

## Implementation and Adaptation of the Minute Paper to an Introductory Geology Classroom

I started using both the traditional Minute Paper (Angelo and Cross, 1993) and my own adaptation of the Minute Paper in an introductory geology course I taught at Florida State University. I chose the Minute Paper mainly because of its flexibility and ease of implementation, but I found that with some minor adaptations of the original classroom assessment technique (CAT), I could easily assess individual student learning at the level of each lecture.

Students were extremely receptive to these assessment techniques for several reasons: 1) They got feedback on their questions and answers after almost every class period. 2) They knew that many of the questions I used in my Minute Paper adaptations were concepts that I considered to be significant, and so they served as a sort of ongoing study guide to the course. 3) It allowed every student voice to be heard—by me—in a way that they perceived as being non-threatening (as opposed to, say, calling on a student in the middle of class).

The traditional Minute Paper CAT asks students to synthesize and comment on the most important pieces of each lecture. I used the Minute Paper (or the Half-Minute Paper) CAT on the average of once a week during the course, at the end of lecture. I found it to be most useful when discussing new information, or information that was conceptually difficult for most students, for example introductions to crystal structures or crystal chemistry. What I noticed most frequently about the use of the traditional Minute Paper in these situations was how often my explanations were several orders of magnitude more detailed than what was necessary for general comprehension and how confused lower-level students were as a result. It was easy to revisit these points at the beginning of the next class period.

It is true that students often pick out trivial details to comment on and frequently fail to grasp the important concepts during the lecture. After initial frustration, I started to put an outline on the board at the beginning of the lecture detailing the important concepts I was discussing during the class period. I then referred back to the outline when making major points.

### Minute Paper Adaptation:

I used the traditional Minute Paper at the end of some (but not all) class periods. However, at the beginning of EVERY class period, I did a variation of the Minute Paper that was also very successful. I used the first five-ten minutes of each class period to have students write on questions based on the previous lecture. I usually aimed these questions at the level of “Comprehension” (Bloom’s taxonomy), which meant using questions that started with words like “explain” or “predict.”

### Step-by-step procedure:

1. I put the question up, usually on an overhead as students were coming into class and settling in.

### Sample question:

Explain (in terms of crystal structures) why diamond and graphite, which have identical chemical compositions, have such different physical properties.

2. I asked the students to think about the question WITHOUT looking at their notes or the book and write their best response.

3. I gave the students generally on the order of two or three minutes to think by themselves about the question. Then I asked them to pair up with a partner and discuss their answers for another two or three minutes. I asked them to write their new answers or modify their old answers using a different color pen or different style of writing.

4. As a large group, we had a short discussion (two or three minutes max) about the question. After discussing their ideas with someone else, students were much more confident and willing to voice answers or ideas.

5. At the end of class, each student handed in his or her paper with his or her name clearly marked at the top of the page.

6. I read through each answer to look for the most common errors or misconceptions. I often addressed these in class; however, I think a better (and less time-consuming) approach would be to post this information on an electronic discussion board. This allowed me to assess how well students understood major points from previous lectures.

**Key points:**

Students always received credit for AND feedback on this work (credit was based only on completion and not on the quality of the answer).

One or two questions based on these papers appeared in every exam (and some appeared in more than one exam).

The time out of class was trivial (fewer than ten minutes per class period) and got students “warmed up” for the daily class period.