Content Mathematics Course for Elementary Teachers

Paul Hartung
Elizabeth Mauch
Bloomsburg University of Pennsylvania

Abstract
Bloomsburg University revised their mathematics for elementary education majors course so that it would be more meaningful to elementary education majors. A three-tiered approach was utilized to obtain this goal. First, updates were made to the course to reflect a new standardized test given in the state of Pennsylvania. Second, a gateway exam was given so students who were not prepared for the course could move to a more appropriate course. Third, the entire mathematics department was brought on board to understand the importance of the course.

Bloomsburg University’s curriculum includes a mathematics content course especially designed for elementary education majors. Most elementary education degree-granting institutions, especially those in the State System of Higher Education, are likely to have such a course. For many years this course, Mathematics for Elementary Teachers, was taught by mathematics professors who did not enjoy teaching it and elementary education majors who loathed taking it. The course was such a drain that untenured faculty refused to teach it for fear of bad teacher evaluations. At Bloomsburg University, we have created a course that mathematics faculty enjoy teaching. Moreover, our students have begun to appreciate the course, as is evidenced by evaluations at the end of the semester. We have transformed this course with a three-way approach. We began by partnering with area elementary education teachers in the renovation of our course. We used innovative ideas in the formation of this new course, which captured the attention of other faculty members. Finally, we overhauled the course so that each student who passed it had content knowledge to teach any elementary grade. Each of these pieces has helped to make a course that is fun to teach and beneficial to students.
We began our partnering process with area elementary teachers by visiting their sites, examining the math textbooks they used, and having them review materials for Mathematics for Elementary Teachers. We first discovered that elementary mathematics is not what we remember from our own experiences, and we have adjusted Mathematics for Elementary Teachers accordingly. The major change has been our emphasis on problem-solving techniques. In the state of Pennsylvania, there is a new generation of standardized mathematics test – called the Pennsylvania System of School Assessment (PSSA) Mathematics Assessment. This test reflects the standards of the National Council of Teachers of Mathematics (NCTM) and problem solving is strongly emphasized. The PSSA is broken up into two portions – enhanced multiple choice and open-ended questions. The enhanced multiple-choice questions are one-step word problems where the student is given a choice of four answers. The open-ended questions involve multiple-step problems where detailed explanations are required for full credit. The test is given in the fifth, eighth and eleventh grades, with a third grade version in the works. As a direct result of this test, elementary schools in Pennsylvania have had to change the way students are taught in all elementary grade levels, because mastery of the necessary skills can take years. Since most of our elementary education majors at Bloomsburg University have had no real exposure to solving these problems, we emphasize problem solving for the first five weeks of our sixteen-week course. We model solving word problems in ways appropriate to the elementary classroom. We have also used problems from past PSSA Mathematics Assessments. In this way, we show our students that the material we are covering and the techniques we employ will be valuable tools in their classrooms.
The content of the course was not the only hurdle we had to get past. We realized that teaching elementary education majors must be highly valued, not only by the faculty teaching the course, but also by the rest of the mathematics department. All in the department must have an understanding that although much of the content in the course is aimed at the elementary experience, it is aimed that way so that future teachers see the beauty and utility of mathematics. Many of the concepts that we teach speak to a real understanding of why mathematics works the way it does. Other mathematics faculty members at Bloomsburg University showed an interest in what we were doing in this course when we created a “gateway exam” that all of our students had to take and pass to pass this course.

The gateway exam is an exam that covers basic concepts that are covered in most fourth and fifth grade textbooks. There is a sample copy of this test at the end of this paper. Although we had many bright students who could grasp the concepts we were teaching, we also had many students who were not able to complete basic mathematics facts, even with a review of how these problems were solved. This caused difficulty when students tried to answer other higher-level problem-solving questions. To combat this difficulty and to get those students into a more appropriate course, we began giving the gateway exam. Students were given up to five attempts to pass the test. One must complete eighteen out of twenty problems correctly to pass the exam. Typically half of the students pass on the first try, and half of the rest pass on the second try. Students tend to move to a more appropriate course if, after three or four tries, they are still getting a significant number of problems incorrect. This type of test has caught the interest of
several other members of our department. They have asked us how they can create a gateway-type exam for everything from College Algebra to Differential Equations.

Because of the gateway exam, students have begun to accept responsibility for doing these gateway problems correctly. The students realize that they should be able to do these problems and work hard to combat any deficiencies. Because we are able to show them that these problems are coming from textbooks that they will be teaching from, students see how important these questions are to their future jobs. Because students have spent time learning these concepts on their own, we have class time available for discussions regarding the techniques for solving these problems. Once students know that they need to get common denominators to add fractions, the real question is why. Given the types of questions asked of elementary school students on the PSSA Mathematics Assessment, these related discussions will be useful to our students when they become teachers themselves.

In the final analysis, this course has raised the bar for what our elementary majors know with regard to mathematics. We have created a course that strengthens the mathematics skills of the elementary education majors who pass through our classrooms. We feel that our students are on the path to helping their own students understand mathematics better. We are still on the path to creating a better course, but we feel that we have chosen the right path to travel.
References:


