Mathematics Education Independent Study

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Abstract
A pre-elementary education student at West Virginia University completed an independent study on mathematics anxiety, which included reading research articles, keeping a journal, completing a research project, and writing a paper. This article will discuss details of the project and results from a survey that the student completed. In particular, the researchers found that writing a paper incorporating reviews of research articles relevant to the student was especially beneficial. However, this research supports recommendations that students need a support system before beginning similar projects.

Introduction
There have been calls for change in teacher education. For example, Nyaumwe, Mtetwa, and Brown (2005) open a debate about effective mentoring of preservice teachers. The National Council of Teachers of Mathematics (NCTM) states that “effective teaching requires knowing and understanding mathematics, students as learners, and pedagogical strategies” (2000). Furthermore, other research highlights the critical role of content knowledge, pedagogy knowledge, and pedagogical content knowledge in developing mathematics understanding (Fennema, & Franke, 1992). In addition, Wu (2004) suggests that professional development of teachers that includes pedagogical content knowledge is necessary for effective teaching. Efforts have been made to define exactly what should be included in preservice teacher education. Mohr (2006) describes current research on the subject and suggests that teacher preparation should be grade specific.

Recently, there has been a push to include mathematics education research in the preparation of teachers. For example, the NCTM professional guidelines (2000) state that preservice education teachers should learn about mathematics education research and methods to ensure continued study of mathematics for students of all backgrounds. Research by D’Ambrosio and Campos (1992) shows that encouraging prospective teachers to reflect on research about students’ learning helps the teachers to be more sensitive to the needs of students and to assess students’ understanding. Meel (2002) states that understanding students’ difficulties “…affects the choices a teacher makes about what to teach, how to teach it, how to organize the classroom, what techniques to use, how to individualize instruction, and what modifications will be made.”

For these reasons, the authors were interested in working with an education major on a project combining mathematics education research and practical skills for the mathematics classroom. Early in 2004, fliers were posted advertising the independent study (IS). At the time, Ann was a student in the first author’s College Algebra course and a preservice elementary education major. Due to mutual interest, Ann and the first
The author decided to work on a 2 credit IS project together and set up a meeting. The general guidelines for the IS were set out at this initial meeting. Several research topics were discussed, but Ann felt the most interested in mathematics anxiety; Ann felt that she suffered from mathematics anxiety herself. It was decided that the project would include reading research articles, keeping a journal, attending weekly meetings and monthly mathematics education research discussions in the department, completing a research project, writing a final paper, and giving a talk at a regional Mathematical Association of America (MAA) meeting. Early in 2006, Ann completed a survey about her experiences during the IS. This article discusses the specifics of the project, as well as Ann’s reactions to the IS.

Journal and Research Readings
During the course of the IS, Ann kept a journal. In weekly meetings, the first author would give Ann assignments for the week, often including journal prompts. Ann was also encouraged to write whatever she wished in the journal; she reacted to many aspects of the IS and commented on the approximately 10 research articles related to mathematics anxiety that she read. The first author had suggested some research articles, and Ann found some articles herself. Articles pertaining to preservice elementary education students were of special interest to Ann.

Ann often used her journal to reflect on her own feelings of anxiety surrounding her past and current mathematical experiences. For example, Ann wrote a mathematical autobiography describing positive and negative experience with mathematics starting in second grade. In particular, Ann noted that she avoided math classes her senior year in high school and her first two years of college. When asked in a journal prompt what she hoped to get out of the IS, Ann stated, “In addition to trying to prevent math anxiety, I hope to gain knowledge about math in general that will help my in my classroom someday.”

During the IS project, Ann was enrolled in trigonometry and physics courses, and she often used the journal to work through frustration from those classes. Ann also struggled to use what she was learning about math anxiety in her own studies. For example, in her journal, Ann wrote about her second trigonometry exam, “I tried to control my anxiety…I arrived early to review, took my time during the test, and re-checked my answers.” When she was stressed about upcoming exams in those classes, Ann wrote, “This is harder to overcome than I thought.”

Overall, Ann had positive experiences using the journal and wrote, “Writing about math and math issues seems more exciting to me than doing math.” Ann was also interested in using journals in her own classroom someday, but was sensitive to the fact that journals might add frustration for students who struggle with writing. Ann also enjoyed the research readings and having the opportunity to reflect in the journal, stating “I really enjoyed the articles…I love to write, but hate to solve math problems.”

Final Project and MAA Presentation
After developing a background in the mathematics anxiety literature, Ann was interested in completing a project on the subject. Ann completed a literature search and found the Attitudes Toward Mathematics Inventory (ATMI) (Tapia & Marsh, 2004). The first author obtained permission to use this inventory for free from the authors. In spring 2005, there were two sections of a Liberal Arts Math course, each with approximately 200 students. The second author was the coordinator of this course and believed that students in this course generally have negative views of mathematics. Ann was interested in testing these views by distributing the ATMI in this class during the last week of the semester.

To conduct this research, Ann needed to complete the appropriate training and obtain permission from the University. After doing so, Ann was able to give and collect the inventories, tally the results, and write a final paper about the research. Ann was surprised at how negative the survey results were, stating in her final paper, “Many college students say they choose their major based on which required the least amount of mathematics…these students chose their life’s career based on avoidance.”

Ann also researched ways to help relieve mathematics anxiety, especially at the elementary school level. In her final paper, Ann gave discussed several possible strategies to help alleviate math anxiety. In this paper she wrote, “As a future educator, I wanted to learn more about the problem [of math anxiety] and how I can help give my students positive attitudes and experiences.”

The first author was able to obtain a grant to take Ann to a regional Mathematical Association of America meeting. At this meeting, Ann agreed to give a talk about her research. The authors felt it was very important for Ann to experience a mathematics conference, and that it was an especially big accomplishment for Ann to give a talk. At the meeting, Ann’s undergraduate talk was very well attended, with many of the teachers at the conference interested in the presentation.

**Survey Results**

Ann completed a survey about the independent study that was written by both authors. Both authors read Ann’s survey responses individually and then met to agree on idea blocks.

Ann repeatedly mentioned how using the journal in the project helped her learn about her own views of mathematics. In particular, Ann noted that the journal entries enabled her to see how her own views changed throughout the research. For example, Ann stated, “The journal I kept during this study allowed me to see how negative my attitudes truly were about the subject. I could see if I wanted to change my grades, I would first have to change my attitude.”

When asked about the MAA talk, Ann stated, “The talk at the conference was a great experience. I was surprised that so many students and teachers selected my talk to see…. ” She also noted that the talk gave her a good opportunity to share her research and reflect on her findings.
Of the three aspects of the IS, the journal, the paper, and the presentation, Ann felt that the paper was the most beneficial. She noted, “The paper … made use of critical thinking skills and [thinking] beyond the numbers.” In particular, Ann found the paper very helpful in preparing for the talk at the MAA meeting. She wrote in the survey that “…the paper let me organize my thoughts and findings so they are easy to share with others.

Conclusion

The IS would be strengthened if the student spent time reading and reflecting on the NCTM mathematics guidelines. On the survey, Ann suggested that interacting with other student researchers would have also improved the project. While this project was successful, it is not feasible for working with large numbers of students. Work should be done to make the benefits of the IS experience available to more students, possibly by using graduate, undergraduate, or in-service teachers as project mentors.

Of the three aspects of the IS, a research paper would be the easiest to incorporate into mathematics education courses for preservice teachers and was considered the most beneficial by Ann. Meel (2002), however, advises using caution when introducing preservice teachers to research articles. Thus, care should be taken to develop supportive relationships for students engaged in this type of exploration. Furthermore, Ann commented on the survey that, “it was nice to know that just because my research was independent it did not mean that I was completely on my own.”

Finally, Ann was particularly motivated by articles concerning preservice elementary teachers or elementary students. This corresponds to research which suggests that preservice teachers highly value experiences that are directly related to practice (Beswick, 2006). Through the IS, Ann decided, “I plan to be as positive as possible about every subject when I am a teacher in hopes that my students can start their education with a fresh outlook on their own intelligence.” Assessing her experiences, Ann states, “In my opinion, changing my views to better educate my students is one of the most important changes I can make as a teacher.”

References


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