Instructor Guidelines
Using EXPLANATION to Promote Learning

The act of explaining involves articulating the meaning of a concept, idea, solution or other type of subject matter to oneself or another person. *Trying to explain*, can be a potent learning process.

> *Even if learning materials are inadequate (such as not perfectly sequenced, with much missing information), students can learn, in fact even more effectively, if they try to explain the materials to themselves. Doing so allows them to infer the missing information, synthesize the presented information even if it is out-of-sequence, and so on. This has been coined the self-explanation effect.* (Chi, 2017, p.1)

How explaining supports robust learning

Explaining is a sense making activity in which students analyze new information, relate it to prior knowledge, look for connections between ideas, and build mental representations or models of the material. It involves a deliberate effort to express the meaning to oneself or another person.

During class students may not have a deep grasp of the subject, but episodes in which they try to explain the new material pushes their understanding forward. In this way, explaining is a way to develop deeper learning. Explaining also helps students monitor and recognize gaps in their understanding. Being aware of what you don't know is an important step in rethinking, revising, and expanding one's understanding.

Research on explaining and self-explanation

A large body of research has shown that self-explanation can enhance learning (Bisra, Liu, Nesbit, Salimi, & Winne, 2018; Chiu & Chi, 2014). For example, Chi, Bassok, Lewis, Reimann, & Glaser (1989) found that higher achieving students engage spontaneously in self-explanation as they read and study. They generate inferences about the material, connect the new information to their own prior knowledge, and monitor their comprehension. In a study that compared effective and ineffective readers, effective readers detected 9 times as many comprehension failures as ineffective readers did. In other words, they noticed when they did not understand what they were reading 9 times as often as ineffective readers.

Based on a meta-analysis of 64 research studies involving 6000 participants, Bisra, Liu, Nesbit, Salimi, & Winne (2018) concluded

> Our findings have significant practical implications. The foremost is that having learners generate an explanation is often more effective than presenting them with an explanation. Another major implication for teaching and learning is that beneficial effects of inducing self-explanation seem to be available for most subject areas studied in school, and for both conceptual (declarative) and procedural knowledge. The most powerful application of self-explanation may arise after learners have made an initial explanation and then are prompted to revise it when new information highlights gaps or errors. (p. 720)

Strategies to promote deeper learning through explaining

Below are strategies that can induce students' self-explanation, and provide opportunities to learn course material more deeply by explaining it.

1. Think-Pair-Share. In class, the instructor stops lecturing and:
    a. poses a question such as, How does concept X relate to concept Y that we explored last week?
    b. gives students a few minutes to think and write a response
    c. asks students to share their ideas with a classmate and try to identify the key points in their two answers
    d. the instructor collects responses and reads several to the class, using them to highlight major ideas and give specific feedback to the entire class

2. Minute Paper. At the end of class ask students to explain concepts or topics in writing. The instructor decides what to emphasize, e.g., general understanding of the topics vs. deeper understanding of a specific idea, etc. The instructor collects the responses and uses them as feedback to plan the next class period.

3. Predict – Explain – Observe – Re-explain. In class the instructor
    a. describes a relevant case, experiment, demonstration, or scenario
    b. asks students to predict and explain the outcomes or results
    c. describes or demonstrates the actual results
    d. asks students to reconcile their predictions with the actual outcomes
    e. gives feedback to the class to help resolve discrepancies between students' predictions and actual outcomes

4. Group Grid. Students organize, classify and analyze information, e.g., concepts or solutions to problems, using a grid or table to sort responses into categories. Categories could be basic such as strengths and weaknesses of solutions or more differentiated e.g., categorizing solutions according to theoretical assumptions. After groups complete their grids the instructor shows an *expert* version. Students compare their work, ask questions and revise their ideas.

5. Draw a diagram to illustrate content or a concept. Ask students to draw a sketch or graph to illustrate specific content or concepts. Students add explanatory notes to the illustration. Instructors should downplay artistic skill or students may spend more time drawing than thinking about the concepts.

6. Explain worked examples. A worked example consists of a problem statement and then a detailed description of the solution. Studying worked examples is particularly effective when students are first learning a new topic or procedure (Schwartz, Tsang & Blair, 2016). Present students with a partially worked example that shows the solution path but not the conceptual explanation for the steps. Ask students individually or in pairs to explain the solution.

7. Homework questions. Assign questions in which students explain course concepts based on class material and reading assignments. Students submit these online before the class period and/or have access to them in class. The instructor uses the questions for class discussion, asks students to share responses, and provides feedback on key points.

Guidelines for Using EXPLAINING Strategies

Whether self-explaining strategies are effective depends on how they are implemented. To enhance their effectiveness, instructors should consider a number of factors:

- Pre-training. Prepare students to use self-explaining activities. For example,
  - Emphasize that the learning goal is to develop better understanding of the topic at hand. Discuss how explaining involves working out better understanding of the topic rather than automatically producing a correct answer.
  - Describe how self-explaining supports learning through making new associations, determining meanings, and identifying gaps in one's knowledge.
  - Model the process of explaining. Describe what students should do *mentally* when they *explain* a concept, idea, or issue. Talk through or think aloud how you would try to explain an unfamiliar concept.
  - When available, highlight examples of explanations that are well developed, underdeveloped as well as non-explanations.
  - Describe how participation in self-explaining will contribute to students' course grade.

- Use prompts, questions or tasks that induce *explaining* as a cognitive activity, such as explain, compare and contrast, interpret, paraphrase, restate in their your own words, categorize and explain, justify, predict, provide evidence, defend, integrate, critique. Key processes are that students organize, compare and integrate new information with prior knowledge, and make inference to fill in missing information, and so forth.

- Take students' prior knowledge of the topic into account. Try to find the right level of challenge.
  - Explaining may not be a productive experience for students who are very unfamiliar with a topic. They may have no basis for explaining anything about the topic.
  - Questions that are too difficult may produce frustration and a sense of futility.

- Low stakes. Emphasize that the goals is to develop better understanding of the material. To support that view, students' performance should be ungraded or very low stakes, e.g., receive participation credit for good faith effort.

- Include some in-class tasks and questions on subsequent exams. This signals that being able to explain the material is a key measure of learning in the course. Moreover, it demonstrates that the in-class explanations are *practice* for the test.

- Give feedback. As indicated earlier, "The most powerful application of self-explanation may arise after learners have made an initial explanation and then are prompted to revise it when new information highlights gaps or errors" (Bisra, Liu, Nesbit, Salimi, & Winne, 2018, p. 720).

Feedback is vital, but it does not always need to be individual feedback. Instructors can give group feedback in class, e.g., collect a few examples of students' explanations-in-progress and discuss them, highlight strengths and shortcomings, ask the class to elaborate on them, or compare them to their own explanations.

- Use student performance as feedback to plan subsequent instruction. Students' explanations provide a glimpse into their developing understanding of the subject matter, what they understand, don't yet understand, misconceptions, and gaps. You can use this feedback to plan subsequent instruction.

- Avoid overusing the technique. Overuse can make class excessively repetitive and tedious. Have you ever heard students say, "If I have to answer one more [expletive deleted] clicker question, I'll drop this class."

References

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