

## CONSTANCY AND CHANGE IN PROSPECTIVE TEACHERS' CONCEPTIONS OF AND ATTITUDES TOWARD MATHEMATICS

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*This study explored the change and lack of change of prospective elementary school teachers' conceptions of and attitudes toward mathematics during the time the subjects were enrolled in a "teaching mathematics" course. The research involved 34 students who completed a Mathematics Inventory, a "What Is Mathematics?" journal entry, and a concept map of mathematics at both the beginning and end of the semester. Four students were also interviewed on two different occasions. A framework was developed to synthesize, analyze, and organize the data. Results showed a shift in positioning in the students' relation to mathematics, an increased awareness of the usefulness of mathematics and the processes used in mathematics, and improved attitudes toward mathematics and teaching mathematics.*

The study of teachers' conceptions of and attitudes toward mathematics has been an important part of research in the field of mathematics education for many years. This study specifically explores the role a "teaching mathematics" course might play in changing these conceptions and attitudes of prospective elementary school teachers. Following is a brief summary of this study. (A full report can be found in Tuft, 2005.)

### Description of the Study

#### *Rationale and Questions*

Many have suggested that two factors that influence how teachers teach mathematics are their conceptions of mathematics and their attitude toward it (Dossey, 1992; Ernest, 1991; Thompson, 1992). The literature is also replete with reports of research that conclude that many prospective elementary school teachers have negative attitudes toward mathematics (see for example, Becker, 1986) and conceptions of what mathematics is that differ from the view of mathematics espoused by The National Council of Teachers of Mathematics (2000). It would seem, therefore, that part of the aim of "teaching mathematics" courses should be to improve these students' attitudes toward mathematics and change their conceptions of mathematics. But, does this happen?

To answer that question, I designed a study to investigate the specific questions of what a group of preservice elementary school teachers' conceptions of and attitudes toward mathematics were at both the beginning and the end of the semester in which they were enrolled in a "teaching mathematics" course. The other question that guided the study was what factors influenced whether these conceptions and attitudes changed or did not change.

### Methodology

#### *Subjects and Situation*

The subjects for this study were the 34 elementary education majors I taught in a "teaching mathematics" course at a large midwestern university.

### ***Data Sources and Analysis***

Four data sources informed the questions of this study: a Mathematics Inventory which included both Likert-type questions and open-ended questions, a “What Is Mathematics?” journal entry, a mathematics concept map, and interviews of four focus students. The students completed each of these data sources at both the beginning and end of the semester. The Likert-type questions were analyzed by using a matched-pairs t-test for independent means, and the other data were synthesized and organized qualitatively in various data displays with quantitative descriptors (see Tuft, 2005).

### ***Development of a Framework of Mathematics***

I originally expected to report the findings by determining categories that would best describe the students in relation to their conceptions of mathematics such as those suggested by Ernest (1991) or Cooney, Shealy, and Arvold (1998). However, as I began examining the data, I concluded that, for this study, labels would not adequately describe the many facets of the students’ conceptions and attitudes. Since most of the data sources were open ended, many of the students’ responses did not fit neatly into predetermined categories. I also found that the same participant could fall into different categories depending on the data source.

As a result, I developed a framework to describe these conceptions and attitudes. This framework played a crucial role in the synthesizing, analyzing, and reporting of this study. It allowed me to organize the description of different facets of the students’ conceptions of and attitudes toward mathematics. It also allowed me to code virtually every statement in the students’ writings and every item in their concept maps as well as categorize every item in the Mathematics Inventory. (For a full description of this framework, see Tuft, 2006.)

### **Discussion of the Findings of this Study**

#### ***Major Findings, Implications, and Contributions***

There were several noteworthy and significant findings that emerged from an analysis of this study. One of these findings is that the students shifted their position in relation to mathematics from that of an experienced student to that of a prospective teacher. Other findings were that the students’ awareness of the usefulness of mathematics and the processes used in doing mathematics was increased. The findings also indicated a more positive attitude toward mathematics and a more positive attitude toward teaching mathematics.

This research provides some implications for mathematics teacher education. It indicates that students’ shift in positioning in relation to mathematics can serve as a vehicle for changing their conceptions of and attitudes toward mathematic. It also provides insight into areas where change is more likely to occur. This study also makes contributions to the field of educational research such as a study that shows there can be change, a new framework for looking at conceptions of mathematics, ideas for using concept maps as a data source, and understanding the significance of the shift in positioning.

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