

# Method for Assessing Course Knowledge in a Large Classroom Environment: An Improved Version of the Minute Paper

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Assessing learning in large lecture based classes is one of the most difficult tasks in teaching. The use of the minute paper provides an easy method for gathering information about student learning. The minute paper uses two brief questions to determine if students have correctly identified the most important topics from a lecture and to determine if they are left with any confusion concerning a particular topic. In addition to its use as an assessment method, the minute paper has numerous well-documented benefits such as increased student self-assessment, allowing students to synthesize and integrate information and think holistically. However, the greatest benefit is its ability to create a better learning environment by enhancing communication between faculty and students. The information gathered in the minute papers can be used not only to determine deficiencies in student knowledge but also to highlight possible weaknesses in lectures, which allows the instructor to refine and strengthen these points for future classes. One of the known weaknesses of the minute paper has been that students sometimes relate only trivial details and not important facts. This limitation seems to have been overcome, in this case, by introducing a third question to the paper allowing students to relate the most interesting fact that they learned from that lecture. We have used a survey to examine many of the reported, but rarely documented benefits of the minute paper. We find that students are very receptive to the use of the minute paper in pharmacy courses. They feel that it increases their understanding of difficult material and improves student-faculty communication. The survey also reveals that students would like to see the minute paper used in other pharmacy courses.

## INTRODUCTION

Classes with large numbers of students (greater than 100) that are primarily lecture-based comprise a large percentage of introductory courses in the pharmacy curriculum at the University of Georgia. However, the intent of this article is not to discuss the relative merits of lecture-based courses in pharmacy programs, rather the aim is to discuss how best to study student learning in such an environment. The primary tool that is presently used is the test. While there can be little doubt as to the effectiveness of testing for determining the understanding of students, this method of assessment does not help to highlight or correct deficiencies in student knowledge prior to a grade being assigned. In addition, tests strongly bias the learning of students. All faculty have experienced this when hearing students ask, "Will this be on the test?"

Ideally, one would hope to be able to correct student misconceptions at the earliest time, without having to resort to levying a grade, and in the most time effective method for the instructor (*i.e.*, not having to tutor each of the students individually). One of the most successful and often used methods to date is the "Minute Paper."<sup>(1)</sup> This assessment tool has many positive aspects such as minimal effort on the part of the faculty member in terms of preparation, implementation and analysis and minimal effort on the part of the students to complete. These factors greatly contribute to the overall success of this technique. In general, the minute paper consists of some variation of two questions: (i) What was the most important

piece of information you learned today? and (ii) What was the most confusing point from today's lecture?

The minute paper was first reported by Weaver and Cotrell<sup>(1)</sup>. They felt that it was a valuable tool in lecture type classes as it made the students feel more involved in their education. After this initial report, the minute paper was briefly mentioned in a number of other articles<sup>(2,3)</sup> leading to an excellent report on the merits and limitations of this technique by Angelo and Cross<sup>(4)</sup>.

The advantages of the minute paper are that it can provide immediate feedback to the faculty member, and these responses can be rapidly read and tabulated. It is believed to encourage active listening<sup>(1)</sup>. In fact, one study has shown that the use of minute papers leads to a 6.6 percent across the board increase in student performance<sup>(5)</sup>. By relating the results of minute papers back to the class, students are able to compare themselves to their classmates<sup>(6)</sup>. Perhaps the most important advantage of the minute paper is that it allows a faculty member to demonstrate respect for and interest in student learning and in this way encourage student-faculty interaction during lectures, which is often very difficult to initiate in large lecture classes<sup>(4,5,7,8)</sup>. However, there are disadvantages associated with the minute paper such as students confusing trivial details

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with significant themes and the loss of class time spent on review of previous material(1,4).

The two questions in the minute paper allow for the instructor to assess two basic issues. First, are the students concentrating on the correct topics, and secondly, are there any topics which may have confused a significant portion of the class. While clearly, one cannot possibly address all of the students' concerns from a given day, the minute paper does allow for rapid response to confusion by a significant number of students. The speed of responses to minute papers can be increased if the information collected from students and replies from the instructor are made electronically(9). However, this approach may decrease the interpersonal communication benefits of the minute paper. A final added benefit is that an individual instructor can refine their lectures in response to the students' input. These refinements may be in terms of insuring the proper highlighting of what the instructor feels is the most significant concept in a given lecture and perhaps strengthening any perceived weaknesses in the lecture in terms of both presentation and the connection of ideas.

## METHODS

### Administration of Minute Papers

We have been using the minute papers for four years in the first year pharmacy course entitled Biochemical Basis of Drugs and Disease. The course is designed to teach the basic biochemical pathways necessary for later courses such as medicinal chemistry and pharmacology. The course also provides an opportunity to introduce the students to many of the diseases that they will see in their pathophysiology course and to drugs that will be taught in many other courses such as infectious disease, chemotherapy, disease state management and medicinal chemistry.

There are approximately 100 students in the class. The students are divided up into 5-6 sections of 14-20 students. In order to lessen the burden on the instructor and the students, only students from one section are required to turn in minute papers on a particular day. Therefore, this technique involves a sampling of the students. The students are asked to put their names and student identification numbers on the top of a sheet of paper and the answers to the minute paper questions and to turn them in to the instructor at the end of class. In order to ensure compliance the minute papers count as a small percentage (four percent) of the student's final grade in the course. This format does allow for the minute paper to be used to determine student attendance. It would be especially effective if the students did not know which group was responsible for turning in papers on a given day. However, it has been shown that using minute papers as an attendance technique lessens its impact as a teaching aide(1). Therefore, at the beginning of the course the schedule of which groups would be responsible for turning in minute papers on each specific day was announced.

### Construction of the Minute Papers

The first year that minute papers were used, they consisted of two questions: (i) what was the most important fact that you learned today; and (ii) what was the most confusing point of the lecture. While the construction of the minute paper with this format seemed a logical starting point based upon the literature, students had difficulty answering the first question and often confused it with what they felt was the most interesting part of the lecture. Since the students seemed to enjoy relating their favorite parts of the lecture, and this information was also valuable in the construction of lectures, the second year the format was changed to include a third question. This question asked, what was the most interesting fact that you learned

**Table I. Student responses to positive aspects of course**

Year 1 (n=62)	Year 2 (n=56)
1. Minute Papers - 41	Minute Papers - 23
2. Good Use of Audiovisual Aides - 17	Clear Explanations - 23
3. Clear Explanations - 15	Material Interesting - 15
4. Well Organized-12	Well Organized - 11

today. With this third question in place the students were better at providing the expected responses to all of the questions.

### Study Setting and Design

Initially, feedback about the course was obtained from students via a mid-term evaluation. This evaluation asks students, in an open-ended format, to relate the positives and negatives of each course they are taking that semester. Students were later asked to complete a ten-question survey related to the minute paper (see Appendix). The survey used the standard five-level Likert scale for the responses. The purpose of the survey was to assess some of the strengths of the minute papers that have been previously mentioned in the literature. In addition to the survey questions, the students were asked to provide their gender and whether they possessed a college degree prior to entering pharmacy school. Forty-nine males and one hundred twenty-seven females responded to the survey. The survey was given to two separate years of pharmacy students in the spring of 2001. A group of eighty-five students had recently complete the course that used the minute paper, while the second group of ninety-two students had not been exposed to the minute paper for the previous twelve months. Of the one hundred and seventy-nine students completing the survey, forty-seven had a previous degree, one hundred twenty-eight did not have a previous degree and four students did not answer this question.

## RESULTS

The use of the three-question format for the minute paper has greatly improved the quality of information obtained from this technique. When using the two-question format the majority of students would report what they found to be the most interesting. The addition of the third question allowing the students to report the most interesting point from the lecture has caused an increase in the quality of information for the instructor obtained from the minute paper. It is easier to determine if the students are focussing on the major points of the lecture and it is easier to see that they understand the applications of the material, which they will often answer as the most interesting point of the lecture.

### Student Reactions to the Use of Minute Papers

Feedback about course was obtained from students via two methods: a mid-term evaluation and a survey. The mid-term evaluation asked students, in an open-ended format, to relate the positives and negatives of each course they are taking that semester. The survey was administered to students after they had already completed the course

Table I shows the students responses from the mid-term evaluations from the first two years that the minute paper was used in this course. In both years, the use of minute papers was cited most frequently as a positive aspect of the course. Another interesting point to note is the dramatic increase from year 1 to year 2 in the number of people citing clear explanations as a positive aspect of the course. We believe that this is related to

**Table II. Student Responses to Survey Concerning Use of Minute Paper**

	N	Mini- mum	Maxi- mum	Mean	SD
Question 1	178	1	5	4.53	0.77
Question 2	179	1	3	1.27	0.55
Question 3	179	1	5	4.28	0.82
Question 4	178	1	5	1.94	1.00
Question 5	179	1	3	1.52	0.66
Question 6	179	1	3	1.64	0.68
Question 7	179	1	3	1.16	0.44
Question 8	179	1	5	4.72	0.67
Question 9	177	1	5	4.70	0.70
Question 10	177	1	5	4.66	0.74
Gender	176	1	2	1.72	0.45
Prev. Degree	175	1	2	1.73	0.44

the lectures being restructured in response to student feedback from year 1. For two years of data, the most frequent response to the question involving negatives of the course was that no changes were needed. Additionally, in both years the minute papers were not cited by any students as a negative aspect of the course.

The results of the minute paper survey are shown in Table II. The results from the survey show similar findings to the mid-term evaluation. Survey questions were initially evaluated using simple descriptive statistics. The results of questions 1 and 9 show that the student's feel that the minute papers improve their understanding of difficult material and that they find the minute paper to be beneficial. Questions 2, 4 and 5 deal with the way that the answers to the minute papers are revealed to the students. The students feel that going over the results from the previous lecture at the beginning of class is a valuable use of lecture time. The students did not favor using e-mail to relay the results of the minute papers versus covering the results during class time as recommended by Chizmar and Walbert(5). The students were exposed to e-mail responses several times per semester to cover the last minute paper prior to an exam. The results from the minute papers are tabulated and presented to the students each day and then selected topics are covered. The students responded that they prefer to see other students' responses, which is consistent with the findings of Olmstead(6). The students responded overwhelmingly in question 6 that the minute paper increases the likelihood that they will ask questions, as reported by Angelo and Cross(4).

One of the aspects of the minute papers that is often touted in the literature (4,5,7,8) is that it demonstrates the interest of the instructor in the success of the student. The response to question 8 confirms this benefit. Questions 7 and 10 show that the students enjoy having the minute paper associated with this class and that they believe that it should continue to be used in this class. Finally, question 3 shows that the students believe that the minute paper would be useful in other pharmacy courses.

The data was further analyzed using one-way ANOVA's. The analysis of the survey showed a gender bias in question 6 in that women feel more strongly ( $P<0.01$ ) that the use of the minute paper encourages students to ask questions.

## CONCLUSIONS

The minute paper is an effective method for aiding student learning in the large classroom environment. Benefits of the minute paper include that it takes little effort on the part of both

students and faculty to supply and evaluate the data. Students feel that the minute paper improves their understanding of difficult material and that it is an effective use of class time. The minute paper creates improved student-faculty relationships due to students' perception of the faculty taking an active interest in student learning. This improved relationship leads to students feeling better about asking questions in class as they feel that the instructor is more receptive. This relationship is much more difficult to achieve in the large classroom environment. The use of a third question in the minute paper allowing the students to describe the most interesting point from the lecture has improved the quality of the student responses. Students appear to be excited by many examples and want to share their enthusiasm by relating this type of information to the instructor. Therefore, providing a third question allowing the students to describe the most interesting point of the lecture has caused a significant increase in the quality of responses for the most important point of the lecture.

The daily use of the minute paper does adversely affect the amount of material that can be covered in a given course. The review of questions arising from the minute papers from the previous lecture will take on average 5-10 minutes at the beginning of each class period. Over the course of a semester the review of minute papers will reduce the course by several lectures. However, the overall benefits of the minute paper far exceed this loss of course material.

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## APPENDIX. STUDENT SURVEY

Circle the number that best describes your response to the question.

1 – Strongly Disagree, 2 – Somewhat Disagree, 3 – Neither Agree or Disagree, 4 – Somewhat Agree, 5 – Strongly Agree

1. The Minute Paper improves understanding of difficult material  
1      2      3      4      5
2. The Minute Paper detracts from valuable lecture time  
1      2      3      4      5
3. I think that the Minute Paper should be used in other pharmacy courses  
1      2      3      4      5
4. I would prefer if the responses from the Minute Paper were done by e-mail  
1      2      3      4      5
5. I don't gain any benefit from seeing the other students responses to the Minute Paper  
1      2      3      4      5

6. If we did not use Minute Papers I would be just as likely to ask questions in class  
1      2      3      4      5
7. The use of Minute Papers should not be continued in the course  
1      2      3      4      5
8. I feel the use of Minute Papers demonstrates the instructors interest in my learning  
1      2      3      4      5
9. I think the use of the Minute Paper is beneficial to this class  
1      2      3      4      5

10. I like having the Minute Paper included as part of the instruction in this class  
1      2      3      4      5

**Demographic Information**

Sex      M      F

Do you have a previous college degree?      Yes      No

If you answered yes to the previous question, what was your degree in? \_\_\_\_\_

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