



INNOVATION ABSTRACTS

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STUDENTS' QUESTIONS OPEN NEW PATHS TO EXPLORE

In "Mathematics for Elementary School Teachers," a course for pre-service teachers, I decided that the homework would always be the same. The students would ask three questions using the following format: "My question is..." and "I ask it because..." The questions would stem from the material of the day, and students were free to ask about any topic covered in class.

I wasn't quite sure how this would work, nor exactly what to do with it. Obviously, I couldn't grade their homework in the traditional sense. First of all, the novelty of the assignments would require students to make quite an adjustment, and I felt grading their work would be more a subjective, judgmental assessment, which wasn't my intent.

I was absolutely amazed at the range and depth of the thinking that went into students' questions. In some cases, their questions anticipated an extension of the topic covered, leading me to reconsider how to construct the next class. In other instances, there was overlap. But in every case, students had unique perspectives that reflected their concerns, interests, and intuitions about the topic.

The students keep their questions and my responses in a folder that they hand in at the end of the term. I will guide them to examine the evolution of their thinking about math topics, how they are responding to their growing knowledge and skills in mathematics, and how it affects their thinking about themselves as teachers of mathematics. For example, I introduced them to the binary system through an activity designed to have them talk about different base number systems in the context of place-value systems. Beyond the typical questions about the daily utility of the binary system, there were questions such as "Are there decimals in the binary system?"; "Why teach two ways to convert between base systems?"; "What base system is time?"; and "Are there bases greater than base-10?" As another example, a student asked, "What's the point of fractions?" Although this might seem like a simplistic, perhaps antagonistic and hostile question, it's not. It generated much discussion and led us to consider the merits of the metric system, which is easier to understand and do operations with using

decimal notation rather than fractions. Furthermore, one student had done some research for an English paper and educated all of us on why the United States chose not to adopt the metric system.

The essence of this idea is that I have created an individualized dialogue with each student and can reply in kind with questions to their questions, pushing them to do more reading, exploration, and research on their own. Although there is the common core of information that all will experience, their questions have and will continue to reflect individual paths to understanding math in a way that they had not previously considered.

I am delighted with the apparent success of this approach and it has stimulated a considerable amount of classroom discussion. When I hand the homework back, I allow them to read my replies and ask further questions in class. I also make a list of the questions I want to discuss, so we have an outpouring of ideas that would, in my view, otherwise remain unvoiced.

The bottom line is that the class has been transformed into a seminar-style, student-directed "multi-logue." I would not have anticipated the subtlety and sophistication of the questions and the discussions. There has been an evolution in their thinking as well as mine. Somehow, treating these community college students as if they were in a graduate school seminar elevated their approach to understanding mathematics. In addition, I am learning more about students' thinking and their range of math concerns with this three-question homework format than I would have learned by the traditional approach of lecture, discussion, activities, homework, and quizzes. I am not anti-traditional, but rather, pro-awareness beyond the traditional.

This piece of serendipity will guide my thinking about introducing the same concept into my other courses. I suspect that it would have to be a much more limited approach because the curriculum must be addressed, particularly in courses such as pre-algebra where some foundations must be established in order for students to be successful in algebra.

Mark Schwartz, *Instructor, Mathematics*

For further information, contact the author at Southern Maine Community College, 2 Fort Road, South Portland, ME 04106. Email: mschwartz@smccme.edu