comparison/Sharing - One reason that some students perform poorly is that they do not always know what to write down or may have gaps in their notes. Have students occasionally compare notes. Stop lecturing immediately after covering a crucial concept and have students read each others' notes, filling in the gaps in their own note-taking. Once students see the value of supplementing their own note-taking, they might continue outside of class.

19. Evaluation of Another Student's Work - Students are asked to complete an individual homework assignment or short paper. On the day the assignment is due, students submit one copy to the instructor to be graded and one copy to their partner, who may be matched up that day or assigned as partners to work with throughout the term. Each student then gives his/her partner feedback. This is an effective way to improve student writing.

Cooperative Learning Exercises

For more complex projects, where many heads are better than one or two, working in groups can encourage discussion of problem solving techniques and support students who need extra help.

20. Cooperative Groups - Pose a question to be worked on in each cooperative group and then circulate around the room to answer questions, ask more questions, and keep the groups on task. After an appropriate time for discussion, students are asked to share their points with the class.

21. Active Review Sessions – Instead of students asking questions and the instructor answering them while students copy the answers, the instructor poses questions and the students work on them in groups. Students show their solutions to the group and discuss any differences among solutions proposed.

22. Work at the Board - In many problem solving courses, instructors review homework by solving the problems themselves. Because students learn more by doing than watching, have students in small groups solve problems at the board or use butcher paper or computers.

23. Concept Mapping - Students construct concept maps by showing connections between terms or concepts, identifying and organizing information and establishing meaningful relationships.

24. Visual Lists - Groups can generate more comprehensive lists than students working alone, especially when comparing views or listing pros and cons of a position. Students may draw a "T" and label the left- and right-hand sides of the cross bar with opposing positions, listing everything they can think of that supports these positions on either side of the vertical line.