conversations and reserve announcements about class being canceled for tweets or text messages, you can create the expectation that e-mail is a content delivery system.

Show Your Passion

Communication is highly motivating and has a direct impact on students' learning. Students want to know that you love your subject and that you care about their learning. Use your e-mail style to demonstrate that this subject matters to you.

Digress and Make Connections

We all do it: We suddenly think of another interesting tangent or example, and soon students are wondering how far off topic our lecture will go. If you can catch yourself, you can make connections via e-mail between today's topic and current events and have more time in class to stay focused on the topic at hand.

Introduce Readings

E-mail is a great way to prepare students for a reading, acquaint them with a video, or introduce their first exposure to a new subject. Some of the most common complaints from students are that there is too much reading for the course, the reading is boring, or there are too many readings that say the same things. While all of these things might be true, and students often do not like to read, the problem may be that students have not been properly introduced to the reading.

In the traditional model, students are assigned readings before a class. We assume, incorrectly, that students will figure out why the readings are important and how they contribute to class lectures or discussion. Readings are an important way for students to get detailed information and to hear extended arguments, but they are often the worst starting place. Faculty know why they have assigned the reading and what they hope it will say to students,

but most students lack the interest and the ability to read the disciplinary and professional clues needed to guide them through the reading. (Students who are really good at interpreting reading tend to become faculty later in life.) It is much better first to get students interested in a question that matters to them and then to introduce them to a reading that might provide the answer.

Implementation: Sample Reading Introduction

This is an example of an e-mail that I send to students a week before this reading is due. Motivation to read a difficult text is one of my goals, so I tell them some of what Rousseau is trying to say in advance and then ask questions that can open our discussion. I also try to supply some of the author's agenda and demonstrate relevance to contemporary issues as well as those we've been discussing in class. Clarity is another goal: what are we reading and why?

Hi all,

Here is an introduction to our reading for Wednesday. We will be reading Jean-Jacques Rousseau's "Letter to M.D. Alembert on the Theatre" from 1758. You do not need to read the intro or appendix, but I'd like you to read the entire letter (pp. 3–137) before you come to class on Wednesday.

I should note that, because I am sending you this e-mail, I will NOT provide an introduction to the text in class. These are the issues I hope we can discuss together, so come to class with some answers to the questions I've raised below and some views about the big questions Rousseau asks. Deal?

Rousseau's letter is a response to the article D'Alembert wrote about the city of Geneva for the seventh volume of the *Encyclopedie*. For D'Alembert, all Geneva needed to become a great city (like Paris) was a Théâtre Comique. For Rousseau, Geneva is the modern ideal of the great polis, Sparta. Why? What does this tell you about Rousseau?

Rousseau's letter is a public attack on the fundamental assumption of the Enlightenment: that reason was, or should be, the core essence of humanity and human dialogue. For Rousseau, the *Encyclopedia*, his response, and indeed any discourse is also governed by rhetoric, passion, and persuasion. Rousseau is particularly disdainful of philosophers or scientists trying to pretend they are above politics or emotions. The implications are that society can never be fully rational: trying to make society entirely rational only perverts and corrupts. So this is a text about the importance of persuasion. Do you agree with Rousseau? How important is emotion in any discourse? Note the similarity to today's prevailing notion that logic is all it takes. (With a presidential campaign in full swing, think about the importance of symbols and passion in politics. Does the music or drama of a convention matter? How would Rousseau advise the candidates?) Note, too, that Rousseau takes his own advice, and his letter is deliberately rhetorical and public and not just logical.

Some other key issues:

VIRTUE. This is a key concept for Rousseau. Do you care about virtue? In the end virtue versus art is an impossible choice; is it better to be miserable and art-loving or happy and ignorant? That virtue is boring in the essay adds to the difficulty.

WOMEN. It is hard to argue that Rousseau isn't a misogynist or at least a chauvinist, but the feminists are having another look. Sadly, his position on women is an important part of his critique of the theater that we can't avoid. The basic argument is that when female modesty declines (according to Rousseau) men stop loving women as women and distrust builds (why is she dressing up so much?). Odd, yes, but his fundamental question is interesting. Is there something about modern society that makes women want to be less modest and what are the consequences? Will the men in class be wearing "guyliner" and "manscara" next week?

EDUCATION: This is also an attack on the value of education! Rousseau argues that science, as well as art, show people how

stupid and unsophisticated they are. He asks if education will make you happier. Is that a reasonable question? What is his answer?

HABITS: Rousseau believes that habits are really what govern human society and that we won't change habits with reason. Habits come from (and can be changed) only through law, pleasure, and public opinion. Which do you think will work best? Do your own habits help or hinder you?

In the end, this is a difficult and thorny text, but that is the point. In many aspects of life (including the arts, business, higher education, politics) we often recognize the most important thinkers as those who ask the really big questions, even if they get it totally wrong in the end. (This is how I will grade your papers: I would rather you wrestle with a big issue and fail than be unambitious!)

Rousseau did not resolve all of the problems he saw, but he was a critical thinker and saw new problems and issues. Many of the issues he identified are even bigger issues now. Many critics have noted that there is even more access to art and entertainment today and that this might be bad. (Someone needs to defend *Real Housewives* please.)

In short, Rousseau should make you question a wide range of art, media, politics, and even religious experiences. But you don't have to agree with Rousseau. I should note that he calls into question all of the basic assumptions I routinely like to make about school and the importance of art in society! This is a humbling work, and I hope you enjoy it.

See you in class.

Technology for First Exposure

Great lectures can be an important motivational tool, but they are poor at delivering content, creating high-level questions, encouraging deep learning, and getting students to reexamine

student beliefs and preconceptions remains one of our most difficult and unsuccessful tasks. While the classroom seems an ideal place for challenging and exploring new ideas, furiously transcribing oral content is clearly not the ideal learning activity for teaching critical thinking. Active learning has been demonstrated to improve retention of content, but it can also stimulate critical thinking, as in the previous Implementation box.

For faculty with years of ready-to-deliver lectures, shifting to active learning is monumental. Start small: making minor modifications to create interactive lectures or breaking up lectures with demonstrations, buzz groups, mini-writing assignments, or other engagement techniques is relatively low risk and still pays dividends.

For new faculty, the conceptual leap to untried teaching styles is equally great as for seasoned faculty, and the fear of starting a new teaching career with new teaching techniques is even more daunting. Younger faculty need support in the form of mentorship and encouragement from colleagues to support their risk-taking in the classroom. New faculty should know that designing new courses that use class time for learning activities might take less time than preparing 45 PowerPoint presentations a semester.

Structuring Good Discussion

Discussion is an outstanding way to make the most of face time with students and to promote higher-order learning, but leading a good discussion that results in the learning outcomes you want can be much harder than delivering a competent lecture. A small group of prepared, talkative, and comfortable students and an engaging topic can make preparation easier, but striking a balance between guiding the discussion and letting students discover their own connections is difficult. Knowing when and how to intervene and cultivating patience and the ability to tolerate classroom silence takes practice, but there are some ways to foster productive student discussion.

Christensen (in Christensen, Garvin, & Sweet, 1992, pp. 153–172) frame the roles of discussion learning into questioning, listening, and response. Start by preparing a few good questions in advance (but not organized sequentially, as discussions are never linear). Different types of questions lead to different types of discussions, and one of the first tasks of the professor is to assess student needs and interests and connect them with the instructor's goals.

There is a crucial difference between the quantity and quality of classroom discussion. You can generate quantity by asking students what they think about the food in the cafeteria, but a high-quality discussion that fulfills your learning outcomes also requires student preparation. Many of the techniques in Chapters Five through Seven on how to prepare students for class can also be used to stimulate class discussion.

Faculty commonly assign reading as preparation for discussion. It is essential, however, to make sure that whatever preparation you require is directly relevant for the discussion. Do not assign a reading as background that won't somehow be discussed in class. Students will rarely make the connection on their own between the reading and the discussion. And once students discover that they can participate in class without reading the background, they will do so. A typical faculty mistake is to forget to refer directly to each specific reading in the class after the reading is due. Take five minutes (or find some other assessment) to make sure that students can articulate the basics of each reading: what it said, what it means, why it is important (see Chapter Six). If you can't afford the time to do this, then the reading is probably not essential.

Since writing is a skill that we want to cultivate and grading writing is time-consuming, using writing as a springboard for class discussion solves two problems at once. In a large class, you might start by asking pairs to discuss ideas written on index cards or in short papers. For a smaller class, Walvoord and Anderson (1998) includes a set of guidelines for group responses to draft writing. While their focus is on using this process to improve writing

without more grading, it also provides a framework for class discussion (see Walvoord & Anderson, 1998, p. 114).

Running a good discussion is an art and takes flexibility, practice, and preparation. Christensen (in Christensen, Garvin, & Sweet, p. 159) recommends preparing with a very short typology of questions, including diagnostic, hypothetical, implication, and action. During the discussion, Christensen describes what amounts to a dance of alternating listening and responding, with ongoing choices between attending to content and to process. Students also need guidance in how to conduct themselves during a discussion.

Implementation: Teaching Discussion Behaviors

Faculty need to be transparent about what discussion behaviors will be rewarded and how.

Ask students to focus on making two types of comments (from Harnish, 2008):

1. Comments introducing substantive points that are "clearly a result of thoughtful reading and thinking about the assigned text and become . . . the focus for group exploration lasting several minutes." Examples include:

   a. Identify essential issues or questions the text is discussing.

   b. Point to the author's main hypotheses, claims, and supporting arguments and evidence.

   c. Point to important passages that need to be understood.

   d. Explain the complexities faced in exploring this text.

   e. Describe passages that are personally meaningful or connected to some shared experience.

2. Comments that deepen the discussion, such as:

   a. Provide additional supportive quotes; explain relevance; ask clarifying questions.

   b. Share the thought process that was personally used in developing an idea.

   c. Paraphrase what the author means in a specific passage.

   d. Summarize the arguments being presented.

   e. Identify similarities and differences in positions being argued.

   f. Challenge an idea or present an alternative interpretation.

   g. Connect ideas from several participants or from other texts the group has read.

   h. Formulate insightful questions that spark group response.

   i. Introduce personal experiences that illuminate the text for others.

Faculty should help prepare students for group discussion by providing in advance (1) guidelines for good behavior (like those previously outlined), (2) learning outcomes for the discussion (that might include learning how to make quality contributions to discussion), and (3) an entry point for the reading (see Chapter Six). Faculty should also clarify that discussion is a group exploration and that, like faculty, students should weigh the individual importance of what they want to say against how it will help the group progress.

Such behaviors can be reinforced if students understand the grading system for class discussion. Students are conditioned to think that talking more in class is a good thing. Grading participation will encourage students to talk, but if you just want to encourage talking you can probably get the same results by handing out pieces of chocolate for every comment. (I use about two bags of chocolate kisses every semester.) Creating a system that rewards quality over quantity will improve the substance and depth of your discussions. For example, after each class send out an e-mail (or post on the class discussion board) the best

examples of good seminar behaviors. Alternatively, post what contributions were most useful in discovering new insights or including new members. Such contributions could be an extra credit or required part of the grading scheme: for example, each student must make two substantive contributions to class discussion during every week.

The way you conduct the discussion also matters. You can model good discussion behavior for students by providing compliments, defusing tense moments, and creating the right environment. Do what you can to create the best physical environment. Rearrange the rows of chairs into a big circle. Call on students by name. If you can tell a student is having trouble getting a word in, then hold off the others and call on that student. You might start by allowing students to introduce themselves by completing the statement, "Hi, I'm Joe, and in discussion sessions I usually . . ." Explain and model good active listening with eye contact, smiles, nods, and supportive body language.

It is also the responsibility of faculty to manage the discussion in real time by keeping the group focused on the topic or text. If there is a lull, you can summarize the discussion so far and either (1) ask for a clarification or deepening insight on the current topic (perhaps from a new voice) or (2) introduce or ask for a transition to a new topic. Providing potential questions in advance will also help guide the discussion.

Another method is to have students monitor the discussion themselves. Ask them to sit in two concentric circles: the inner circle participates in the discussion; the outer circle (where faculty sit) observes and then (after 10 minutes) analyzes the quality of the inner-circle discussion. For example, did the question get resolved? Was participation spread adequately? Did anyone monopolize or make negative attacks? Did the group introduce new questions or insights? Then have the groups switch and pose a new question. If you want, you can put an empty chair in

the inner circle and allow outer-circle students who simply must make a comment to briefly use the empty chair.

As with a good lecture, discussion or seminar classes need to be structured into clearly defined sections to help students understand the purpose of the discussion. You might not want to tell students the exact aims of a discussion, but hoping students will stumble upon the key passage in a text is not a sound pedagogical strategy. Try telling students that you want to talk about a particular topic for 15 minutes and why. Then at the end of the section you can tell them what you hope they discovered through their discussion. Have them reflect (perhaps in writing) on what they understood. In the two-circle technique, for example, you might tell students that the goals are to allow them to have discussion without your assistance and to improve the quality of that discussion by focusing on how groups can work together to answer questions.

You also need to support risk and failure. Try a brainstorming technique where students need to come up with a long list of potential uses for used cars or 10 different interpretations of a story. The point is to create a long list, not to worry about the quality of the list. Getting students used to errors and mistakes as a part of the process and getting them comfortable with each other's failures will create the sort of relaxed environment where risk can occur.

Faculty can also support risk (and civility) by asking students to relate new comments to old ones. Ask students to start with a summary and a compliment ("What I like about your idea is . . .") before they disagree or digress. It is also useful to ask students to paraphrase and then ask for clarity about a point. Help students understand the different types of disagreement: is there a difference of facts, interpretations, belief systems, cultural assumptions, or type of discourse? Ask a third student to summarize a disagreement and a fourth student to articulate the nature of the disagreement. Understanding the rules of academic discourse is difficult, and I make this a topic in and of itself.

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E N G A G E M E N T
T E C H N I Q U E

4

Quotes

Essential Characteristics

PRIMARY MODE	Collaborative
ACTIVITY FOCUS	Discussing
DURATION OF ACTIVITY	Single Session
ONLINE TRANSFERABILITY	Moderate

DESCRIPTION AND PURPOSE

Students select a slip of paper from a container filled with quotes from an assigned reading. They are given a few minutes to think about what they want to say in response to their quote, and then each student reads their quote and comments on it.

"Quotes" is an effective strategy for ensuring equitable participation because it provides all students a platform by which to join the discussion. It also underscores the instructor's commitment to the value of the assigned reading, addressing complaints that follow-up, in-class conversations do not draw explicitly enough on the text that students have been asked to spend time reading.

STEP-BY-STEP DIRECTIONS

1. Select 5–6 different sentences or passages from a text.
2. Type and copy these to create multiple slips of paper each containing one quote, and put them into a container.
3. Each student draws one slip of paper.
4. Students take a few minutes to think about what they want to say in response to their quote.
5. In an order controlled by students, the discussion continues with each student reading a quote and commenting on it, offering new insights or building upon or contradicting comments that have already been made.

Introduction to Shakespeare

Professor Rose N. Crantz uses a variation of "Quotes" as a means to stimulate whole-class discussion and detailed analysis of the dramatic works of Shakespeare. She selects a variety of quotes from one of the assigned plays. Students use the quote they've drawn as the basis for their contribution to the discussion. The first student to talk about a specific quote must provide, at a minimum, basic information about the quote (who said it and the dramatic context). Other students build upon these comments, adding insights regarding the quote's deeper meaning and relationship to the play's themes. She observes that the SET helps ensure students have done the reading and come to class prepared, that it gets discussion started quickly, and that the structure propels the discussion naturally as students must offer new and deeper insights as they build upon each other's contributions.

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Principles of Advertising

In this course, the teacher selects slogans from a wide range of advertising campaigns spanning several decades and prints them on index cards. He then organizes students into groups, asks each group to draw 2–3 cards from the stack, and participate in a group discussion on the selected quote. To help focus the discussion, he provides students with a handout that includes a series of prompts asking students to determine the intended audience; to identify the idea, product, or service the slogan was designed to promote; and to analyze why, in their assessment, the slogan was or was not persuasive. He follows up with a whole-class discussion in which students identify the characteristics of effective advertising slogans, using the quotes their group analyzed to illustrate their points.

ONLINE IMPLEMENTATION   Although this technique is very effective when students are able to interact in the moment as they respond to their quote and to the comments of others, you can modify it for an online course by selecting 4–5 quotes and creating a forum for each quote, asking students to select a forum (or assigning them to a forum) to which they post comments on the quote.

VARIATIONS AND EXTENSIONS   • Ask students to find their own relevant quotes from a preparatory text. Quotes in the pre-reading can be statements that they especially liked or disliked, that best illustrated the major thesis, that they found most difficult to understand, and so forth. Students say where their quote is in the text (for example, "page 3, paragraph 5") and then read the

quote while all class members follow along (Brookfield & Preskill, 2005, pp. 72–73).

- Instead of drawing quotes from an assigned reading, select a set of interesting quotes to use as a discussion stimulus.

- Organize students into groups, give groups a container with the quotes, and have students draw and comment on their quote in round-robin fashion.

OBSERVATIONS AND ADVICE   Give students sufficient time to think about their quote and formulate their ideas before starting the class discussion. The time required will depend on the nature, scope, and complexity of the quotes and the reading assignment from which they were taken.

KEY RESOURCE   Brookfield, S. D., & Preskill, S. (2005). *Discussion as a way of teaching: Tools and techniques for democratic classrooms.* San Francisco: Jossey-Bass, pp. 72–73.

S T U D E N T
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7

Seminar

Essential Characteristics

PRIMARY MODE	Collaborative
ACTIVITY FOCUS	Multiple
DURATION OF ACTIVITY	Single Session
ONLINE TRANSFERABILITY	Medium

DESCRIPTION AND PURPOSE

"Seminar" helps students prepare for and participate in an in-depth, focused, and meaningful small-group discussion of a text. In preparation for class, students read a document, marking and prioritizing specific passages they want to discuss with the group, and writing a short essay about what they read in response to a prompt. Students bring their marked-up copies and essay to class, and they use these as their ticket to participate in a highly structured small-group discussion.

The steps students must take to prepare for the discussion encourage them to stay focused in their reading and to get more deeply into the source, even if they initially find it overwhelming or off-putting. The structure of the small-group discussion provides even shy and diffident students and non-native speakers with a platform to practice their voice. Additionally, the passages that each student reads are ones that they found to be most personally relevant and therefore require some degree of individual commitment.

STEP-BY-STEP DIRECTIONS

1. Select a text that is conceptually rich (a journal piece, a book chapter, a newspaper editorial) and duplicate it or provide a Portable Document File (PDF) online so that each student has his or her own copy to mark up.
2. Craft a prompt for a writing assignment that connects to the reading and will prepare students for participating in a discussion.

3. Create a handout that provides students with directions for both the reading and discussion. Consider incorporating Exhibit 12.3, "Identifying Good Seminar Behaviors."

4. Outside of class, students read the document, marking and then prioritizing the passages that they found to be most interesting, provocative, puzzling, and so forth and that they want to discuss with the group. They also write a brief essay in response to the instructor-developed prompt. This preparation is their ticket for assignment to a small group (although they do not submit the essay until the SET is finished).

5. The teacher forms prepared students into groups of 4–6. (Either dismiss unprepared students, or allow them to observe in fishbowl fashion, sitting in chairs outside a group, listening to the discussion but not participating.)

6. In round-robin fashion, each student selects one of his or her high-priority passages, identifies it (such as "page 3 paragraph 2") so that other group members can follow along, reads it aloud to the group, and then briefly explains why it was selected. The other group members listen and take notes but do not respond.

7. After every student has contributed, students respond to what they heard from one or two of the other participants.

8. Students enter into a free-flowing discussion, sharing what they learned or found most meaningful, and as much as possible connecting their comments to specific passages in the text.

9. After discussion, students add further comments, reflections, or insights as a postscript to their essays and submit them to the instructor.

EXAMPLES

Intro to American Literature

Professor Sal Inas uses "Seminar" regularly to provide a structure for both discussion and in-depth analysis of reading assignments. For example, as students read John Steinbeck's *East of Eden*, he organizes a "Seminar" around the theme of immigration and American literature, and asks students to mark up the text as well as write a brief essay in response to the prompt "When Sam and his wife Liza immigrate to America, what is it from the 'old country' that they bring with them, and why? How does living in America change them, and their children? What are the challenges and the opportunities America presents to the family?"

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Cultural Anthropology

To help students explore anthropological perspectives on contemporary issues, this professor decided to use "Seminar" to have his students discuss a think piece on the challenges Bhutan, an isolated Himalayan Buddhist kingdom, faces as it opens to the Western world. She asked students to read through the article and mark it carefully, paying special attention to the topics of political organization, language, kinship, religions, and social inequality that they were studying in class. She also asked students to write responses to each of the following questions:

- Identify three examples the author provides on how tradition and change now coalesce in Bhutan.

- Discuss three concerns a cultural anthropologist might have regarding the impact of westernization on traditional Bhutanese culture.

Students used their marked-up articles and their written assignment as the basis for small-group discussions. The teacher believed that the activity helped deepen students' grasp of the concepts, theories, and methods used in the class, and by focusing on the challenges Bhutan was facing right now, that the activity helped give the course contemporary relevance.

ONLINE IMPLEMENTATION This technique is designed for a face-to-face environment. However, the basic steps can be adapted for an online class. For the reading stage of this SET, students can take notes on specific passages and write the essay and then submit these as an assignment. After submission, students can be assigned to a group to participate in an online discussion. To implement the SET without adaptation, students could scan and upload their marked-up documents and talk "in the moment" using synchronous tools such as teleconferencing or chat sessions—but these modifications are cumbersome and probably not worth the effort.

OBSERVATIONS AND ADVICE Most students will need guidance on how to read critically and how to contribute effectively to the discussion. Suggest to students that as they read, they keep in mind the following three questions and underline appropriate passages or make comments in the margins:

1. What does the text say? (Stick to straightforward facts.)

2. What does the text mean? (Look for the concepts or interpretations behind the exact words or inferences between the lines.)

3. Why is this important? (Share your personal analysis, reaction, or evaluation.)

To prepare students for good discussion, consider reviewing with them Exhibit 12.3, "Identifying Good Seminar Behaviors."

EXHIBIT 12.3.

Identifying Good Seminar Behaviors

When assessing seminar behaviors one can ask, How does a person contribute to the seminar? To what degree does he or she engage in the following three kinds of behaviors?

A. **Introduce substantive points:** A substantive point is one that is clearly a result of thoughtful reading and thinking about the assigned text and becomes the focus for group exploration lasting several minutes.

   Identify essential issues or questions the text is discussing.

   Point to the author's main hypotheses, claims, and supporting arguments and evidence.

   Point to important passages that need to be understood.

   Explain the complexities faced in exploring this text.

   Describe passages that are personally meaningful or connected to some shared experience.

B. **Deepen the discussion:** Help the seminar process with individual contributions that lead the group to discover new insights and understanding of assigned readings.

   Provide additional supportive quotes; explain relevance; ask clarifying questions.

   Share the thought process that was personally used in developing an idea.

   Paraphrase what the author means in a specific passage.

   Summarize the arguments being presented.

   Identify similarities and differences in positions being argued.

   Challenge an idea or present an alternative interpretation.

   Connect ideas from several participants or from other texts the group has read.

   Formulate insightful questions that spark group response.

   Introduce personal experiences that illuminate the text for others.

C. **Facilitate group exploration:** Focus on what the group is accomplishing more than on individual students' performance.

   Help to identify the goals and format for the group process.

   Keep the group on task.

   Focus group back to the text.

   Summarize for the group what has been discussed.

   Bring closure to one point and make a transition to a new one.

   Paraphrase someone's comments, identify what you don't understand, and/or formulate a specific question asking for clarification.

   Encourage nonparticipants by being alert to who wants to speak, or who hasn't spoken, and help them get the floor.

Indicate support by responding to a person's ideas, or complimenting them.

Show active listening by means of nonverbal cues like eye contact, nods, and smiles.

Become aware when dominating the discussion and then modify behavior.

Defuse a tense moment with use of humor.

Source: Used by permission of Jim Harnish.

KEY RESOURCE   Harnish, J. (2008). *What is a seminar? Seminar process to encourage participation and listening. Identifying good seminar behaviors.* Handouts distributed at Collaborative Learning Conference II: Working Together, Learning Together, Everett Community College, Everett, WA, February 22–23.

S T U D E N T
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16

Team Concept Maps

Essential Characteristics

PRIMARY MODE	Collaborative
ACTIVITY FOCUS	Diagramming
DURATION OF ACTIVITY	Single Session
ONLINE TRANSFERABILITY	Low

DESCRIPTION AND PURPOSE

This SET is an example of a graphic organizer. Because a picture can be worth a thousand words, graphic organizers are powerful tools for converting complex information into meaningful displays. They can be used for many different purposes, including helping students pull background knowledge forward, assessing how well knowledge is remembered and understood, and fostering creativity as participants generate new ideas.

In "Team Concept Maps," student teams draw a diagram that conveys members' combined ideas or understanding of a complex concept, procedure, or process. This SET engages students by challenging them to synthesize and be creative as they organize their hierarchy of associations into a meaningful graphic. Diagramming words, ideas, tasks, or principles is identified by many different names, including "Word Webs," "Mind Maps," and "Cognitive Maps." The name "Concept Maps" is used here because this term is used in the literature to describe a broad, inclusive approach and this SET will be most effective if teachers are creative in deciding what should be diagrammed and students are encouraged to be creative in choosing what is the most appropriate graphic.

STEP-BY-STEP DIRECTIONS

1. Choose a concept, procedure, or process for students to map that is important to your course and that is rich in associations and connections.

2. Brainstorm for a few minutes, writing down terms and short phrases that represent the most important components of the concept.

3. Choose a graphic image that you believe best captures the relationships of the concept (for example, a spoked wheel, a flowchart, a network tree, or a fishbone) and map the concept yourself so that you can uncover potential problems. Your own diagram can also serve as a model against which to assess group work.

4. Map a parallel concept to demonstrate the process to students.

5. Decide what to use as a shared writing space (for example, flip charts, large pieces of paper, the whiteboard) and bring it and colored markers or crayons to class.

6. Describe and demonstrate the process to students.

7. Form teams, distribute paper and markers, and present the central concept that you want students to graph.

8. Have students sketch out a diagram starting with the central idea or first step in a process and adding words, phrases, or images connected by lines or arrows.

ONLINE IMPLEMENTATION This technique is most effective when students are able to interact in the moment. Consider using a whiteboard tool during a synchronous session. The outcome can be captured as a screenshot to be uploaded onto a forum and shared with other students. If this SET will be an ongoing activity in your course, consider purchasing a software package that assists in the development of concept maps, such as Inspiration (http://www.inspiration.com/) or use presentation or word-processing software that includes drawing tools. Each person adds to the diagram in different color fonts.

EXAMPLES

Statics

Professor Alec Tricity used "Team Concept Maps" to help students synthesize and demonstrate their understanding of the elements and processes of an electric charge. He explained what he wanted students to do, using an overhead projector to demonstrate the concept of an electric field as an example. He formed groups of three and provided each group with newsprint and markers. After about ten minutes, he asked each group to select a reporter who then explained its map to the whole class.

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History of the United States from 1877

In a freshman history course, Professor Rose E. Riveter wanted students to synthesize their understanding of the complex effects of World War II on the United

States. She organized the class into groups of four, and gave each group a large piece of newsprint paper and four different colored markers. Using "WW II's effects on the continental U.S." as the central theme, she asked students to generate ideas and to show the relationship of their ideas in a graphic. For example, students in one group identified women, education, and the economy as core ideas, with each student who had the idea writing it on the paper with his or her marker. The next step was to identify and graph details and supporting elements. Under *Economy*, students mentioned that World War II provided many jobs in defense, boosted American markets, and brought the United States out of the depression. Again using their markers in different colors, students were able to demonstrate relationships (for example, that jobs in defense offered opportunities for women). The groups turned in their "Team Concept Maps" to Professor Riveter for evaluation, and because students used different colored markers, Professor Riveter could assign individual participation grades (adapted from Kagen, 1992; Barkley, Cross, & Major, p. 227).

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Basic Two-Dimensional Design

This course introduces students to basic design concepts and their application. Professor Pat Tern Uses "Team Concept Maps" throughout the class to help students analyze and synthesize ideas and represent them visually. As the term progresses and students become more adept at diagramming, she encourages them to enhance the graphic by choosing various shapes, lines, images, and values and arranging them to create a unified visual statement. Figure 14.1 is a copy of a "Team Concept Map" a group of students created the first day of class in response to her prompt "What is design?" (Barkley, Cross, & Major, 2005, pp. 227–228).

VARIATIONS AND EXTENSIONS

• Use different kinds of graphics to represent different relationships. For example, graphs may resemble a spoked wheel with the central idea at the hub, or a solar system with the stimulus in the sun's position, or a geographical map (Angelo & Cross, 1993, p. 200). There are many models for organizing information.

  • The "Series of Events Chain" in Figure 14.2 is useful for describing the stages of an event.

  • The "Spider Map" in Figure 14.3 demonstrates a more layered approach to charting ideas related to a central concept.

  • Additional ideas include "Network Tree" (Figure 14.4) to organize a hierarchical set of information and "Fishbone Map" (Figure 14.5) for nonredundant cause-effect relationships.
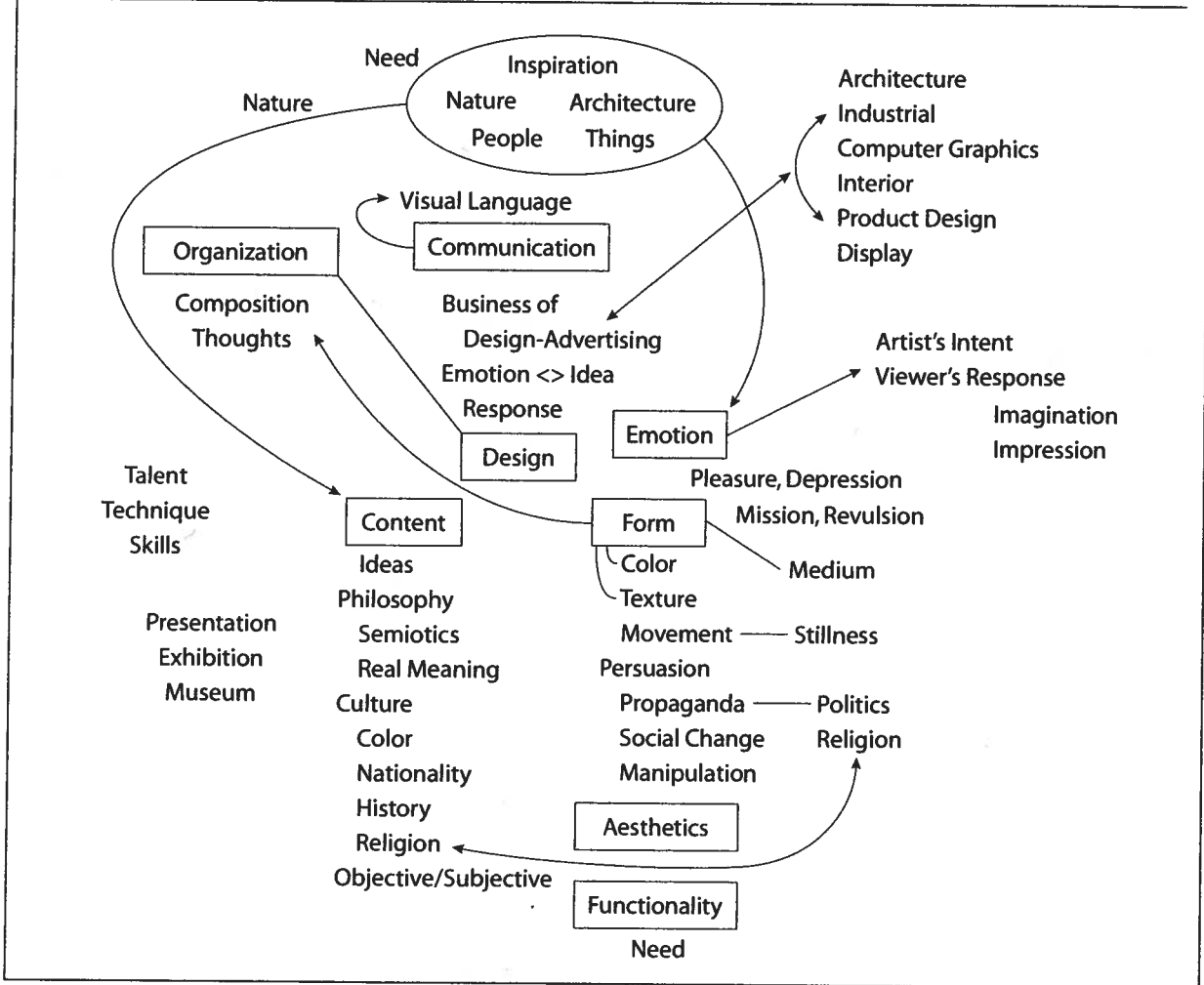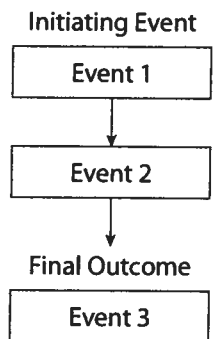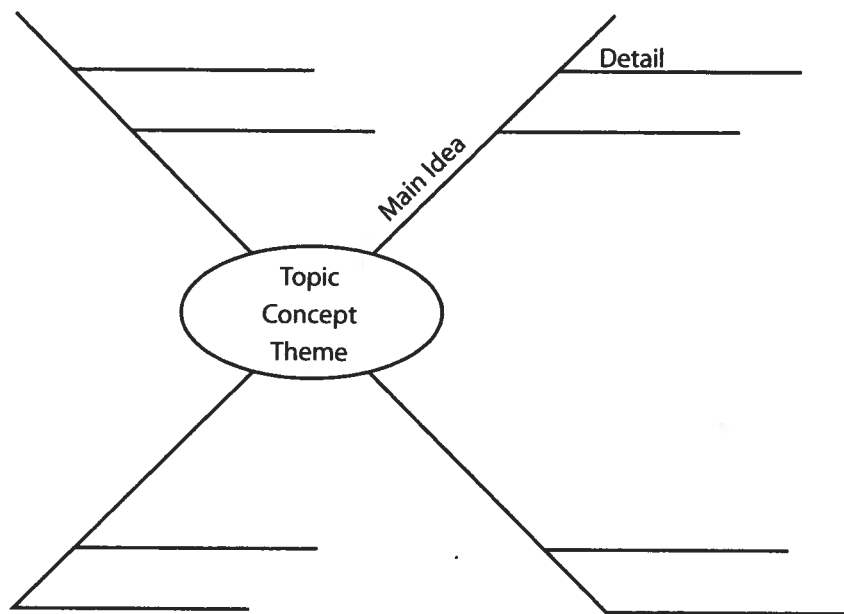
FIGURE 14.1.

Example of a Team Concept Map

Need

Inspiration

Nature

Nature   Architecture

People   Things

Architecture
Industrial
Computer Graphics
Interior
Product Design
Display

Visual Language

Organization   Communication

Composition
Thoughts

Business of
Design-Advertising
Emotion <> Idea
Response

Artist's Intent
Viewer's Response

Imagination
Impression

Design   Emotion

Talent
Technique
Skills

Content   Form

Pleasure, Depression
Mission, Revulsion

Ideas
Philosophy
Semiotics
Real Meaning
Culture
Color
Nationality
History
Religion
Objective/Subjective

Color
Texture
Movement —— Stillness
Persuasion
Propaganda —— Politics
Social Change   Religion
Manipulation

Medium

Presentation
Exhibition
Museum

Aesthetics

Functionality

Need

FIGURE 14.2.

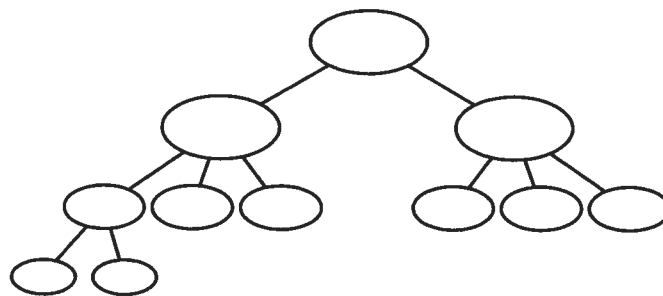## Series of Events Chain

Initiating Event

Event 1

Event 2

Final Outcome

Event 3

Source: North Central Regional Educational Laboratory, Learning Point Associates. (1988). *Graphic organizers*. Retrieved from http://www.ncrel.org/sdrs/areas/issues/students/learning/lr1grorg.htm

FIGURE 14.3.

Spider Map

Source: North Central Regional Educational Laboratory, Learning Point Associates. (1988). *Graphic organizers*. Retrieved from http://www.ncrel.org/sdrs/areas/issues/students/learning/lr1grorg.htm

FIGURE 14.4.

Network Tree
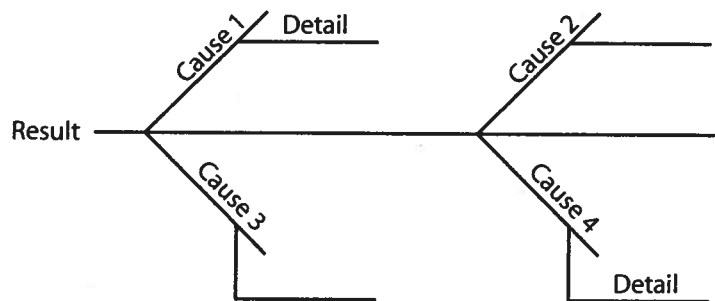

Source: North Central Regional Educational Laboratory, Learning Point Associates. (1988). *Graphic organizers*. Retrieved from http://www.ncrel.org/sdrs/areas/issues/students/learning/lr1grorg.htm

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FIGURE 14.5.

Fishbone Map

Source: North Central Regional Educational Laboratory, Learning Point Associates. (1988). *Graphic organizers.* Retrieved from http://www.ncrel.org/sdrs/areas/issues/students/learning/lr1grorg.htm

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Other graphic organizer examples can be found at http://www.graphic .org/goindex.html. Or use a browser search engine, entering terms such as "graphic organizer" + "teach" to find other examples on the Internet.

- Instead of having students generate the list of ideas constituting the components of a concept, provide them with a list and ask them to graph out the relationships between the items, adding any new ideas.

OBSERVATIONS AND ADVICE   Angelo and Cross (1993, pp. 197–202) offer the following considerations regarding use of concept maps.

- Asking students to create concept maps helps educators and students pay attention to the schemata—or conceptual networks—that we use to organize what we learn.

- Because concept maps organize information graphically, this activity appeals to students with strong visual learning skills. Conversely, students with well-developed verbal skills and weaker visual skills may find this activity frustrating and believe that it is a waste of time.

- Although some students may find it difficult to generate ideas or distinguish between levels of ideas, it may be even more difficult for them to identify relationships. Therefore, take sufficient time to introduce this activity so that you can demonstrate the process and clarify your expectations.

- Comparing groups' concept maps can be difficult unless you limit items to a closed list of terms or phrases. Although comparisons will be easier, this limitation diminishes student creativity, breadth, and depth.

See Nilson (2007) for an insightful discussion on the benefits of graphics for learning. She also explicates the features that distinguish concept maps from mind maps.

How you close this activity depends upon your purpose for having students construct the concept map. Teachers often use this activity to prepare students for a second, more extensive activity. For example, you may want teams to create concept maps to generate and organize their ideas for the teaching stage in a jigsaw activity (SET 33, "Jigsaw") or to create a topic overview for a "role play" (SET 19, "Role Play"). Or you may want to use the concept maps as the basis for a whole-class discussion, asking team spokespeople to show and explain the ideas and associations in their group's concept map. Another option is to have teams submit their concept maps to you for evaluation. If each student on a team uses a different colored marker, it is possible to assess individual participation.

KEY RESOURCES   Angelo, T. A., & Cross, K. P. (1993). *Classroom assessment techniques.* San Francisco: Jossey-Bass, pp. 197–202.

Barkley, E. F., Cross, K. P., & Major, C. H. (2005). *Collaborative learning techniques, A handbook for college faculty.* San Francisco: Jossey-Bass, pp. 226–231.

Graphic.org. (n.d.). Graphic Organizers. Retrieved from http://www.graphic.org/goindex.html.

Nilson, L. B. (2007). *The graphic syllabus and the outcomes map: Communicating your course.* San Francisco: Jossey-Bass.

S T U D E N T
E N G A G E M E N T
T E C H N I Q U E

24

Think Again!

Essential Characteristics

PRIMARY MODE	Individual, Collaborative
ACTIVITY FOCUS	Problem Solving
DURATION OF ACTIVITY	Single Session
ONLINE TRANSFERABILITY	High

DESCRIPTION AND PURPOSE

In this SET, the teacher presents a common misconception in the discipline and then takes a quick, informal poll asking students to agree or disagree with the statement. The teacher then tells students that the statement is untrue and assigns students a task that requires them to prove why it is untrue.

This activity challenges students by creating cognitive dissonance, requiring them to subject their belief to critical analysis and use the knowledge and understanding they are acquiring in the course to gather the appropriate evidence to demonstrate why a commonly held belief is untrue.

STEP-BY-STEP DIRECTIONS

1. Identify and write a common misconception in your discipline on a presentation slide or overhead transparency.

2. Decide on the task that students will do to prove the statement is untrue.

3. Tell students you are going to share with them a statement and that you would like them to agree or disagree, assuring them that their choice will not affect their grade.

4. Display and read the statement and ask students who agree with it to raise their hands.

5. Assuming the majority agree, tell students that the statement is untrue and then ask them to turn to a partner and complete a task that requires

them to prove why it is untrue. (If a considerable number of students disagree, pair them with those who agree so that together they can complete the task proving why the statement is untrue.)

Algebra

Professor Polly Nomeal presented students with the following statement:"The maximum speed of a sailboat occurs when the boat is sailing in the same direction as the wind." She took a quick poll, and 80 percent of the students agreed. She then explained that their intuitive answer was wrong. She formed groups of three and told students,"Sailboats can actually go much faster when they sail across the wind. How so? Using what you have been learning in vector algebra, explain why sailboats can sail faster when the wind blows sideways to their direction of travel rather than from directly behind them. Make your explanation clear enough for the general public to understand. You can use diagrams if that helps" (adapted from Bean, 1996, p. 27).

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Introduction to Physics

To keep students actively engaged throughout the lecture portion of a large introductory physics class, this professor sometimes presents a scenario with two or three possible outcomes. For example, to introduce the topic of conservation of energy, he projects an image of three identical skateboarders prepared to race down three differently shaped ramps at precisely the same time. He asks students to decide which skateboarder would win the race—the skateboarder on the (a) straight ramp, (b) the cycloid ramp, or (c) the parabola ramp? Since the lecture hall is equipped with an automatic response system (clickers), he has students first vote individually on a, b, or c. Without revealing the result, he asks students to turn to someone sitting next to them and explain their reasoning. Then he asks them to come to consensus on a choice and vote again. He displays the results of the individual and paired responses and uses them as the basis for an explanation on the principles involved in the example. He often performs a live experiment in front of the class to demonstrate which response was correct.

ONLINE IMPLEMENTATION Save time by skipping the step of asking students to indicate whether they agree or disagree with the statement. Simply present the task as an assignment, asking students to prove why this commonly held belief is untrue. It will be easiest if you have students complete the assignment individually, but if you wish to garner the benefits of collaborative learning, form student pairs who can communicate through private messaging and e-mail, or form

groups and set up a closed-access threaded discussion forum for each group to work out their solution.

VARIATIONS AND EXTENSIONS

- This basic technique can also be used to engage students in solving problems related to course content rather than common misconceptions in the field, as indicated in the physics example above.

- As a follow-up activity to proving why the misconception is untrue, ask students to figure out how to explain it in clear, simple language to the general public.

OBSERVATIONS AND ADVICE

Consider posing the question as "Raise your hand if you think most people on the street would agree with this statement."

If students are savvier than you had thought and the majority of them disagree with the statement, tell them they are right and ask them to explain why.

KEY RESOURCE

Bean, J. C. (1996). Engaging ideas: *The professor's guide to integrating writing, critical thinking, and active learning in the classroom.* San Francisco, Jossey-Bass, p. 27.

S T U D E N T
E N G A G E M E N T
T E C H N I Q U E

27

Send-a-Problem

Essential Characteristics

PRIMARY MODE	Collaborative
ACTIVITY FOCUS	Discussing
DURATION OF ACTIVITY	Single Session
ONLINE TRANSFERABILITY	Moderate

DESCRIPTION AND PURPOSE

In "Send-a-Problem," groups of students each receive a problem, try to solve it, and then pass the problem and solution to a nearby group. Without looking at the previous group's solution, the next group works to solve the problem. After as many passes as seem useful, groups analyze, evaluate, and synthesize the responses to the problem they received in the final pass and report the best solution to the class.

"Send-a-Problem" thus involves two activity stages: solving problems and evaluating solutions. The purpose of the first stage is to provide students with an opportunity to practice together and learn from each other the thinking skills required for effective problem solving. The purpose of the second stage is to help students learn to compare and discriminate among multiple solutions.

STEP-BY-STEP DIRECTIONS

1. Determine the number of problems you will need in order to have all groups working simultaneously.

2. Decide how you will present the problem. Consider attaching each problem to the outside of a file folder or an envelope into which groups can then insert their solutions.

3. Think carefully about the instructions you will give to students regarding time limits and the order in which they should pass the problem (such as clockwise). Being clear with students can help to reduce any confusion.

4. Form groups of 4–6 students, describe the activity, give instructions, and answer questions.

5. Distribute a different problem to each group, asking each group to discuss the problem, generate possible solutions, choose the best solution, and record and place their response in the folder or envelope.

6. Call "Time," and instruct teams to pass to the next group; each group receives a new folder or envelope. Upon receiving new problems, students again brainstorm responses and record results until time is called and they again pass the problem to a new group.

7. Repeat the process for as many times as seems useful and appropriate for the problem.

8. Students in the final group review and evaluate the responses to the problem, adding any additional information they wish.

9. The activity concludes as teams report on the responses contained in the envelope or folder they evaluated. As groups report out, add any points that groups missed and reinforce correct processes and solutions.

EXAMPLES

Urban Planning

This professor decided to use "Send-a-Problem" so that students could evaluate different groups' solutions to a residential rezoning problem. She gave each group a manila envelope that included the data required to solve the problem and two 5 × 7 index cards. She asked students to discuss and agree upon a solution, write the solution on one of the cards and place it in the envelope, and pass the envelope to the next group. The next group also discussed a solution, recorded their responses on the second index card and placed it in the envelope. This group sent their solution to a third group, who reviewed the responses from the first two groups and selected what they believed was the best solution. The instructor asked these third, final groups to report on which solution they felt was best and to describe why.

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Advanced Pathophysiology and Patient Management

To review assessment and treatment of patients with respiratory disease, Professor Xavier Breath divided the class of twenty students into three groups. He then gave each group an envelop with a patient's specific symptoms written on the outside. Professor Breath asked groups to review the symptoms, diagnose the disease, and recommend and write down appropriate treatment and therapy. After each group had discussed the first problem for fifteen minutes, the

instructor asked students to put their responses in the envelope and pass it to a group sitting nearby who repeated the process. After another fifteen-minute discussion, students sent the envelopes to a final group. When the final group received the envelope, they synthesized the responses from the two previous groups and added additional responses. They then selected the most likely disease causing the patient's symptoms and selected the best treatment. The professor called on each group and wrote the best responses on the chalkboard, incorporating a review of diagnosis protocol, symptoms, diseases, and treatment.

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English Literature

In this online class, Professor Fitz William wanted students to think deeply about cultural and social conditions surrounding the development of the novel *Pride and Prejudice.* He decided to have students participate in an online adaptation of "Send-a-Problem." He organized students into three groups and created a forum for each group. He then developed three questions relating the text to the historical context of the nineteenth century and posted one of the questions on each of the group forums. He gave students in each group one week to respond to their first question and a second week to respond to their second question. During the third week, he gave students access to all forums, and asked groups to evaluate the responses to their final question.

ONLINE IMPLEMENTATION An adaptation of this SET can be effective in the online environment. Determine problems and organize students into as many groups as you have problems. Create a protected-access forum for each group. Post problem prompts and ask students to solve the appropriate problem as listed in Table 15.1 for Stage 1. During Stage 2, permit forum access to all students to respond to the solutions that were posted in the preceding two weeks.

TABLE 15.1.

Stages of Problem Solving

	Stage 1: Problem Solving	Stage 2: Solution Evaluation
	Time frame 1	*Time frame 2*	*Time frame 3*
Group A	Solve problem 1	Solve problem 2	Evaluate solutions for problem 3
Group B	Solve problem 2	Solve problem 3	Evaluate solutions for problem 1
Group C	Solve problem 3	Solve problem 1	Evaluate solutions for problem 2

VARIATIONS AND EXTENSIONS

- Allow students to generate their own list of problems that they would like to see the class solve. For example, individuals may wish to have additional coverage of a certain type of problem that they find consistently confusing. Or perhaps there are issues in a reading assignment that they found particularly intriguing and would like to hear what other students think. While you may have specific topics that you must cover, giving students some control over the problems/topics can generate more engagement and investment in this SET.

- Consider using this SET as a review before an examination. Bring in copies of old tests for students to take and compare their answers.

- For closure, have groups write the numbers of the problems on the board, and ask the evaluating teams to report which group's solution they determined was best, recording the team's name under the problem's number. Then ask the evaluating team to summarize the winning team's solution and state why they felt that solution was best. Offer the winning team the opportunity to add any additional comments.

OBSERVATIONS AND ADVICE

Interpret *problem* to include a variety of complex questions and issues (such as text, diagnosis, and identification of a physical element).

"Send-a-Problem" is most effective for developing several thoughtful solutions for more complex problems that do not have a single right answer. In some situations, it may be effective for close-ended problems that students just learned in a lecture or reading assignment. In this way, it can replace traditional drill-and-practice exercises by adding in higher-order thinking skills during the second solution-evaluation stage.

Prepare the problems and work through the solutions yourself so that you can determine the amount of time it will take groups to solve the problems. Depending on the complexity of the problem, you will need to estimate how long each stage of this activity will take to allow enough time for thinking and reflection. Try to select problems that are roughly equal in complexity and that take approximately the same amount of time to solve.

If you are teaching a large class, you may want to have several groups work on the same problem, but you will find that this works better if groups with the same problems are not seated next to each other.

Be fairly specific about time limitations and be thorough in the instructions introducing the activity. This will give students an idea of how much

thought they can give to their responses and it will help ensure that the activity proceeds smoothly. Be prepared to extend the time limit if the majority of the groups seem to still be on task or to call time sooner than you anticipated if the majority of the groups seem to be wrapping up.

Despite your best efforts at developing comparable problems and setting time limits, groups may well work at different rates, and they need sufficient flexibility to do that. In order to prevent any group from having to sit idle or from having to pass the problem before they are ready, have several extensions (additional problems) ready to fill in. Final groups can report on more than one problem, or you can pick up the additional problems and respond.

Having participated in "Send-a-Problem," students should be relatively skilled at solving specific problem types and evaluating problem-solving processes. If students have been working on different types of problems, provide them with a few problems and ask them to state the principle that best applies to each problem. This will help you to evaluate their ability to associate specific problems with the general principles used to solve them and to determine their skill at transferring what they have learned to new problem situations.

KEY RESOURCES   Barkley, E. F., Cross, K. P., & Major, C. H. (2005). *Collaborative learning techniques: A handbook for college faculty.* San Francisco: Jossey-Bass, pp. 177–181.

Kagen, S. (1992). *Cooperative learning* (2nd ed.). San Juan Capistrano, CA: Resources for Teachers, pp. 10–11.

Millis, B. J., & Cottell, P.G., Jr. (1998). *Cooperative learning for higher education faculty.* Phoenix, AZ: Oryx Press, pp. 103–105.

CLASSROOM
ASSESSMENT
TECHNIQUE

4

Empty Outlines

Estimated Levels of Time and Energy Required for:

Faculty to prepare to use this CAT	**MEDIUM**
Students to respond to the assessment	**LOW**
Faculty to analyze the data collected	**MEDIUM**

DESCRIPTION The name of this technique is self-explanatory. The instructor provides students with an empty or partially completed outline of an in-class presentation or homework assignment and gives them a limited amount of time to fill in the blank spaces. To help students better organize and learn course content, many instructors already provide outlines of their lectures at the beginning or end of class sessions. In our experience, however, fewer teachers use the outline format to assess students' learning of that same content.

PURPOSE The Empty Outline technique helps faculty find out how well students have "caught" the important points of a lecture, reading, or audiovisual presentation. It also helps learners recall and organize the main points of a lesson within an appropriate knowledge structure, making retention more likely and aiding understanding.

RELATED TEACHING GOALS Improve skill at paying attention (TGI Goal 9)
Develop ability to concentrate (TGI Goal 10)
Improve listening skills (TGI Goal 12)
Develop appropriate study skills, strategies, and habits (TGI Goal 16)
Learn terms and facts of this subject (TGI Goal 18)

SUGGESTIONS FOR USE This technique works best in courses where a large amount of content—facts and principles—is presented regularly in a highly structured manner. For example, Empty Outlines have been used with success in introductory courses in physical and life sciences, nursing, law, art history, and music history. The technique can be used at the conclusion of a class session or at the beginning of the next one. Because it generates quite a bit of feedback, the instructor usually can read every response only in small classes. In large courses, the instructor can collect only group responses, or read and respond to only a sample of student outlines.

From Pathophysiology (Nursing)

Experience and examination results had convinced this nursing professor that her students had difficulty recognizing, organizing, and recalling the most important points in her lectures. To gain specific insights into how students were managing the heavy information load of her lectures, she handed out copies of an Empty Outline form ten minutes before the end of class. The outline contained four main headings, representing the four main topics she had just lectured on. Each main heading was followed by empty lines for three to five subheadings. She directed the students to fill in the subheadings quickly, making use of their class notes. At the end of the session, she collected the forms.

The Empty Outline form was based on her lecture outline, of course; so she could easily compare the students' subheadings with her own. A quick reading showed her that most of the students placed their responses under the correct headings. However, they often made their subheadings too specific, or they mixed items of different levels of specificity. The responses demonstrated that students were missing at least some important subtopics because they were distracted by facts.

Armed with examples from the Empty Outlines, the instructor was better able to illustrate the level on which she wanted students to focus their attention during the lectures. By the third application of this CAT, most students had located that level and were therefore more successful at "seeing the forest for the trees."

From Child Language Acquisition (Child Development)

Before he showed a videotape of an educational television program on the stages of language acquisition from birth to five years, the instructor watched the video himself and sketched a simple outline of its topics and major points. The major topics in his outline were the developmental stages of language acquisition; the subheadings were the developmental milestones that characterize each stage. To create an Empty Outline assessment form, he simply deleted the content of his subheadings, leaving the main headings intact.

After the class had viewed the hour-long videotape, the instructor passed out the one-page Empty Outline forms and asked students to work in pairs to fill them in. He allowed five minutes for the work and then collected the completed forms. A quick analysis of the results showed him that his students most clearly recalled the milestones from the first and last stages presented in the video. Their responses to the intermediate stages were much sketchier. This information gave the teacher clear directions on where to begin the follow-up discussion and what to focus on. It also convinced him of the need to stop in the middle of the videotape to allow students time to take notes and review what they had seen and heard to that point.

From International Marketing (Business/Management)

In this upper-division course, taught primarily through the case method, the instructor wanted to determine whether her students were noting the major points brought out during case discussions. She drew up her

outline before the discussion and then revised it as the case discussion took place. Ten minutes before the end of the two-hour class meeting, the marketing professor sketched a simple Empty Outline on the board. It consisted of four Roman numerals, each followed by three capital letters. She directed the students to copy the outline on a blank sheet of paper, to fill in the main points illustrated by the case discussion, and to follow each with at least three supporting comments made by class members.

While she had expected some range of responses, the width of that range surprised her. There was general agreement on only two major points, and very little consistency in the supporting comments cited. Many students had difficulty coming up with supporting comments. Her outline and the students' were often far apart, and not in ways that simply reflected reasonable differences in focus or interests.

The marketing professor summarized these differences broadly and reported back to the students, letting them know what she saw as the main points and strong supporting comments, and why. She invited discussion of her outline content—and got it. Several students were able to explain their responses persuasively.

At the suggestion of members of the class, she repeated the Empty Outlines exercise halfway through the next case discussion, and made time for small-group discussion of responses and revision of responses before they were handed in. Over several class sessions, the use of this technique led to much greater consensus on the important points and much more careful listening and questioning during the case discussions.

STEP-BY-STEP PROCEDURE

1. Create an outline of the lecture, presentation, discussion, or reading you want to focus on.

2. Make conscious decisions about the level on which you will focus the Empty Outline and, thus, the students' attention. Do you want students to supply the main topics, the main subtopics, or the supporting details? These decisions will determine what information you supply in the form and what you leave out.

3. When students are to complete the form from memory—that is, without any notes or other information—limit the number of items the Empty Outline elicits to fewer than ten.

4. If your Empty Outline focuses on a live presentation or a discussion, make sure that your own notes reflect any important changes that may have occurred between what was scripted and what actually happened.

5. Let students know how much time they will have to complete the outlines and the kinds of responses you prefer—words, short phrases, or brief sentences.

6. Be sure to announce the purpose of the assessment and the time when the students will receive feedback on their responses.

TURNING THE DATA YOU COLLECT INTO USEFUL INFORMATION

As with the responses from many other CATs, you can take your analysis in two useful directions. You may wish simply to compare the actual responses to those you expected, counting the number of students who agreed or disagreed with your responses for each item. As an alternative, or as a second

step, you can look at the range of responses among students, focusing more on the patterns that emerge than on how well they match your expectations.

IDEAS FOR ADAPTING AND EXTENDING THIS CAT

If students have a great deal of difficulty completing the Empty Outline, try providing the class with a jumbled list of headings and subheadings and letting them structure the outline by using that content. Provide main headings but not subheadings; at other times, list the subheadings or details and ask students to fill in the main points. For more advanced learners, provide nothing more than guidelines. Simply ask them to create outlines of the focus lesson and indicate how much detail you expect.

Use the technique to assess student expectations of the lesson by having them fill in the Empty Outline before the presentation or reading. Allow students a few minutes to work in pairs or small groups to fill in the outlines. Use Focused Listing (CAT 2) as a warm-up or step-up to Empty Outlines. Consider using Concept Maps (CAT 16) as an alternate or next step.

PROS

Repeated use of this CAT can promote more careful listening and note-taking.

Feedback on responses gives important direction and useful models to less experienced students.

Empty Outlines can help students better organize and more effectively reorganize their memories of the material they are learning.

The Empty Outline can be used to demonstrate the basic organizing schemes of the discipline and to give students practice in using these schemes.

CONS

Once you have decided to use the Empty Outline at the end of a session, you may feel more constrained to follow your own outline than you otherwise would.

Not all information is best organized or best remembered in the hierarchical, linear fashion commonly associated with outlines.

Unless students are creating their own outlines from "scratch," little if any higher-order thinking is required.

CAVEATS

Because learners start at different points and process information differently, there will always be some variation in the way students complete the Empty Outlines.

Don't try to assess too much at any one time. If there are twenty main points in your lecture or in the chapter you are focusing on, for example, use the Empty Outline to assess understanding of only one-third or half of that material.

CLASSROOM ASSESSMENT TECHNIQUE

6

Minute Paper

Estimated Levels of Time and Energy Required for:

Faculty to prepare to use this CAT	**LOW**
Students to respond to the assessment	**LOW**
Faculty to analyze the data collected	**LOW**

DESCRIPTION

To the best of our knowledge, no other Classroom Assessment Technique has been used more often or by more college teachers than the Minute Paper. This versatile technique—also known as the One-Minute Paper and the Half-Sheet Response—provides a quick and extremely simple way to collect written feedback on student learning. To use the Minute Paper, an instructor stops class two or three minutes early and asks students to respond briefly to some variation on the following two questions: "What was the most important thing you learned during this class?" and "What important question remains unanswered?" Students then write their responses on index cards or half-sheets of scrap paper—hence the "Half-Sheet Response"—and hand them in.

PURPOSE

The great advantage of Minute Papers is that they provide manageable amounts of timely and useful feedback for a minimal investment of time and energy. By asking students what they see as the most significant things they are learning, and what their major questions are, faculty can quickly check how well those students are learning what they are teaching. That feedback can help teachers decide whether any mid-course corrections or changes are needed and, if so, what kinds of instructional adjustments to make. Getting the instructor's feedback on their Minute Papers helps students learn how experts in a given discipline distinguish the major points from the details. The Minute Paper also ensures that students' questions will be raised, and in many cases answered, in time to facilitate further learning.

Despite its simplicity, the Minute Paper assesses more than mere recall. To select the most important or significant information, learners must first evaluate what they recall. Then, to come up with a question, students must self-assess—asking themselves how well they understand what they have just heard or studied.

RELATED TEACHING GOALS

Develop ability to synthesize and integrate information and ideas (TGI Goal 5)

Develop ability to think holistically: to see the whole as well as the parts (TGI Goal 6)

Improve skill at paying attention (TGI Goal 9)

Develop ability to concentrate (TGI Goal 10)

Improve listening skills (TGI Goal 12)

Develop appropriate study skills, strategies, and habits (TGI Goal 16)

Learn terms and facts of this subject (TGI Goal 18)

Learn concepts and theories in this subject (TGI Goal 19)

SUGGESTIONS FOR USE

Minute Papers are probably most useful in lecture or lecture/discussion courses, although the technique can be easily adapted to other settings. For example, the Minute Paper can also be used to assess what students have learned from a lab session, study-group meeting, field trip, homework assignment, videotape, or exam. Minute Papers work well at the end or the beginning of class sessions, serving either as warm-up or wrap-up activities. Like other simple techniques in this section, Minute Papers can be used frequently in courses that regularly present students with a great deal of new information. Because it is quick to administer and easy to analyze, the Minute Paper is well suited for use in large classes.

EXAMPLES

From European History: Renaissance to Modern Times (History)

At the end of an exquisitely prepared, well-illustrated lecture on the Renaissance entitled "Why Italy?" the veteran history professor decided to use a new feedback technique she had heard about from a younger colleague. She passed out small, blank index cards and then raised the projection screen to reveal two questions, which she had written on the chalkboard before class. She told the students that she wanted thoughtful, brief, and legible answers, but no names. Then she read the two questions aloud: "What is the single most significant reason Italy became a—if not the—center of the Renaissance?" "What one question puzzles you most about Italy's role in the Renaissance?"

After five minutes, the history professor collected the index cards, told the students that she would respond to them at the next meeting, and dismissed the class. Reading through the forty-plus cards in her office, she was pleased that many of the students offered reasons she had underlined in her lecture. For this professor, acceptable reasons for Italy's central role in the Renaissance included its geographical proximity to Asia and Africa, its political organization into city-states, its historical links to Greece and Rome, and its highly developed mercantile economies.

She was irritated, on the other hand, because some students insisted on confusing cause and effect, reasoning that Italy became a Renaissance center because it had so many great artists and learned men. A few students even seemed to think that the Renaissance was created by Marco Polo, Leonardo da Vinci, Michelangelo, or the Medicis—a "Great Man" view of history that annoyed her even more!

How on earth, she wondered, could these students have missed the main points of her excellent, crystal-clear lecture?

She was so delighted with their questions, however, that she soon got over her irritation and began to reshape her outline for the next class meeting. On the whole, they were much more thoughtful questions than students asked in class. She prepared an overhead transparency that categorized the students' responses as Major Causes, Minor Causes, Effects, Actors, or To Be Discussed, this last category for answers she could not fit in the other categories. She then listed five questions that had been asked by more than two students and tried to answer them by referring to information the class had provided. Although her response to the Minute Papers and the ensuing discussion devoured one-third of the following class, she considered it time well spent. The class's excellent performance on the midterm essay question dealing with causes of the Renaissance was further evidence that her personalized Minute Paper had improved their learning.

From Introductory Statistics (Statistics)

Intrigued by a demonstration of the Minute Paper during a faculty development workshop at his college, this young mathematics instructor decided to adapt the technique for use in his intensive Introductory Statistics course. Although he liked the format, he felt that asking for only one significant point was too limiting, and decided to ask students to come up with several. Consequently, a few minutes before the end of each lecture, he asked students to list the five most important points from that session, along with one or two important questions they had. He then collected the responses and quickly read them after class, making a list of the "important points" and questions and tallying how often each item was repeated.

At first, the variety of points that students listed as important astounded the statistics instructor. He found that, as a group, his thirty-five students came up with as many as twenty different important points from the same lecture. Many of the points they listed were ones he considered details; others were distortions of things he had said; still others were points he was sure he had never mentioned at all! The bewildering variety of responses on Minute Papers from the first few class meetings convinced him of the need to teach students how to tell the "wheat from the chaff."

He began by listing the ten or twelve most common responses on the board before class. He then took the first five to ten minutes of class to explain the relative importance of these points and their relationships to one another. He also let students know which points were definitely not related. In the course of these "feedback sessions," he could often weave in responses to two or three commonly asked questions as well. The Minute Paper responses convinced him that his students needed a more explicit road map than he had been providing. Therefore, in addition to the list of responses to the preceding lecture, he wrote his own list of most important points for that day. With both lists on the board, he could make connections between one class and the next graphically clear.

After a month of following the Minute Paper at the end of one class with a feedback session at the beginning of the next, the average total

number of different "important points" had dropped from nearly twenty to eight or nine. That was a level of variation he could live with. Repeated use of the Minute Paper helped his students learn to listen more carefully and focus more effectively during lectures. The CAT helped the instructor realize the importance of being explicit in teaching statistics to students with very little or no previous knowledge of the subject.

From Writing for Magazines and Newspapers (Journalism)

As she neared the end of the hour, the journalism instructor suddenly realized that she had spent far too much time on one topic, slighting two other important themes she had planned to develop in her lecture on the life cycle of magazines. She felt guilty of self-indulgence, since the topic she had lingered on—the death of general-interest magazines—was one she found particularly fascinating. It was clear to her that she had been carried away in her enthusiasm and had pounded the same points home too many times.

Although she was certain that she could predict their responses, the journalism instructor went ahead with the Minute Paper anyway. She had established the use of CATs as part of the classroom routine from the first day of class and did not want to break the pattern. So she handed out squares of scrap paper and asked students to write down the three most important things they had learned from her lecture, and one important question they would like to pursue further.

To her astonishment, very few of the Minute Papers even mentioned the topic to which she had devoted most of the lecture: the demise of weekly magazines such as the Saturday Evening Post and Life. Instead, most of the students had focused on the rise of the more specialized, current magazines they were familiar with and on her few comments about getting published. In essence, her students had paid scant attention to information the instructor worried she had overstressed. When she asked why a major portion of the lecture was poorly represented in their Minute Papers, the students explained that they considered it background information—interesting but not very relevant history. To them, the most important information was that which they thought might help them succeed as professional writers. This response made the journalism teacher realize that she should continually point out the connections between the content of her course and the "real world" of journalism and the job market.

STEP-BY-STEP PROCEDURE

1. Decide first what you want to focus on and, as a consequence, when to administer the Minute Paper. If you want to focus on students' understanding of a lecture, the last few minutes of class may be the best time. If your focus is on a prior homework assignment, however, the first few minutes may be more appropriate.

2. Using the two basic questions from the "Description" above as starting points, write Minute Paper prompts that fit your course and students. Try out your Minute Paper on a colleague or teaching assistant before using it in class.

3. Plan to set aside five to ten minutes of your next class to use the technique, as well as time later to discuss the results.

4. Before class, write one or, at the most, two Minute Paper questions on the chalkboard or prepare an overhead transparency.

5. At a convenient time, hand out index cards or half-sheets of scrap paper.

6. Unless there is a very good reason to know who wrote what, direct students to leave their names off the papers or cards.

7. Let the students know how much time they will have (two to five minutes per question is usually enough), what kinds of answers you want (words, phrases, or short sentences), and when they can expect your feedback.

TURNING THE DATA YOU COLLECT INTO USEFUL INFORMATION

Simply tabulating the responses and making note of any useful comments is often all the analysis needed. Consider saving Minute Papers from early in the term to compare with responses at midterm and later. Comparing responses over time can allow you to see changes and development in the clarity of student writing and thoughtfulness of answers.

IDEAS FOR ADAPTING AND EXTENDING THIS CAT

Use only half of the Minute Paper. That is, ask students either for the most important point(s) or for their question(s). These "Half-Minute Papers" are the most common adaptations because they make the assessment process even simpler and quicker. The Muddiest Point (CAT 7) is a particularly creative example of such an adaptation.

Change the wording to make the prompt more appropriate and specific. For example, instead of asking students to identify the most significant point, ask them for one of the following: the most illuminating example, the most powerful image, the most convincing argument or counterargument, the most surprising information, the most memorable character, or the most disturbing idea.

Allow students a few extra minutes to compare and discuss their Minute Paper responses with their classmates in pairs or small groups.

Assign students to small groups. Give each group, in turn, the opportunity to suggest questions for the Minute Papers and let the members of the group analyze and present the results to the whole class.

PROS

Minute Papers provide immediate mid-course feedback to teachers and allow quick response to students.

This advantage is especially important in college classrooms, where many issues and questions have limited life spans and time is always in short supply.

The responses—even from a very large class—can be read, tabulated, and analyzed quickly and with limited effort.

Faculty using the Minute Paper demonstrate respect for and interest in student feedback, thereby encouraging active listening and engagement, which are often lacking in large classes.

Feedback on the Minute Paper allows individual students to compare their responses with those of the class as a whole.

CONS

If Minute Papers are overused or poorly used, students will begin to view the technique as a gimmick or a pro forma exercise in polling.

It is more difficult than it may seem to prepare questions that can be immediately and clearly comprehended and quickly answered.

CAVEATS

Not all learning experiences can be meaningfully assessed by an instrument that asks learners to note significant points or remaining questions. In other words, this technique is flexible but not universally applicable.

When students seem to confuse trivial details with significant themes, or pose questions that you have already answered several times, remind yourself that they see the material through different eyes, hear it with different ears, and make sense of it differently than you do. Hold off responding until the irritation has faded. Accepting their starting points is often a necessary step in getting them to the desired learning goal.

Responding to Minute Papers often takes longer than planned, because questions lead to further questions. Build in some flexibility but set clear limits for the time you will spend on feedback.

To temper expectations and prevent individual disappointment, let the class know in advance that you may not be able to comment on every important point and question submitted. It is often wise to promise less feedback than you think you can deliver. Let students know in advance, for example, that you will respond to the three most commonly raised points and questions from their Minute Papers, even though you hope to do more.

REFERENCES AND RESOURCES

Wilson (1986) describes the Minute Paper in an article on using feedback from students and consultants to improve college teaching. The term *half-sheet response* comes from an article on a similar technique by Weaver and Cotrell (1985). Of course, versions of the Minute Paper, and many other CATs, probably have been invented and reinvented time and again by instructors in various colleges at different times.

CLASSROOM
ASSESSMENT
TECHNIQUE

7

Muddiest Point

Estimated Levels of Time and Energy Required for:

Faculty to prepare to use this CAT	**LOW**
Students to respond to the assessment	**LOW**
Faculty to analyze the data collected	**LOW**

DESCRIPTION The Muddiest Point is just about the simplest Classroom Assessment Technique imaginable. It is also remarkably efficient, since it provides a high information return for a very low investment of time and energy. The technique consists of asking students to jot down a quick response to one question: "What was the muddiest point in _____?" The focus of the Muddiest Point assessment might be a lecture, a discussion, a homework assignment, a play, or a film.

PURPOSE As its name suggests, the Muddiest Point technique provides information on what students find least clear or most confusing about a particular lesson or topic. Faculty use that feedback to discover which points are most difficult for students to learn and to guide their teaching decisions about which topics to emphasize and how much time to spend on each. In response to this CAT, learners must quickly identify what they do not understand and articulate those muddy points. Consequently, even though the technique is extremely simple to administer, responding to it requires some higher-order thinking.

RELATED TEACHING GOALS Improve skill at paying attention (TGI Goal 9)
Develop ability to concentrate (TGI Goal 10)
Improve listening skills (TGI Goal 12)
Develop appropriate study skills, strategies, and habits (TGI Goal 16)
Learn terms and facts of this subject (TGI Goal 18)
Learn concepts and theories in this subject (TGI Goal 19)

SUGGESTIONS FOR USE While this technique can be used in virtually any setting, it is particularly well suited to large, lower-division classes. Since students' responses to the Muddiest Point question usually consist of a few words or phrases, a teacher can read and sort a great many in a few minutes. The Muddiest Point question should be posed at the end of a lecture, at the close of a discussion

or presentation, or immediately after a reading assignment. This CAT can be used quite frequently in classes where a large amount of new information is presented each session—such as mathematics, statistics, economics, health sciences, and the natural sciences—probably because there is a steady stream of possible "muddy points." On the other hand, the Muddiest Point is best used sparingly in courses where the emphasis is on integrating, synthesizing, and evaluating information.

EXAMPLES

From the Decline and Fall of the Soviet Union (International Relations/Political Science)

This professor used the Muddiest Point in his senior-level honors course to assess students' understanding of a prerecorded videotape. The videotape was a recording of an hour-long speech on the reasons for the collapse of the Soviet Union. The speech had been delivered by one of the professor's eminent colleagues to foreign policy consultants and journalists in Washington, D.C. At the conclusion of the tape, the international relations professor asked his eighteen students to write the "muddiest point" they found in the videotape.

As the professor read through the responses, he noted that almost half of his students mentioned the same "muddy point": the videotaped speaker's thesis that "imported inflation" seriously undercut the Soviet economy in the 1980s. Since the instructor regarded that thesis as the most important and original element of his colleague's analysis, he was pleased to discover the students' confusion right away. To clear it up, he prepared a detailed explanation of that critical point, which he presented during the next class meeting.

From Fundamentals of English (English as a Second Language)

After two lectures and related homework assignments on English pronoun usage, the new ESL instructor decided to try the Muddiest Point technique. So, just before class ended, she asked students to write down the "muddiest point" in their minds about pronoun usage. When several students quickly raised their hands to ask what she meant by a "muddy point," she realized that even widely used colloquialisms can stymie nonnative English speakers. As soon as she explained that "muddy" in this phrase meant unclear, confusing, or hard to understand, they were able to carry out the assessment.

Later, shuffling through the index cards containing their responses, the instructor was dismayed and disappointed by what she read. Although she had worked hard to explain the pronominal system on a conceptual level, stressing what pronouns do in English and why it is important to use them correctly, the muddy points that students mentioned were virtually all about very specific, and sometimes rather minor, rules of usage—such as the difference between "who" and "whom."

Feeling that her class had failed to see the forest for the trees, the ESL instructor asked one of her veteran colleagues for advice. Her colleague assured her that the students' responses were quite normal, given their low level of experience with and knowledge of English. The

veteran teacher reminded the new faculty member to keep her audience in mind. Teaching the pronominal system conceptually makes sense if students are English-speaking linguistics majors or future English language teachers, but is less useful with beginning or intermediate language learners.

After that conversation, the new ESL teacher again looked at the muddy points. This time she realized that she had been teaching about pronouns as she had been taught in graduate linguistics courses, rather than thinking about what her ESL students needed to learn and how they could best learn it. That realization caused her to change her approach to the next few lessons. Specifically, she provided many more examples and much more practice, helping students move from the specifics to the more general concepts and back to specifics—and helping them see the connections.

From General Chemistry (Chemistry)

From the first week of class, students in this general education science course had been responding to the Muddiest Point. Now, several weeks into the course, the professor used this CAT to assess the students' understanding of a lecture on enthalpy and entropy. The most commonly mentioned muddy point concerned the difference between enthalpy of activation and entropy of activation. Other students mentioned the difference between enthalpy of formation and enthalpy of activation. These responses let the professor know that the students had not firmly grasped the differences between entropy and enthalpy and that many of them probably did not understand either principle in isolation. Looking back on her lecture, she realized it had probably contained too much detail and too little differentiation of concepts—resulting in highly "entropic" learning.

STEP-BY-STEP PROCEDURE

1. Determine what you want feedback on: the entire class session or one self-contained segment? A lecture, a discussion, a presentation?

2. If you are using the technique in class, reserve a few minutes at the end of the class session. Leave enough time to ask the question, to allow students to respond, and to collect their responses by the usual ending time.

3. Let students know beforehand how much time they will have to respond and what use you will make of their responses.

4. Pass out slips of paper or index cards for students to write on.

5. Collect the responses as or before students leave. Stationing yourself at the door and collecting "muddy points" as students file out is one way; leaving a "muddy points" collection box by the exit is another.

6. Respond to the students' feedback during the next class meeting or as soon as possible afterward.

TURNING THE DATA YOU COLLECT INTO USEFUL INFORMATION

As with everything else about this technique, data analysis can and should be kept very simple. Quickly read through at least half of the responses, looking for common types of muddy points. Then go back through all the responses and sort them into piles—several piles containing groups of

related muddy points, and one "catch-all" pile made up of one-of-a-kind responses. You may want to count the responses in each group before you decide which to deal with. Or you may want to group together the muddy points that concern facts and principles, those that concern concepts, and those that concern skills.

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IDEAS FOR ADAPTING AND EXTENDING THIS CAT

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Ask students to identify the muddiest points in a homework assignment or an out-of-class reading and to turn in their responses at the next class meeting. For example, ask them to list the three muddiest points in a chapter or a case that they have been assigned to read.

Ask students to read each other's drafts of writing assignments and to point out the muddiest points in those drafts.

When students are familiar with the material and are relatively articulate, ask them to indicate the muddiest point and then to explain briefly what it was about that point that they found "muddy."

At each class meeting, ask a few different students to categorize and summarize the data and to present the results—and perhaps even their responses—at the beginning of the next class.

Use other CATs (such as Directed Paraphrasing, Memory Matrix, or Concept Maps) to check later on how much clearer the most critical muddy points have become since you responded to them.

Let students know that some of your exam questions will concern the muddy points that you have responded to in class.

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PROS

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The Muddiest Point is not only quick, simple, and easy to administer; it also requires very little preparation. This is one of the few CATs you can successfully use on the spur of the moment.

For students who are hesitant to ask questions in class, this technique is a safe alternative. For students who are lost, it can be a "lifeline."

This technique can give the instructor a "snapshot" diagnosis of what students are finding difficult to learn. As a result, the teacher can focus subsequent lessons and assignments much more accurately and effectively.

This technique enables teachers to see the material through their students' eyes and reminds them of the range of intellectual and perceptual diversity present in each classroom.

If students are regularly asked to identify the "muddiest point," they tend to pay more attention to how well they are understanding the relevant session or assignment because they expect to be asked about it. This expectancy can lead, on the simplest level, to more care in listening and studying. Because of the nature of the question, however, this technique also promotes introspection and self-assessment.

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This is a simple technique that students can easily internalize, making self-assessment a regular part of their own classroom and study routines. Students can learn to habitually ask themsleves, "What was the muddiest point in _____?" whether or not other instructors ask them for such feedback.

CONS

As Mosteller (1989) points out, there are drawbacks to asking students to focus only on what they don't understand. Such an emphasis can undermine both the students' and the teacher's motivation and sense of self-efficacy. To restore some balance, teachers need to focus on what students do understand as well as on the muddy points.

It can be disconcerting to realize that even your best-prepared, most lucid lecture or lab will be misunderstood or poorly understood by some of your students.

Initially, a number of students may have difficulty explaining, or even naming, what it is that they don't understand. Becoming effective self-assessors takes time and practice, and you may not wish to develop that skill on class time.

As students become more adept at identifying and explaining the points they find "muddiest," they become more likely to raise difficult questions that you may be unable to answer on the spot.

CAVEATS

Don't become angry or disappointed when students identify something as a "muddy point" that you're positive you presented with absolute clarity. At least, don't respond to the class until you have dealt with those feelings. (Remember: don't ask if you don't really want to know.)

Don't spend so much class time responding to "muddy points" from past sessions that you risk losing the momentum of your course.

Don't give students the impression that all confusions and questions can be cleared up in a few minutes—or even a few days. Make it clear that some points are "muddier" than others and that a few are real landslides that will take a lot of digging out!

REFERENCES AND RESOURCES

In an informative and thoughtful journal article, Mosteller (1989) describes how he developed and used the Muddiest Point in his large undergraduate statistics course at Harvard. To request copies of the journal (*The Journal of the Harvard-Danforth Center*) or reprints of the Mosteller article, contact:

The Derek Bok Center for Teaching and Learning
318 Science Center
Harvard University
Cambridge, Mass. 02138

See also Cottell (1991, pp. 50–51) for a clear and humorous example of the Muddiest Point applied to accounting. In this example, the author refers to the CAT as an adaptation of the Minute Paper.

C L A S S R O O M
A S S E S S M E N T
T E C H N I Q U E

21

Documented Problem Solutions

Estimated Levels of Time and Energy Required for:

Faculty to prepare to use this CAT	**LOW**
Students to respond to the assessment	**MEDIUM**
Faculty to analyze the data collected	**MEDIUM to HIGH**

DESCRIPTION

To become truly proficient problem solvers, students need to learn to do more than just get correct answers to textbook problems. At some point, they need to become aware of how they solved those problems and how they can adapt their problem-solving routines to deal with messy, real-world problems. The Documented Problem Solutions technique prompts students to keep track of the steps they take in solving a problem — to "show and tell" how they worked it out. By analyzing these detailed protocols — in which each solution step is briefly explained in writing — teachers can gain valuable information on their students' problem-solving skills.

PURPOSE

Documented Problem Solutions have two main aims: (1) to assess how students solve problems and (2) to assess how well students understand and can describe their problem-solving methods. Therefore, the primary emphasis of the technique is on documenting the specific steps that students take in attempting to solve representative problems — rather than on whether the answers are correct or not. As they respond to the assessment, students benefit by gaining more awareness of and control over their problem-solving routines. Understanding and using effective problem-solving procedures is, after all, a critical.component of mastery in most disciplines.

RELATED TEACHING GOALS

Develop ability to apply principles and generalizations already learned to new problems and situations (TGI Goal 1)
Develop problem-solving skills (TGI Goal 3)
Develop appropriate study skills, strategies, and habits (TGI Goal 16)
Improve mathematical skills (TGI Goal 17)
Prepare for transfer or graduate study (TGI Goal 22)
Learn techniques and methods used to gain new knowledge in this subject (TGI Goal 23)

Learn to evaluate methods and materials in this subject (TGI Goal 24)
Develop a commitment to accurate work (TGI Goal 39)
Develop ability to perform skillfully (TGI Goal 43)

SUGGESTIONS FOR USE The Documented Problem Solutions technique is especially useful for assessing problem solving in highly quantitative courses, such as accounting, algebra, calculus, computer programming, engineering, microeconomics, physics, and statistics. It can also be used in other fields that teach structured approaches to problem solving, fields such as logic, tort law, organic chemistry, transformational grammar, and music theory.

EXAMPLES

From Algebra I (Mathematics)

> Before moving on to the next topic, an Algebra I instructor wanted to assess her students' approaches to solving quadratic equations. She assigned three problems as a Documented Problem Solution assessment, promising to give students homework credit for complete responses. She directed her students to spend no more than one hour working out the problems and documenting the solutions. After reading the responses she realized that there were three groups in the class: those who answered at least two problems correctly and documented their solutions well; those who answered at least two problems correctly but documented their steps poorly; and those who clearly misunderstood the solution process and got most or all answers wrong. These responses convinced her of the need to spend another session on quadratic equations, focusing on making the solution process explicit.

From Transformational Syntax (Linguistics)

> Students in this first-year linguistics course spend a great deal of time and effort learning to analyze and diagram sentences according to the Chomskyan transformational grammar approach. To gain insights into their problem-solving skills, the professor gave them a rather difficult sentence—one chock-full of embedded relative clauses and adverbial phrases—to diagram. He asked them to fold a piece of paper in half. On the left half of the page, they were to draw each step in the diagramming process; on the right half, they were to write a brief note explaining and justifying each step. The results of this Documented Problem Solution were surprising: although several students followed many of the same steps, they often gave very different reasons for their moves. His summary of these differences led to an in-depth class discussion of what constitutes legitimate and reasonable explanation.

STEP-BY-STEP PROCEDURE

1. Select one, two, or three representative problems from among the problems students have studied during the previous few weeks. If you decide to assign three problems, for example, try to select at least one that all the students can solve, another that most of the class can solve, and a third that will challenge most of your students.

2. Solve the problems yourself, and write down all the steps you take in solving them. Note how long it takes you and how many steps each problem solution required.

3. If you find any of the problems too time-consuming or too complicated, replace or revise them.

4. Once you have good problems that you can solve and document in less than thirty minutes, write them up for the students. Assume that it will take students at least twice as long as it took you to document the solutions. Make your directions very explicit.

5. Hand out and explain the assessment problem(s), making clear to the students that it is not a test or a quiz. It is more important for students to explain how they try to solve the problems than to get the right answers. Having well-documented steps is even more important if they fail to get a correct answer, since they can then diagnose where and how they went wrong. If you assign the assessment problem as homework, let students know the maximum amount of time they should spend on it.

TURNING THE DATA YOU COLLECT INTO USEFUL INFORMATION

If you are teaching more than a handful of students, select a few responses to analyze. After skimming quickly through all of them, pick three responses in which the answers are correct and the solutions well documented. Pick another set of three that contain well-documented solutions but incorrect answers. Compare the solutions within and across sets. Make notes on solution paths that led to successful outcomes and those that led to mistakes. Try to locate general zones, or the exact spots, in the solution processes that determined correct or incorrect results. For example, were the results incorrect because the students skipped steps? After completing your analysis, write down three or four main insights and/or suggestions to share with students. If time allows, prepare an overhead transparency or a handout detailing one or two particularly elegant solutions.

IDEAS FOR ADAPTING AND EXTENDING THIS CAT

Use this device as a diagnostic pre-assessment by giving the class two problems — one of low and the other of medium difficulty — to work through before they study the material. Use the results to gauge the best level at which to begin instruction.

Divide the class into small groups and ask the students with elegant, well-documented responses to explain their solution processes step by step to those who had difficulties.

Ask one or two students who documented their (successful) solutions especially well to lead the class through one of their responses, step by step.

Use this assessment as a regular part of homework assignments. For example, you might ask students to document one problem in each homework set, or one problem on each quiz or test. Students can be

given credit for doing a thorough job of documenting, without receiving a grade.

PROS

The Documented Problem Solution technique helps teachers and students look "behind" specific answers to glimpse the students' thinking processes and problem-solving strategies. In other words, it focuses more attention on the process than on the product.

It allows the teacher and the students to become aware of a range of possible successful—and unsuccessful—approaches to problem solving.

By prompting students to make each step manifest and explicit, this CAT promotes the development of discipline-specific metacognitive skills—in this case, awareness of and control over problem-solving processes.

CONS

At first, many students may find it quite difficult to explain how they solve problems, even when their answers demonstrate that they do know how to solve them.

Even the faculty may not always be able to figure out and explain why a given set of steps worked or failed to work.

When students take different solution paths or are working at a wide variety of levels, it may not be useful or even possible to give general feedback on their responses.

CAVEATS

Don't expect students to write good step-by-step solutions the first or even the second time they try. Most students have little or no experience in reflecting on their own problem-solving processes. If you want students to develop this skill, you—or someone else—may have to help them learn how.

Documented Problem Solutions can be difficult and time-consuming to carry out. To get thoughtful and thorough responses, you may need to give students credit for completing the assessment.

Don't feel bound to analyze more data than you can comfortably handle, but make sure that students at all levels get some useful feedback.

REFERENCES AND RESOURCES

In her widely influential book *Errors and Expectations* (1977), the late Mina Shaughnessy provided a comprehensive description and discussion of her experiences as she attempted to develop error-analysis techniques to help her make sense of the bewildering writing of underprepared college students. Although it deals only with writing instruction, *Errors and Expectations* remains the most thoughtful and inspiring argument we know of for the use of error analysis to improve learning.

CLASSROOM
ASSESSMENT
TECHNIQUE

25

Student-Generated Test Questions

Estimated Levels of Time and Energy Required for:

Faculty to prepare to use this CAT	**MEDIUM**
Students to respond to the assessment	**MEDIUM to HIGH**
Faculty to analyze the data collected	**MEDIUM to HIGH**

DESCRIPTION   Most faculty discover early—often as graduate teaching assistants—that one of the best ways to find out how well they themselves understand the material they are teaching is to prepare test questions and model answers. This technique gives students the benefit of that experience—early on and in small doses.

PURPOSE   Student-Generated Test Questions allow faculty to assess at least three aspects of student learning. In these questions, teachers see what their students consider the most important or memorable content, what they understand as fair and useful test questions, and how well they can answer the questions they have posed. This information not only provides direction for teaching but can also alert the teacher when students have inaccurate expectations about upcoming tests. Responding to this CAT helps students assess how well they know the material, and receiving feedback can refocus their studying.

RELATED TEACHING GOALS   Develop ability to apply principles and generalizations already learned to new problems and situations (TGI Goal 1)
Develop appropriate study skills, strategies, and habits (TGI Goal 16)
Learn terms and facts of this subject (TGI Goal 18)
Learn concepts and theories in this subject (TGI Goal 19)
Learn to evaluate methods and materials in this subject (TGI Goal 24)
Develop a commitment to accurate work (TGI Goal 39)
Develop ability to perform skillfully (TGI Goal 43)

SUGGESTIONS FOR USE   Student-Generated Test Questions can be used in any course in which students take tests—if the instructor is willing to include (revised) student questions in the tests or at least to let students know what kinds of questions will be included. This assessment is best administered two or three weeks

before a major test, such as a midterm or final examination, to allow time for feedback and for appropriate adjustments in teaching and studying. Be sure to let students know in advance whether the test will make any use of the questions they generate. If the test does not draw directly on student questions, students need feedback on how closely their questions parallel the kinds of questions they will see on the exam. With careful planning, this CAT can be used to generate questions that students can use in reviewing for tests and that faculty can modify to include in the test.

EXAMPLES

From Principles of Thermodynamics (Engineering)

To get a better sense of his students' level of sophistication, this engineering professor asked the students in his thermodynamics class to turn in three questions they expected to see on the first midterm exam, along with the correct answers to those questions. To his disappointment, most of the students handed in questions that tested knowledge of facts, terms, and principles or very simple problem-solving skills. The professor had much more challenging questions planned for the test; so he decided to give some examples of likely test questions when he gave feedback on their CAT responses. He prepared a handout containing five "prototypical" questions for the first midterm. Although the students were relieved to have this information in advance, they were also quick to let the professor know that they had not yet had any practice in solving these more difficult problems. Their homework and quizzes had all focused on what he had just referred to as "lower-level stuff." Just as he was about to react somewhat angrily to their assertions, he realized that the students were right. That realization led him to revise their subsequent homework assignments to stress "higher-level stuff" and to postpone the first midterm for a week.

From Kierkegaard and Nietzsche (Philosophy)

The requirements for this senior-level course included five short papers and midterm and final exams. Both exams consisted entirely of essay questions. The instructor decided to use this CAT to assess how deeply students were reading the two nineteenth-century philosophers and, specifically, to see what questions the students were asking themselves about the works they read. To that end, she asked the two dozen students each to prepare three potential final exam essay questions and accompanying A + responses. One question was to address a point of comparison between Kierkegaard and Nietzsche; another, to explore a point of clear contrast; and the third, to deal with the influence of both philosophers on contemporary thought.

Since generating and responding to these essay questions required a great deal of work, she decided to substitute this assignment for one of the five papers. The assessment was counted as equal to the other four papers. Students were given either full, half, or no credit for their responses to the assessment, but no grades.

The philosophy professor was impressed by the overall quality of the questions and answers she received, although many students had trouble either locating a point of comparison or posing a good question

on it. In response, she paid special attention to the "comparison" questions in her feedback. Afterward, she selected the four best "contrast" and "influence" questions and one "comparison" question, made some revisions, and added three "comparison" questions of her own. She then gave these twelve to the students as review questions for the final examination. The students were told that the final exam would consist of six questions: two questions out of the four in each of the three categories. She urged them to study in groups to make sure they could answer all twelve of the possible questions.

STEP-BY-STEP PROCEDURE

1. Focus on a test or exam that is at least three weeks to a month away. Decide what types of questions on what specific topics you want students to generate. Imagine that you are writing specifications to yourself about the kinds of questions you want students to create, and write those directions down for your students. If you have already written the test questions, frame your directions so that students will write similar ones.

2. Decide how many questions you want students to generate. One or two questions of any type are usually enough, especially if you want students to supply answers.

3. Explain what you want the students to do, why you want them to do it, how their questions will be used, when they will get feedback, and how writing questions and getting feedback will help them perform better on the test.

TURNING THE DATA YOU COLLECT INTO USEFUL INFORMATION

First, make a rough tally of the types of questions the students propose. How many require only a knowledge of facts and principles? How many require paraphrasing or summarizing? How many require synthesis or analysis? Next, take a quick look at the range of topics the questions span. Are some important topics left out? Are others overrepresented? Then look for questions that are particularly well or poorly written. You may want to create a form or checklist to accomplish the above. On the checklist, you can quickly note the level of the question, relevance of the topic, difficulty, and clarity. As you read, extract a few questions to use as examples in giving feedback. If there are questions that students would benefit from reviewing, read and revise them as necessary and share them with the class.

IDEAS FOR ADAPTING AND EXTENDING THIS CAT

Many students, particularly those in introductory courses, may find it easier to generate test questions if they work in pairs or small groups.

In a large class, you may want to assign specific topics or units to certain groups of students. For example, you might ask students whose last names begin with the letters A–G to write questions on topics covered in the first three weeks of the course.

Prepare a handout of Student-Generated Test Questions for test review and offer suggestions on how best to prepare.

If you are working with students who are planning to become teachers, give them more feedback on the way they asked the questions and the kinds of questions they asked. Engage them in critiquing and revising the questions. Help students see what makes some test questions better than others for promoting learning.

PROS   By generating test questions students can learn what aspects of the course they understand and what aspects they do not understand.

When students suggest test questions and try to predict the actual test questions, they are — in effect — beginning to prepare, in useful ways, for the upcoming test.

Along with its other benefits, this CAT can help avoid unpleasant surprises. When faculty read student questions, they gain information on the class's expectations. As students get feedback on questions they have written, their instructor's plans for the test become clearer.

CONS   Many students will have had no experience in writing test questions. As a result, their efforts may be quite poor. The less experienced the students, the more direction and feedback they will need.

Given the opportunity, a small percentage of students may try to influence the instructor to include easy questions on the test.

Some students will be disappointed not to see their questions represented on the test, or at least on the review sheet.

CAVEATS   Since you cannot predict the quality or level of student questions, do not promise categorically to include them on the test.

Unless students clearly understand the advantages they can gain by creating their own test questions, they may regard this assignment as a thinly veiled attempt to get them to do the instructor's work.

Because this is likely to be a very demanding assessment, you may need to offer students some course credit for completing it. This is the kind of CAT that can reasonably substitute for a homework assignment.