

Statement on Research – Alan Zollman

My scholarship is a combination of my research, teaching and service. All three, in my view, deal directly with classroom implications and implementations for learning of mathematics.

Research Background: I began my mathematics education research investigating methods to increase the quality and quantity of women, minority, and low social-economic students entering mathematics related fields (Zollman & Freeman 1994; Zollman, Freeman, & Eakin 1991), based upon the work of Uri Treisman at the University of California at Berkeley. We found the same pattern of social and academic isolation as had Treisman (1992, 1985). And as Treisman, we also found success in developing a cadre of students in the learning of calculus. This work directed me to investigate similarly the mathematically gifted population (Zollman, 2008; Zollman, 2007, Ream & Zollman, 1994). Again, we found social and academic isolation of students.

In early 1990s, the National Council of Teachers of Mathematics (NCTM) *Curriculum and Evaluation Standards for School Mathematics* (1989) was leading mathematics education. This led me to researching teacher and student beliefs of mathematics, mathematics teaching and mathematics learning (Zollman & Mason, 1992; Zollman & Smith, 1993; de Mesquita & Zollman, 1995; LaBerge, Zollman & Sons, 1997; LaBerge, Sons & Zollman 2000). The NCTM call for new types of assessment prompted my work with the Kentucky Department of Education (KDE) and the Illinois State Board of Education (ISBE) on developing curriculum frameworks and assessments (KDE, 1989, KDE 1992; Bartosh & Zollman 1992; Zollman & Bartosh 1994; Zollman, 1993; ISBE 2002; Zollman, 1994; Zollman, 2002a; Zollman 2002b).

Current Research: My research utilizes my previous work with public schools, by applying my findings to university undergraduates, both elementary education majors and introductory calculus students. Here my research merges Ma's work on the profound lack of conceptual and procedural mathematics content knowledge (Ma, 1999); and Piaget's process of reflective abstraction (Beth & Piaget, 1966; Thompson, 1985); with Schmidt, McKnight, and Raizen's splintered vision of curriculum (1997). My investigations with elementary education students found improved academic success by decreasing the number of topics while increasing the depth and connections of knowledge through the use of reflective abstraction initiatives (Zollman, 2007; Zollman, 2008). A similar research design on calculus students with my most recent doctoral graduate (Cappetta, & Zollman, accepted; Cappetta, 2007) also found strong success on learning the concept of limits. These last works have multiple future research, and dissertation research, possibilities.

Future Research Agenda: My current grant work is in Science, Technology, Engineering and Mathematics Education (STEM Ed). These investigations are multi-layered and multi-disciplined. In our projects, standards-based *content and applications* are designed by the College of Engineering and College of Liberal Arts and Sciences. *Research-based pedagogy* is developed by the College of Education and College of Liberal Arts and Sciences. In addition, guided by teachers' action research, *dynamic classroom implementation* is delivered by the partnership school districts. Background research shows that the quality of public school teachers has the greatest impact on nurturing cognitive abilities, developing knowledge, and increasing motivation of students (Darling-Harmon, 1999). Indeed, improving teaching quality is an effective instrument for improving students' academic achievement (Wenglinsky, 2000). From this collaborative work I have organized three

interrelated directions of our research. The first area involves the use of writing in the content area (Zollman, 2009a; Zollman, 2009b). This follows my previous work with assessment and portfolios of fourteen years earlier. The second area of research from our STEM Ed projects is identity development formation (Zollman, Smith & Reisdorf, accepted). This area is developed from my earlier work on beliefs and academic/social isolation. The third research area is a paradoxical return to my beginning research, but now centered on methods to increase quantity and quality of all students in all STEM Education fields (Zollman, Kitts, Tahernezehadi, & Billman, accepted; Zollman, Tahernezehadi, Shaw, Kitts, Billman, Cesarotti, Falk-Ross, Rahn, Smith, Haji-Sheikh, Majumdar, Merrill & Kullens, accepted). My research agenda is to expand this STEM Ed research into a meta-analysis of successful national projects to identify implementation directions for future initiatives nationwide.

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