

## Minute Paper

### Procedure

Give students three to five minutes to answer two questions:

- 1) “What was the most important thing you learned \_\_\_\_\_?” (you fill the blank: during today’s class, while doing the homework, while reading the assignment, etc.), and
- 2) “What important question remains unanswered?”  
Students hand in their answers before they leave class. Use this information to find out if students are understating the material in the same way that you intend. If they are not, this information will help you make changes in what you present or how you present it.

## Muddiest Point

### Procedure

This technique is similar to the minute paper. It follows the same procedure as the Minute Paper, but focuses on what students DO NOT understand. Near the end of the class ask students “What was the muddiest point in \_\_\_\_\_?” (you fill in the blank: today’s class, this week’s lectures, the reading assignment, etc.)

Allow students 2-3 minutes to write their answers on an index card or piece of paper, which they hand in to you before they leave class. Use this information to help you decide what to emphasize or how much time to spend when you review material with students in future sessions.

## Combined One-Minute Paper and “Muddiest Point”

### Procedure

- 1a) What is the most important thing you have learned in this course
- 1b) Why?
  
- 2a) What is the 'Muddiest' topic we have covered in class?
- 2b) Did the topic ever get clarified?
- 2c) Can you propose a better way of presenting the material?

## **RSQC<sup>2</sup>** **(Recall, Summarize, Question, Connect and Comment)**

### **Description & Purpose**

RSQC<sup>2</sup> is a simple five-step protocol that guides students' thinking about previously presented material. Engineering faculty have used the entire technique, as well as individual components in their courses. For example, some faculty omit the "comment" step, while others work through only one or two different steps at a time.

RSQC<sup>2</sup> allows instructors to compare detailed information on students' recall, understanding, and evaluation of the class session against their own. It also informs instructors of student questions and comments that need timely responses. This technique also provides students with a comprehensive framework for recalling and reviewing class sessions. It is particularly useful for students who lack preparation in the discipline and for those who lack sophisticated learning and study skills.

### **Procedure**

1. Select which previous class session will be the focus of the RSQC<sup>2</sup> activity and the elements of the RSQC<sup>2</sup> technique that are appropriate for the topic.
2. Write your own responses to the RSQC<sup>2</sup> before you ask students to do so.
3. Recall: At the beginning of the class, ask students to make a list—in words or simple phrases—of what they recall as the most important, useful, or meaningful points from the previous class.
4. Summarize: Direct them to summarize as many of the most important points into one summary sentence that captures the essence of the previous class. Give them one or two minutes to write a summary sentence.
5. Question: Ask them to jot down one or two questions that remain unanswered after the previous class. Again, allow one or two minutes for completing this task.
6. Connect: Ask students to explain—in one or two sentences the connections between each of the main points and the major goals of the course. This task should take an additional one or two minutes.
7. Comment: Invite the students to write an evaluative comment or two about the class. There are a few possible comment themes you can use as starting points: "What helped you learn in this class?" or "What could be changed to improve the class?"
8. Collect the RSQC<sup>2</sup> responses. Let students know what kind of response they can expect from you and when they will receive it.

### **Analysis**

Compare students' responses with your own, note any omissions, additions, and errors in students' lists. Assess the degree of "fit" between your summary of the class and the students'. Look for patterns in their questions and comments. Note which topics or concerns arise most frequently and discuss these with students.

## One-Sentence Summary

### Description & Purpose

This a simple technique challenges students to answer the questions “Who does what to whom?” “When?” “Where?” “How?” and “Why?” about a given topic. They then synthesize those answers into a single informative, grammatical, and long summary sentence.

The One-Sentence Summaries enable instructors to find out how concisely, completely, and creatively students can summarize a large amount of information on a given topic. As the name indicates, this technique requires students to summarize the information within the grammatical constraints of a single sentence. It allows faculty to scan and compare responses quickly and easily. The One-Sentence Summary also gives students practice in using a technique for “chunking” information—condensing it into smaller, interrelated bits that are more easily processed and recalled.

### Suggestions For Use

This assessment technique can provide feedback on students’ understanding of just about any information from chemical reactions to mechanical processes or physical laws.

### Procedure

1. Select an important topic or work that the students have recently studied in your course and that you expect them to learn to summarize.
2. Before asking students to do this assessment, you should answer “Who did/does what to whom, when, where, how and why?” and note how long it takes you.
3. Next, turn your own answers into a grammatical sentence that follows WDWWWHW pattern; again, note how long it takes you.
4. Prepare sufficient student answer forms and your own tally form (see example form on next page).
5. Select a class session in which to conduct the activity; allow your students up to twice the time it took you to carry out the task.
6. Before announcing the topic to be summarized, describe the activity, provide instructions about the purpose of the activity, how long it will take, the kinds of data you expect, and, most importantly, how you will respond to them.

### Analysis of Results

Evaluate each answer with “inadequate,” “adequate” and “more than adequate.” To make the analysis faster and easier, evaluate as you read and simultaneously tally the number of answers under each category. The number of answers in each category of quality will indicate patterns of strength and weakness in the responses. For example, the totals can tell you whether your students are better at answering “who” and “what” questions than “how” or “why” questions.

### Example—One-Sentence Summary

To make sure that her students really understood the definition of “ $\tau_{yx}$ ,” a Chemical Engineering professor asked students to write a One-Sentence Summary. They were asked to summarize the hydroelectric power generation process in one sentence. To help them get started, he provided a photocopied matrix with the questions “What? Does what? To what? When? Where? How? Why?” listed down the left side of the page.

#### For Students

	Who (Person or subject)	Does What	To Whom (Person or object)	When (Condition)	Where (Situation)	How	Why
Student's Answer	<i>viscous shear stress</i>	<i>exert force</i>	<i>a plane perpendicular to Y-axis</i>	<i>flow</i>	<i>X direction</i>	<i>by less Y, on greater Y</i>	<i>transport energy or species</i>

#### Complete Sentence

*Viscous shear stress exerts force on a plane perpendicular to the Y-axis in the X direction by less y on greater y.*

#### For Instructor

	Who	Does What	To Whom	When	Where	How	Why
Inadequate	++++						
Adequate							
More than Adequate		++++					

#### Response to Students

Show students the results of your tally. If the responses indicate that a majority of the class is having trouble with the topic, the instructor may choose to follow-up with an in-class activity that provides students with practice with a particular kind of questions. You might also choose to focus a homework assignment specifically on the misconceptions evident from the student summary activity.

## Student-Generated Test Questions

### Description

One of the best ways to find out how well students understand the material is to prepare test questions and model answers.

### 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 exams. Student-Generated Test Questions help students assess how well they know the material and faculty feedback can refocus their studying.

### Suggestions For Use

This assessment is best-administered 2-3 weeks before a major test, such as a midterm or final exam, to allow time for feedback and for appropriate adjustments in teaching and studying. Let students know in advance whether the test will make any use of the questions they generate. If the test will 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.

### Procedure

9. Decide what types of questions on the specific topics you want students to generate. Imagine that you are writing specifications for yourself about the kinds of questions you want students to create, and write those directions down for your students.
10. Decide how many questions you want students to generate. One or two questions of any type are usually sufficient, especially if students will also supply answers.
11. Explain what you want the students to do, why you want them to do it (e.g. writing questions and answers will help them perform better on the test), how their questions will be used and when they will get feedback.

### Response Analysis

First make a rough tally of the types of questions the students propose. How many require only knowledge of facts and principles? How many require paraphrasing or summarizing? How many require analysis or synthesis? Next, take a quick look at the range of topics the questions span. Are there any important topics left out? Are other's over represented? 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 to students. If there are questions that students would benefit from reviewing, read and revise them as necessary and share them with the class.

### Feedback Options

Ask students to contribute to the analysis of the questions.

1. Redistribute questions to class—give a number of questions to each group of student and ask them to 1) select the best questions and identify the qualities that make it a good question and 2) develop a key for grading the answer (i.e. asks them to identify the critical elements of a good answer.)
2. Show students the tally data and ask them to analyze the topical coverage. Together or in groups, ask students to write new questions to fill the gaps in the range of topics.

## Faculty-Designed Feedback Forms

### Description and Purpose

Engineering faculty can benefit from designing feedback forms that are short, simple, and course-specific to collect information about student learning. Faculty-Designed Feedback Forms can be used in any course to elicit limited and focused responses to specific questions. Feedback forms typically contain from three to five questions in multiple-choice, Likert (ordinal/ranked) scale, or short fill-in answer formats. These formats provide faculty with data that are quickly and easily analyzed and the results can be used to make adjustments during the term.

### Suggestions for Use

To get information early enough to make necessary adjustments, and to track changes over time, instructors should introduce the forms in the second or third week of class. This activity can be then be repeated during the quarter at regular intervals. The best time to administer the activity is the last five to ten minutes of the last class meeting of the week. This procedure avoids derailing other learning activities and allows faculty more time to analyze and summarize feedback before the next class session.

### Procedure

1. Write three to five specific questions about your teaching to which you would like students to respond. Make sure those questions relate directly to your instructional goals for the class.
2. Develop appropriate coded responses (e.g. multiple-choice, scaled, or fill-in; see also, example on next page).
3. To protect anonymity, ask one of the students to collect all the forms in an envelope and leave it in your mailbox.
4. After you analyze the feedback forms, summarize the results for the class and outline the specific actions you intend to take in response to students' feedback.

### Analysis of Feedback

In analyzing students' responses to your feedback forms, give more attention to the direction, intensity, and consistency of the responses, than to their numerical values or means. Numerical responses make it easy to see patterns in the responses across the whole class. For example, if you simply tally the number of students who circled 1, 2, 3 and so on, for each question you can quickly identify areas of disagreement, agreement, or polarization within the class. The comments, though less easily compared, often provide you with the most useful feedback for improving your teaching.

\*Modified from descriptions in: Angelo, Thomas A., and Cross, K. Patricia (1993) *Classroom Assessment Techniques: A Handbook for College Teachers*. San Francisco: Jossey-Bass Publishers.

## Word Summary

### Description

The Word Summary prompts a two-part response. First, the student summarizes a short text in a single word. Second, the student writes a paragraph or two explaining why he or she chose that particular word to summarize the text. The completed response to the Word Summary is an abstract or synopsis of the focus text.

### Purpose

The Word Summary technique enhances engineering students' abilities in reading, writing and memorizing technical information in the following ways. First, it trains the students to read carefully and deeply. Second, it assesses skill and creativity at summarizing what has been read. Third, it assesses the students' skills at explaining and defending the information in a few words. Finally, practice with this Word Summary helps students develop the ability to write highly condensed abstracts and to "chunk" large amounts of information for more effective retention in long term memory.

### Suggestions For Use

The Word Summary is appropriate to use when you expect students to read carefully and thoughtfully, that is, to understand concepts, not simply to memorize information. It works especially well in courses that focus on primary concepts.

### Procedure

1. Choose a concept you want the students to understand.
2. Take a few minutes to come up with a list of reasonable "summary words" for the assigned text. Jot down some notes about the kinds of arguments and analyses you hope students will offer in defense of their word choices. This will serve as a benchmark for you to see whether your expectations for students' arguments are reasonable.
3. Be sure to tell students that the choice of a specific word is less important than the quality of their explanation for that choice. However, you will also want to emphasize that the words they chose must be connected to their interpretations of the text.
4. Give students some examples of what their explanations should contain.

### Analysis

When you read the Summaries, keep track of words that are used by more than one student, or related terms that crop up. Pay close attention to the justifications that students give for their word choices. When possible, categorize Word Summary responses not only by the summary words but also by the types of explanations offered. After analyzing the responses, select examples of three or four different approaches that you can share with the class.

## Half-Sheet Response

### Description

Students respond briefly to the following two questions: “What was the most important thing you learned during this class?” and “What important questions remain unanswered?” Students then write their responses and hand them in.

### Purpose

The Half-Sheet Response provides a quick and extremely simple way to collect written feedback on student learning. 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 students are learning the material.

### Suggestions For Use

Half-Sheet Responses are useful in many different class settings, such as lecture, lecture discussion, lab session, study-group meeting, field trip, homework assignment, or exam. It works well at the end or the beginning of class sessions, serving either as a warm-up or wrap-up activity. This technique can be used more frequently in courses that present students with a great deal of new information.

Because it is quick to administer and easy to analyze, the Half-Sheet Response is also well suited for use in large classes.

### Procedure

1. Determine the focus before deciding when the assessment takes place. If the focus is on students' understanding of a lecture, the last few minutes of class may be the best time. If the focus is on a previous homework assignment, the first few minutes may be more appropriate.
2. Start with the two basic questions, “What was the most important thing you learned during this class?” and “What important questions remains unanswered?”
3. Plan to have 5 to 10 minutes of class time to conduct the assessment; you will want to take about 5 minutes in a subsequent class session to discuss the results.
4. Give students instructions and let them know how much time they will have. Give them an example of the kinds of answers you expect and when they can expect your response.
5. Inform the students that you will respond to the most important or most common questions, not every question. You must also consider letting students know that they can follow-up individually if a specific question is not answered in class.

### Analysis

Tabulate the responses and take notes of any useful comments. Save Half-Sheet Responses from early in the term to compare with the responses at mid term and later. Changes in students responses through time can provide evidence that students are developing critical thinking skills.

### Alternatives

**Muddiest Point:** Ask students “What was the muddiest point in today's class/assignment?” This technique provides information on what students find least clear or most confusing about a particular lesson or topic. Faculty can use the feedback to make teaching decisions about which topics to emphasize or review in the next session.



## Course-Related Self-Confidence Surveys

### Description & Purpose

Course-Related Self-Confidence Surveys, consist of a few simple questions aimed at getting a rough measure of engineering students' self-confidence in relation to a specific skill such as design or problem-solving.

Course-Related Self-Confidence Surveys help engineering faculty assess students' confidence in their ability to learn course-related or disciplinary information and skills. This technique helps engineering students establish confidence in what they already know and make effective use of the knowledge. It also helps them to recognize the weaknesses that they need to emphasize and develop in future studies. Having this information can help engineering faculty effectively structure assignments to build confidence and enhance motivation and learning.

### Suggestions for Use

This technique is useful in courses where students are learning new and unfamiliar skills/knowledge, or familiar skills that they failed to learn previously. To document students' improvement and development, faculty can compare survey results from before new material is introduced and after students are likely to have made significant progress toward mastering it. Conducting these surveys both pre- and post-student learning, helps make their progress more visible to students.

### Procedure

1. Identify skills or abilities that are important to success in the course.
2. Design questions to assess students' self-confidence in relation to these skills or abilities. Be as specific as possible in your questions (see example on next page).
3. Remind students that their survey responses are anonymous.
4. Allow students 5-10 minutes in class to respond to the survey.

### Response Analysis

In analyzing student's responses to the survey, pay attention to the direction, intensity, and consistency of the responses. Summarize the comments from the surveys. From the summary, make a list of things that students can do to help improve students' confidence. Discuss the summary and the list with students and ask them to add items to your list. Ask students to select a couple of items to do and periodically remind them to do the things on their lists. You might also want to check your list when preparing teaching materials.