

Using Mathematical Research as a Professional Development Technique

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Abstract. University and middle-school mathematics faculty design and implement three research activities: studying division of fractions, understanding the concept of zero, and investigating continued fractions. We describe the structure of these mathematical explorations and several of the benefits. This article presents an overview of the project.¹

To provide both professional development and a hands-on mathematics laboratory to four schools in the Baton Rouge and Hammond areas, the Departments of Mathematics at Louisiana State University and Southeastern Louisiana University entered a partnership. An essential component of the project was providing each of the four schools with a “math lab” consisting of materials and space needed to conduct hands-on learning was. Each university would then work with two of the participating schools by providing professional development for participating teachers. These measures, providing materials and assistance in implementing their proper use, were standard professional development practices, although the materials for the “math lab” were extensive.

The uniqueness of this program was offering the participating teachers the opportunity to conduct mentored research in mathematics. According to the NCTM “To be effective, teachers must know and understand deeply the mathematics they are teaching and be able to draw on that knowledge with flexibility in their teaching tasks.”

¹ Descriptions of the specific university and middle-school mathematics faculty interactions are discussed in manuscripts by each of the authors of this overview. The manuscript by Dr. Schultz is included in this current issue of the LATM Journal. Manuscripts by Ms. Kirkpatrick and Dr. Pedersen will appear in future issues of the LATM Journal.

(NCTM 2000) Research supported by the Office of Educational Research and Improvement, U.S. Department of Education. on professional development stated that “*Professional development should provide opportunities to engage in developing a theoretical understanding of the knowledge and skills to be learned.*” (Hawley and Valli 1999). A major goal of this project was to provide the participating teachers with research based experiences. The project developers felt that by participating in research, applying their new knowledge to actual lessons, and piloting these lessons with small groups of students the teachers would not only gain deeper understanding but would be able to more effectively transfer new knowledge to the classroom.

The concept of having in-service teachers participate in mathematics research produced some interesting questions. What type of research would be appropriate for the participating teachers? How would the participants demonstrate their effectiveness in taking what they learned back to the classroom? How do we evaluate the overall effectiveness of this approach to professional development?

The summer research component was conducted over a five week period in June and July of 2003. Louisiana State University faculty members worked with teachers from the Baton Rouge Magnet High School and Sherwood Forest Middle School. Southeastern Louisiana University faculty members worked with participants from Hammond Westside Upper Elementary and Springfield Middle School.

Dr. Katherine Pederson, Ann Kirkpatrick, and Dr. Lou Schultz of Southeastern Louisiana University’s Department of Mathematics mentored the five teachers from Hammond Westside Upper Elementary and Springfield Middle School. All three of the faculty members had previously worked with the participating schools during early

components of the “math lab” project. The first decision made was how to separate the five participants into research groups for maximum effectiveness. This was accomplished by taking into consideration each participant’s formal mathematical training, grade levels taught, years of experience, and classroom observations by a university faculty member.

The summer research component was a five weeks program broken into two sections. During the first two week segment the participants periodically met with their mentor, decided on their research question, conducted their research, and prepared a report on their research. At the end of the first two weeks all of the participants and university faculty met at Springfield Middle School where each group presented their research and received feedback from the entire group. The second segment was three weeks long and was directed toward the groups refinement of their research and development of grade appropriate lesson plans. In the middle of the third week the participants and faculty members met at Sherwood Forest Middle School in Baton Rouge. Each group presented their lesson and received feedback from the other participants and university mentors. The final meeting was held at Springfield Junior High school where the participants taught volunteer 7th and 8th grade students their lessons in a simulated classroom setting. The students were placed in groups which rotated so that each student participated in two lessons. At the end of the day the project teachers and staff met for a final critique of the entire project from research to classroom implementation.

The teachers from Westside Upper Elementary and Springfield Junior High were divided into three groups for the research portion of this project. The following is a summary of each group’s progression through the six distinct parts: 1) selecting the

research question, 2) researching the question, 3) analyzing the research results, 4) reporting the process and results, 5) incorporating this newly gained knowledge into an appropriate lesson, and 6) testing the lesson using students.

This project surpassed our expectations. It provided an opportunity for teachers to explore mathematical concepts in a new and rewarding manner. It showed that research is not only a means of adding to the existing knowledge pool but is also a very effective teaching tool. In depth knowledge provides a mastery that instills confidence in the instructor.

The teachers working with fractions commented on their growth as teachers and the fact that their students would benefit from their new insight. They believed that their research would enable them to add conceptual understanding to mathematical operations involving fractions. The teachers investigating zero left the program with a newly found excitement for math, learning, and teaching. Their excitement has poured over into their teaching as evidenced by classroom observations by the university faculty. They have incorporated the concepts of discovery, exploration and questioning in their teaching of mathematics and science. The teacher who investigated continuing fractions saw new connections to familiar concepts and a renewed value in different approaches to the understanding of a mathematical concept.

The university mentors came away with an excitement produced by the sharing and discovery of new knowledge. As one mentor said, "This was one of the most exciting mathematical experiences of which I have been a part of." The collegiality created by sitting around discussing mathematics with other university faculty and the teacher participants was a high point of the project and has continued after the project. Another

realization was how much influence the pre-service university faculty member has on the classroom teacher years later. This influence includes but is not limited to content knowledge, pedagogy, and conceptual connections. Each of the university faculty members commented on the fact that this project has re-energized their belief that as teachers we must stress the importance of conceptual understanding and not just getting the correct answer to a problem.

All of the educators involved in this project have benefited from their participation regardless of the level they teach. There is a new bond between those involved and a step has been made toward the removal of the barrier between the various levels of mathematic instructors. One teacher who started out being intimidated by working side-by-side with a “college professor” now realizes that we only succeed by working together and that we all have something to contribute to improving mathematics education.

We appreciate not only the time that the classroom teachers put into making this project successful but also their willingness to share strengths and weaknesses in order to improve their teaching.

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