

Metacognitive Teaching and Learning Activities

(Techniques for helping students gain a sense of self-efficacy and agency)

The following activities provide opportunities for students to engage with how they are learning in and out of the classroom. These techniques can provide instructors with ways of encouraging students to perceive and reflect on the process of learning in a course, and give students tools to better chart the course of their learning and development as student-scholars. Many of these techniques take 5 minutes or less to complete.

The techniques outlined in this packet are organized according to when these techniques are generally effective to offer in a course: at the term's start, during the middle of the term, and at the end of the term. There are many ways to vary each of these activities, so use this guide as a jumping-off point for your own ideas!

Pre-Class Knowledge Survey

Students complete a survey before the beginning of a course or unit to self-assess their familiarity, interest, knowledge, or experience with the course topics.

Steps:

1. At the start of a term, provide students with a short survey that gauges students' familiarity or knowledge of upcoming course material. Use a Likert scale (1= not familiar, 5= Oh yeah, I know all about that!) or "exam style" questions that test knowledge of key terminology, concepts, or applications of course knowledge.
2. Students can work individually, in pairs, or small groups, or as a class (or combination of these).
3. After analyzing the results, you may want to share your analysis with the class (e.g. "I see many of you are already familiar/interested in topics x and y, but most haven't had prior experience with z. In this course we'll see how z relates to x and y.")
4. At the end of the term or unit, you may provide students with another short survey that gauges familiarity, knowledge, or asks students to identify new areas for future study. Ask students to use the survey to reflect on what they have learned over the course of the term.

Value: Allows students to connect what they already know or want to know with what they will learn. For instructors, the survey responses provide useful data for shaping the content of future classes to be tailored to student needs.

Variation: Instructors can use knowledge surveys at the start of new course units.

Personal Goals Statement

Students craft a series of goals for engaging with the course to achieve personal, academic, or professional goals.

Steps:

1. At the beginning of a term, assign a short essay (~750 words) prompting students to identify their goals for the course and explain how the student will achieve the goals.
2. Use essay prompts that require students to be specific and detailed in explaining both the goals and the steps they will take in order to achieve these goals.

Value: Students who plan for success are able to more immediately see the personal relevancy of the course to their own interests and goals.

Variations: There are many variations to this assignment. These include having students write a letter to themselves titled, "how I earned an 'A' in this course," or an essay that contextualizes the goals of the course within the student's larger goals in life.

Metacognitive Activities Inventory (MCAI)

Students self-assess how many metacognitive behaviors they regularly display.

Steps:

1. Develop a list of metacognitive activities that are useful in learning or problem solving within your particular disciplinary context as well as a list of negative, or un-useful, activities that connote a lack of metacognitive behaviors. Melanie M. Cooper and Santiago Sandi-Urena have developed one such list for chemistry students (see references below).
2. Survey students by having them respond to each useful item using a Likert scale (1=never, seldom, 5=always, most of the time). Code the useful activities positively and the negative activities negatively (-1=never, seldom, -5= always, most of the time).
3. Explain to students that higher aggregate scores suggest a student is regularly using metacognition, and research shows metacognition is crucial for efficient, deep learning.
4. To wrap-up the activity, ask students to write a short statement indicating how they will maintain or change their behavior based on the survey data they generated.

Value: Structures reflection of the metacognitive abilities and practices of students.

Personal Manifesto for Learning

Students write an essay expressing how they learn best and set principled goals for that learning.

Steps:

1. Introduce the assignment by explaining to students that actions are guided, often implicitly, by sets of strongly held values and principles.
2. Share examples of manifestos as kinds of documents that explicitly outline what values and principles people should uphold or pursue.
3. Assign students the task of writing a “personal manifesto” about how one ought to learn in college broadly or the particular course, more narrowly.
4. Have students share their manifestos with the class in small groups or through a stirring recitation of bombastic public oratory (as all manifestos should be read!).

Value: Students set goals and establish ownership of their personal “methods” of learning through the writing and sharing of the assignment. The manifesto is a fun genre for students to write in, and offers instructors opportunities to share their “manifesto” for teaching... better known to the profession as a teaching philosophy statement.

Critical Incidence Questionnaire (CIQ)

Students regularly answer the same metacognitive question(s) to develop a reflective approach to their learning in the course.

Steps:

1. Create a form that asks students one or more metacognitive questions, such as: “at what moment in class or doing homework this week where you most engaged as a learner?”
2. Assign the CIQ to students with the same question(s) at intervals (weekly, biweekly, etc.) of your choosing throughout the term. Explain to students that while the questions will remain similar, their answers will likely change.
3. Share anonymized results (partial or total) with the class following each CIQ. Use the data to encourage changes in class structure, student/instructor behavior, etc.

Value: The CIQ encourages students to become reflectively aware of themselves as learners and participants in a course. The results will help the instructor self-reflect on how the course is progressing and how one might intervene to improve student learning.

Note: It is important to frame the importance of this practice to students, as the repetitive nature of the activity may appear extra “busy work” to students who do not see the importance of thoughtful answers for both helping them become better learners and helping the instructor orchestrate a better course.

Learning Logs

Students journal throughout the term based on instructor or student-generated prompts to record and reflect on the ways they learn throughout the term.

Steps:

1. Design a journaling assignment that asks students learning-related questions. There are limitless questions you can organize to structure student reflection throughout the term. Some examples include:
 - a. Identify a goal you have for this term. What specific activities will you do to pursue this goal? How will you know when you’ve met your goal?
 - b. What surprised you from the exam this week? Did you find it difficult, or easy? How did you prepare for the exam? How will you change your study strategies for the next exam?
 - c. Of all the out-of-class readings we’ve engaged with over the last week, which was your favorite, and why?
 - d. Go back and reread your learning log entry number X, and respond to what you wrote, now that we’ve finished learning about topic Y. If you could write back to your former self, what would you tell yourself about what you thought in that entry?
2. Provide students with journaling logistics (the medium of the journal, due dates, purpose, expectations, etc).
3. Regularly require that students reflect on their learning by responding to the prompts of the journal. Collect journals after every entry, or alternatively collect and comment on the entries less frequently (but at least twice a term). Grading can be as simple as a “Pass” or “No Pass” based on completion of the assignment.

Value: Learning Logs help students cultivate a practice of reflecting on their learning. Reading the journals regularly may help instructors steer classroom conversations, lectures, or assignments in response to student feedback. Commenting on students personal reflections can also help build instructor-student rapport.

Propose and Justify Test Questions

Students propose, and explain, potentially valuable exam questions.

Steps:

1. A week before a midterm or final exam (or more frequently throughout the term), ask students to bring in a proposed exam question that might appear on the exam.
2. Create a form for students to submit the question(s) and respond to prompted questions in order to justify why the question would be a fair, authentic assessment of their learning in the class. Prompts might include:
 - a. What kind of thinking does this question test?
 - b. Why is the answer to this question important to the major learning goals of this course?
 - c. Why did you create this question, in particular? Why focus on *this* topic, concept, or information?
 - d. What kind of studying would be required in order for a student to score well on this essay?
 - e. From where in the course (lecture, discussion section, homework, readings) did this question come from?
3. Share some (but not all!) of the best questions with the class to use in reviewing for the exam. Include some of the excellent questions on the actual exam.

Value: Anticipating what would make for a “good” exam question helps students structure their study time and efforts. Student questions can also help instructors write an exam or see where students have misconceptions about course concepts.

Post-Exam Wrapper

Students reflect on their approach, emotions, and performance after an exam to identify new study strategies.

Steps:

1. Include several metacognitive questions about how a student prepared for the exam at the end of an exam.
2. Students answer these questions after finishing the formal exam. Questions might include: “How did you prepare for this exam?” and “What grade do you expect to earn on this test?” or “What type of question was most difficult in this test, and why?”
3. The last question should prompt students to make a plan for preparing for the next exam. This need not be an elaborate plan, but a means for setting a specific goal moving forward.

Value: Helps students reflect in the moment on how a test went, and how they might make future tests go better (grade-wise, emotionally, etc.).

Post-Exam Autopsy

Students correct test errors, diagnose why they lost points, and plan to correct mistakes in the future.

Steps:

1. Provide students with a form along with their graded midterm exams. Either require, or encourage (perhaps through some level of redemptive credit), the students to use the form to perform a “exam autopsy.”
2. In the autopsy, students perform a post-mortem analysis of their errors in the graded test.
3. In the autopsy, use a form to prompt students to identify the specific errors or insufficiencies that made them lose points. To do this, students should be prompted to answer “why did I get this wrong? Did I run out of time, or apply the wrong concept, or just carelessly misread the question, etc.?” Using a matrix format can help students list and organize each mistake.
4. As a final prompt on the form, require students to move beyond diagnosis and offer a prognosis for the next exam. How will students use this autopsy to avoid making similar errors in the future?

Value: Requires students to re-study the test that they did not “ace,” increasing the amount of time students spend considering particular course material and their approaches to learning it.

Midterm Student Feedback Survey

Allow students to reflect on the good, the bad, and the ugly of the course and, as a class, make useful adjustments.

Steps:

1. In weeks 4-6 of the term, administer an anonymous online or in-class survey of how the course is progressing.
2. For smaller classes, open ended questions will illicit the most interesting and useable data. Ask students to identify and explain what about the class is going well for them, what about their own engagement with the class is going well, as well as what about the class could be improved, and what about their own engagement with the class could be improved.
3. Create a handout or slide indicating complete or representative responses to the survey and share this document with the class. Either invite students to assess the survey results through class discussion or share your own interpretation of the results with the students. Use this discussion to clarify misconceptions and identify useful changes to how the course will progress.

Value: In addition to encouraging student self-reflection, the feedback can help the instructor and students collaboratively shape and reshape a course.

Note: The kinds of questions you ask students are highly variable. Think about what kind of data will be most useful to you as the instructor to gather, and what form of reporting is most useful.

Gots/Needs Wrapper

Students “wrap up” class session by crystallizing the main information or skills they “got” and identify additional concepts, skills, or classroom support they “need.”

Steps:

1. At the end of a lecture segment or the end of the lecture class, have students spend two or three minutes writing a summary of the main points.
2. Ask at least one student to share what he/she wrote.
3. Collect the papers for review (but not for a grade).
4. You can also use the minute paper to have students to write down questions they have about the lecture, 3 key points of the day, indicate points they don’t understand, or share feedback about your delivery, use of slides, etc.

Value: provides immediate feedback about student understanding, helps instructors prioritize items for review or discussion, and allows students to put material into their own words.

Variations: Instead of framing the feedback as “gots” and “needs,” you could tailor the feedback to be more about the class experience with “plus/ Deltas” (pluses being positive aspects of the class, Deltas being things to change for the better). Another variation could be a “learned/want to learn” wrapper.

“Think-Aloud” Modeling

Instructor conspicuously models the disciplinary and cognitive processes of thinking for students.

Steps:

1. In lecture or class discussion, instructor narrates one’s thinking about a topic.
 - a. e.g. “When I’m asked, ‘what does this stanza of this poem mean,’ as an literary scholar I immediately start looking for patterns in the text’s diction and syntax. I notice in *this* passage that most of the lines are very short, which gives this stanza a kind of staccato sound when I read it aloud—which is always a go-to trick of mine to capture the feel of any written passage. And the ‘feel’ of a word can be as weighty, when analyzing poetry, as its literal meaning.”
2. Later, when eliciting student engagement, ask individuals or groups to “think aloud” as they approach a similar problem, concept, or case study.

Value: Research shows that good students (unconsciously or consciously) model the kinds of arguments and intellectual “moves” their faculty use in classes. Making the academic moves that matter transparent and conspicuous to all students may help these students model their own critical practice.

“Think-Aloud” Collaborative Inquiry

Students are paired and given problems to solve collaboratively as “problem-solvers” and “listeners.”

Steps:

1. Present a particular problem, ideally an appropriate discipline-related problem that can be solved in a relatively short time frame (or, for a more complex problem, the method of inquiry via which you would go about solving the problem can be presented).
2. Next, literally talk aloud in front of students how you would go about engaging the problem using the same format as the “Think-Aloud” modeling (above).

3. Next, have student form pairs and assume the roles of “problem-solver” and “listener.” Then present a problem for them to solve. The “problem-solver” is to read the problem aloud and talk through the reasoning process in attempting to solve it. The role of the listener is to encourage the problem-solver to think aloud, describing the steps to solve the problem. The listener can also ask clarifying questions or offer suggestions but should not actually solve the problem. (e.g. “Wait, how did you come to that conclusion?” “What information are you assuming when crafting your answer?” not “are you sure pi is 3.14?”)
4. Present yet another problem and have students switch roles.
5. After an allotted amount of time, have student pairs share their experience. Did they actually solve the problems? What obstacles or breakthroughs did they encounter? How did it feel to talk aloud or listen to “thinking in action”?

Value: promotes critical thinking and inquiry, attentiveness, and collaborative learning

Collaborative Rubrics

Students and instructors work together to draft rubrics for major assignments.

Steps:

1. Instruct students to craft a rubric for an upcoming assignment (such as a research paper, essay, or portfolio).
2. Students can work individually, in pairs or small groups, or as a class (or combination of these).
3. Have students share their rubric criteria with the class. As a group, evaluate which criteria seem fair and authentic to evaluate the assignment. As the instructor, clarify and augment student ideas by “thinking aloud” to show students how you approach evaluating their work.
4. As the instructor, synthesize a rubric from this activity to give to students during the next class or online.
5. Have students reflect, after turning in the assignment or receiving the graded assignment, if the act of considering the rubric enhanced their work on the project.

Value: Makes students carefully consider what constitutes “success” in a given assignment and makes them plan ahead to achieving success. If an instructor synthesizes and uses a rubric based on student input, the activity may also build a stronger sense of student agency within the classroom environment.

Note: As the instructor you will still need to come up with the authoritative rubric for the assignment, or at least elements you are prepared to include into whatever rubric the students generate. While writing their own rubrics is a valuable exercise, you don’t want to necessarily cede complete control of the assignment’s standards to the students without ensuring the rubric is indeed rigorous, fair, and clear.

Snap Reflection

Students quickly capture what they’ve learned in their own words.

Steps:

1. Have students take a few minutes to think and write down their thoughts about the lecture material just presented or a particular question or problem that has been posed
2. Collect student papers, if you wish, and review their responses to assess their understanding and identify areas that need clarification at the beginning of the next lecture (you can also assign participation points for responses or allow students to submit them anonymously)

Value: allows students to think through material and put it in their own words

Statement of Interest, Importance, and Audience

Short assignment asks students to explain a project or paper’s personal and social relevance before undertaking the assignment.

Steps:

1. Before a large project, such as a research paper, is due, require students to submit a short statement explaining why the project is meaningful or interesting to the student. Additionally, have the student

identify the importance of the project to a specific audience (such as a profession, school or thinkers, a specific community, etc.).

2. As a part of the statement, have students explain how they will communicate this project's importance to that specific audience. You may use prompts to guide students to consider what kinds of communication, tone, or information will help communicate effectively with that audience. For example, "what kinds of arguments and information would this audience deem valuable?"

Value: Helps students contextualize cognitive labor for a particular assignments within larger personal, social, or professional settings.

Variation: Have students include this statement along with the finished project and ask students to explain how the content of the project takes into consideration the student's and audience's interests and concerns.

End of Term Reflective Narrative

Students reflect on how they engaged and learned in the course.

Steps:

1. Towards the end of the term, students write a 750 word essay narrating how they engaged with the course. The essay should note what was asked of the student and how the student personally responded within the context of the course.
2. To conclude the essay, students should reflect on how they would change their engagement if they were to retake the course, or reflect on how this reflection might help them engage in other future courses or occupations.

Value: Helps students feel closure at the end of the course while orienting their knowledge and habits towards new endeavors.

Variations: There are many variants to this assignments. Students might be asked to reflect on a specific project or group work instead of their engagement, for instance. Students might write a letter to the next cohort of students about how to best learn and succeed in the course. Students might write a diagnostic essay examining what the most important thing they learned in the course was and why this was the most important thing to them.

The activities featured above and those featured in "Interactive Teaching Techniques" are compiled from the following sources:

Angelo, Thomas A., and K. Patricia Cross. 1993. *Classroom Assessment Techniques: A Handbook for College Teachers*. 2nd Edition. San Francisco: Jossey Bass.

Barkley, Elizabeth F. 2010. *Student Engagement Techniques: A Handbook for College Faculty*. San Francisco: Jossey-Bass.

Cooper, M., & Sandi-Urena, S. (2009). Design and Validation of an Instrument To Assess Metacognitive Skillfulness in Chemistry Problem Solving. *Journal Of Chemical Education*, 86(2), 240-245.

Davis, Barbara G. 1993. *Tools for Teaching*. 1st Edition. San Francisco: Jossey Bass. [see Chapter 16, "Supplements and Alternatives to Lecturing: Encouraging Student Participation," pp. 131-139]

Handlesman, J., S. Miller, and C. Pfund. 2007. Chapter 2, Active Learning in *Scientific Teaching*. New York: W.H. Freeman and Co.

Lin, Xiadong. (2001). "Designing Metacognitive Activities." *Educational Technology Research and Development*. 49(2), 23-39.

McClanahan, E.B., and L.L. McClanahan. 2002. *Active Learning in a Non-majors Biology Class: Lessons Learned*. *College Teaching* 50(3): 92-96.

Nilson, Linda B. 2010. *Teaching At Its Best: A Research-Based Resource for College Instructors*. 3rd Edition. San Francisco: Jossey-Bass

Weimer, M. (2013). *Learner-Centered Teaching Five Key Changes to Practice* (2nd ed.). New York: Wiley.

Tanner, Kimberly. 2012. Promoting Student Metacognition. *CBE Life Science Education*. 11(2): 113-120.

Additional examples and resources can be found at:

50 CATs by Angelo and Cross – Compiled by Cunningham and Moore

http://tep.uoregon.edu/resources/newteach/fifty_cats.pdf

Classroom Assessment Techniques (CATs) – UO Teaching Effectiveness Program

<http://tep.uoregon.edu/resources/assessment/cats.html>

Classroom Assessment Techniques (CATs) – Center for Teaching, Vanderbilt University

<http://cft.vanderbilt.edu/guides-sub-pages/cats/>

Teaching Excellence in Adult Learning “Metacognitive Factsheet”

<https://teal.ed.gov/tealguide/metacognitive>

“On the Cutting Edge: Strong Undergraduate Geoscience Teaching:” Metacognitive Activities pages

<http://serc.carleton.edu/NAGTWorkshops/metacognition/index.html>