Chapter 75

Pre–Service Teachers' Self–Efficacy and Attitudes toward Learning and Teaching Science in a Content Course

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ABSTRACT

Science teaching is approached with hesitation by many PreK-8 teachers. This chapter explores the research on attitudes toward science and learning science as well as the perceived science efficacy of elementary pre-service teachers. It also describes a content-based, pedagogically rich life science course for pre-service preK-8 teachers that incorporates active and interactive teaching techniques in lieu of the traditional science methods course. Using evidence from this project and other research studies, the chapter argues for the inclusion and modeling of these approaches when preparing teachers of science and proposes that this non-traditional approach for teaching content-based courses for preparing teachers be considered in place of traditional science methods courses.

ORGANIZATION BACKGROUND

Over twenty years ago, a large public university in the southeastern United States took a bold step and changed their science methods course from a traditional, pedagogically focused format to a duo of content-based courses: one in biology, and one in chemistry/physics. This unusual move was in response to a growing body of research indicating that increasing teachers' content knowledge of science leads to increased achievement of their students (Druva & Anderson, 1983; Wayne & Youngs, 2003). Teacher preparation programs were being criticized for their superficial curriculum that lacked appropriate emphasis on preparing pre-service teachers to teach rigorous content (National Commission on Teaching and America's Future, 1996). This university felt it

was imperative to increase the content knowledge preparation of its PreK-8 teacher graduates and thus changed their requirements.

Teacher preparation program design and requirements vary throughout the United States. Additionally, states have different requirements for obtaining a teaching certification. Typically, secondary level teacher candidates must hold a degree in a specific field of study (English, music, science, mathematics, etc.) and a minor in education. However, students seeking elementary certification are required to take fewer courses in each field of study and more courses in education. These candidates usually take a minimum number of college credit hours in science content courses along with an additional science education methods or integrated methods course to prepare them for the classroom (U.S. Department of Labor, 2014). At this university, preK-8 pre-service teachers complete eight hours of content-based science, but in lieu of the typical science methods course they take an additional eight hours of content-based courses specifically designed for elementary education majors. Four of these additional hours consist of the course, Biology 3000, Life Science for Elementary Teachers. The first author has taught this course for over twenty years with a focus on providing the deep understanding of science content needed by elementary teachers, through reform-oriented, research-based pedagogical techniques. This study examines whether this life science content course for pre-service teachers experiences results in increased science attitudes and increased self-efficacy.

SETTING THE STAGE

Elementary teachers are expected to be all things for all students: content delivery experts, special education providers, learning disabilities specialists, guidance counselors, health advisors, and pedagogy authorities, as well as content specialists in all traditional subject and skill areas. This is a

tall order for anyone, particularly a new teacher who is years away from becoming a master educator (Berliner, 1988). The National Commission on Teaching and America's Future (1996) reported that one-third of all new teachers leave after three years, and 46 percent are gone within five years. Ingersoll (2003) estimated that 40-50% of teachers leave within the first five years and that rate has remained fairly consistent (Ingersoll & Perda, 2012). Ingersoll and Perda also noted that there is more pre-retirement attrition of mathematics and science teachers than those in any other subject areas.

The quest for excellence in all aspects of education is perhaps most pressing in the area of science. High quality science educators, using reform-based instructional methods, are vital to the development of future generations of scientifically literate citizens. Teacher preparation programs have a duty to effectively prepare candidates to meet this goal and to successfully handle the expectations and demands of this challenging career. With the increased emphasis on in-depth science content knowledge and delivery methods in K-12 classrooms, teachers now more than ever must be fully prepared, self-confident, and accomplished in conveying science content and skills to their students.

The development of national standards detailing content to be taught in all subjects at all grade levels has helped to elevate and standardize the educational process in the United States. The National Science Education Standards (NSES) provided teachers with clear student goals and administrators with professional development requirements (NRC, 1996). The NSES influenced various states' own science learning and associated state-wide standardized testing. National and state entities have continued to expand and mandate rigorous standards which teachers must ensure students attain. The Next Generation Science Standards (NGSS Lead States, 2013) require that teachers be well-versed in science subject matter and able to directly apply that knowledge through

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