Secondary Mathematics Teachers’ Understanding of Mathematical Functions

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Dissertation Abstract

The purpose of this study is to describe the understanding of mathematical functions held by a selected group of experienced in-service secondary (grades 8-12) mathematics teachers in light of three theoretical frameworks: Even’s (1990) subject-matter knowledge, Perry’s (1970) scheme of individual’s view of their worlds, and Vinner/Dreyfus’s (1989) categories for the definition of functions. The research questions included: (1) What are in-service secondary mathematics teachers’ conceptions about mathematical functions? (2) What belief orientation do these teachers possess and how does this orientation affect their teaching of mathematical functions? (3) What influence does participation in a mathematics education course or project have on in-service secondary mathematics teachers?

The study began as a case study of six teachers participating in an NSF-funded Teacher Enhancement grant at Syracuse University. It evolved into a descriptive study with flexible design involving five more teachers selected from a summer class designed to examine the potential effectiveness of Calculator-based Laboratories™ (CBL™) investigations in fostering in-service teachers’ conceptual understanding of functions. Data collection techniques included observations, journals, interviews and template-like instruments such as card sort activity and function application questionnaire.

Using deductive analysis, I matched each participant’s responses to the components of the three frameworks. The findings indicate that approximately half of the teachers in this study had a weak understanding of functions with most of them holding a conception of functions that was primarily that of correspondence or dependence relation. All of them readily applied the Vertical Line Test demonstrating a reliance on their concept image of one-valuedness, rather than on their
definition, in determining the functionality of a mathematical relation. In Perry’s (1970) scheme, ten of the eleven teachers displayed a multiplist orientation towards teaching.

Written accounts by the participants indicated that hand-held technology positively influenced their beliefs about teaching and would affect their teaching practices. The results showed that when in-service teachers are given the opportunity to reflect on their own conceptual and pedagogical understanding of mathematical functions, they can become excited about teaching the concept in ways that are recommended in the *Curriculum and Evaluation Standards for School Mathematics* (National Council of Teachers of Mathematics, 1989).