

The Impact of PMET on math and science pre-service teachers.

By Nancy Ruppert, UNC-Asheville

During PMET workshops in North Carolina, mathematicians and mathematics educators came together to look at programs, activities, and the integration of mathematics and science.

Following these workshops, I began working with the physics instructor at my university. We are the coordinators of our respective licensure programs (mathematics and science) and each of us teaches the “capstone methods course” to pre-service teachers. At our institution, these courses involve methods, management, and field experiences that prepare candidates for student teaching. Before we began working together, methods professors in each of the disciplines (Language Arts, Drama, Art) had not communicated with each other about the courses, common experiences, or expectations.

By collaborating together in planning for the methods courses, we were able to give our students ideas and procedures for integrating mathematics and sciences in their classrooms. We also were able to use resources from other methods courses to strengthen the courses we designed. In addition, we believe we became better teachers. The following description summarizes the steps we took, an evaluation of the project, and an overview of the products we created together to improve the teaching of mathematics and science for pre-service teachers.

Step 1: Seek Common Grounds

When we began to plan our methods courses, we started by finding out where our courses overlapped. We looked at the State Standards that are required for mathematics and science licensure candidates. We found that while our state requires that very specific content be covered in both mathematics and science, there are common expectations as well: Candidates in all licensure areas are expected to be able to integrate technology, focus on historical perspectives, communicate and participate with families and community, understand the diverse needs of learners, manage children, apply best practices, plan lessons and units, and – for math and science – apply the process skills of inquiry, communication, representation, problem solving, and making connections. We were surprised to discover that our two areas had so much in common.

Step 2: Format the Courses

Fortunately, we had a small number of participants – 16. We worked with our department heads to arrange for the two courses to be offered at the same time so our students could occasionally meet as a group. We required our students to work as math/science teams so they could exchange ideas about best practices, including strategies that work with diverse learners. We also brought

both groups together to discuss classroom management and procedures that are generic to teaching. We found that discussions were richer than relying on students to describe past experiences – partly because of the small number of participants, and partly because our students had studied different fields. In total, we were together for eight of sixteen sessions.

Step 3: Develop a Common Field Experience

During the planning process, we developed a co-teaching model with gifted teachers at a middle school. In the capstone courses, students must work with a class throughout the semester, develop a two-week unit, and implement three days of the unit. Designing and implementing units for the first time can be difficult for pre-service teachers. In addition, our students are teaching “solo” for the first time; so if there are problems, they may not be visible until late in the semester. Our students were placed with a teacher at the beginning, and then worked with him or her throughout the semester.

To help improve students’ abilities to plan lessons and actually stand in front of students and teach, we wrote and received a university research grant to plan a co-teaching model with local teachers for our methods students. We worked with gifted teachers at the local inner-city middle school to develop a two-week unit using the CIESE (Center for Innovation in Engineering and Science Education) project called “The Noonday Project.” This is a technology-based project in which students from all over the world can submit data and information. The information is then used to calculate the circumference of the earth using geometry that Eratosthenes used in 220 b.c. We used this resource and developed additional lesson plans for middle school students to learn how to measure the circumference of the earth. We followed a “unit plan template” that was being used in the other methods courses at our institution and presented this unit to our pre-service teachers as a model for developing a unit and lessons.

The pre-service teachers practiced the lessons and actually taught the unit with us during the first half of the semester. The pre-service teachers indicated that they learned about gifted students, how to manage children, and the relationship between lessons and a unit. We saw them gain more confidence and become more assertive. Initially, they were somewhat apprehensive about working with middle school gifted students; but by the end, they told us that they had enjoyed working with them and were surprised at how responsive the children were.

After the co-teaching experience, pre-service teachers developed units and taught three days of their unit to students they were assigned to for the following semester. The units were more connected and the quality was better than that of lessons that had been created in previous years. The co-teaching experience showed students what a lesson plan looked like and its value. In addition, because they had worked with the middle school children early in the program, the pre-

service teachers were not as anxious about working with the students they worked with during their unit.

Step 4: Evaluate the Experience

At the end of the project we invited our students to share what they thought about having these courses taught together. Their responses were mixed. They liked the conversations that took place and the chance to plan activities together, but they wanted more time to learn about specific strategies for teaching either math or science. They said they understood the need to integrate math and science, but they weren't sure how comfortable they were doing this all the time. They felt like we spent too much time talking about management and diversity.

We agreed with our students. We felt like we didn't accomplish as much working with one another as we did when we worked alone. We also found that teaching together took a lot of time. We met before each class and we met after the class to reflect on the experience and to revise our plans for the following classes. We talked a lot about our students and what they needed. However, we believe the collaborative experience made our individual courses stronger. While the evaluations of the courses were not as positive as we had hoped, we believe the experience was very valuable to us as instructors and that our students now receive a better experience.

Summary

The PMET focus of mathematicians and mathematics educators working together gave us the idea to work together. We were able to create a course in which mathematics and science educators worked together side by side for a semester. Students saw us as colleagues. We took our students with us to present the co-teaching project at State, regional, and national conferences. We also had articles published about the co-teaching experience. In addition to this project, we have worked on a project that integrates mathematics and science with weather (using Weatherbug.com), and we are designing an inquiry course that looks at the relationship between physics experiments and mathematical for future teachers.

While we believe our courses are better, we have also been able to help the other methods instructors design common rubrics. Accreditation in our state focuses on common practices and collecting, analyzing, and using data to improve programs. Because our unit rubric was also used in other courses, we were able to show colleagues how to use the data to evaluate candidates at the unit and at the program level. Collaboration has not only allowed us to create integrated experiences for our students, and influence what is happening in the college of education, it has also given us with the opportunity to make our respective courses better.

Biographical Information

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