Challenges of and Resources for Reform-based Science Teacher Learning: A Case Study of a Preservice Science Teacher

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Abstract: This case study examines the challenges faced and resources employed by a preservice science teacher throughout his teacher preparation program. Challenges included an absence of supported space in field experiences, intense emotions associated with learning, and establishing "effective" relationships with students. Supports included affordances offered by program sequence, program coherence, and a personal, professional blog.

Introduction

Research has identified strong learning benefits of using reform-based practices, defined as "inquiry into authentic questions generated from student experiences" (NRC, 1996, pp.32-33). However, there is little evidence of reform-based practices occurring in secondary science classrooms (Anderson, 2002) with potential factors including the lack of coherent teacher preparation programs committed to reform (Darling-Hammond & Hammerness, 2006), the conceptual, pedagogical, cultural, and political challenges presented specifically to reform-minded teachers (Windschitl, 2002), and challenges specific to novice teachers (Feiman-Nemser, 2001). Research clearly suggests a need for effective supports to adequately prepare science teacher learners for the significant challenges they will face. This article contributes to the field of learning sciences by 1) offering evidence for the types of challenges encountered by a pre-service science teacher-learner and 2) implications for future preparation programs.

Literature Review and Theoretical Framework

Recent literature has identified the complexity involved in adequately preparing novice teachers to reconcile a reform-based image of instruction with personal, prior beliefs (Kagan, 1992), position themselves within a larger community of practice (Windschitl, 2002), develop confidence and manage the emotional dimensions of personal development (Alsup, 2006), and integrate theory and practice (Feiman-Nemser, 1990). Program elements identified as successful include coherence between theory and practice, developmentally appropriate curriculum, and teacher learning situated in supportive, authentic contexts (Darling-Hammond & Bransford (Eds.), 2005) While these findings represent a significant foundation for supporting reform –based teacher education practices, we have much to learn about the unique challenges faced by beginning science teachers who are not only preparing to be expert practitioners but also agents of change.

Identity theory, and more specifically, professional identity theory addresses the unique learning challenges involved in becoming a reform-minded science teacher (Luehmann, 2007) and considers experiences in light of how they impact one's professional practices, values, and commitments (Flores & Day, 2006). We have argued elsewhere (Luehmann, 2007) that this framework offers the field of science teacher preparation four primary insights: 1) People approach learning situations with core identities that need to align with the new identity; 2) Not all forms of participation and engagement are equal with respect to learning potential; 3) Trying on a new identity within a community of practice involves assuming risks; and 4) Learning as identity work occurs in the interpretation, narration, and thus recognition of that participation (by self and others). In this study, these four insights serve as a lens for understanding how one preservice teacher experienced his initiation to reform-based pedagogy as he tried on and developed his identity as a reform-minded science teacher.

Research Design

An exploratory case-study approach was used to address two questions: What are the primary challenges faced by a pre-service science teacher as he progressed through a preparation program committed to reform-based pedagogy? What features of his preparation program contributed positively to his ability to successfully face and work through these challenges? Core program field components for Orlando were a Saturday Science Club, three separate and unique student teaching placements, and leading an inquiry camp. All field experiences occurred in conjunction with university coursework which required maintaining a personal professional web log (blog). The primary data source for this study was one academic school year of Orlando's blog posts (August 2005 – June 2006) consisting of 45 posts (1951 lines) and 32 corresponding comments (http: www.getrealscience.com/teacherorlando). Two interviews and course artifacts were used as secondary sources for the purposes of triangulation. Grounded theory (Strauss & Corbin, 1998) was the method of data analysis. Orlando's blog posts were coded independently by two researchers with respect to: 1) the focus of the post; 2) the "type of work" engaged in (such as documenting events); 3) evidence of connection making (between theory and practice); 4) type of comments; and 5) specific blog features employed (such as images and hyperlinks).

Results

Our analyses revealed three core challenges that Orlando faced during his pre-service learning. The first challenge centered on characteristics of student teaching placements; specifically, Orlando struggled and benefited differently in placements that varied dramatically with respect to the combination of *support* for reform-based teaching and *space* to individualize instruction that were offered by his mentor teachers. The second significant challenge was the intensity and range of emotional processing that emerged as a core ingredient of Orlando's wrestling with an idealistic commitment to inquiry practices with typical classroom constraints. Lastly, Orlando struggled with defining and establishing "effective" relationships with students that both respected them and "managed" classroom dynamics. Three distinct support systems emerged as being particularly effective in addressing these challenges and, thus, nurturing Orlando's identity as a reform-minded science teacher. First, the scaffolded engagement with reform-based practices offered *across* the preparation program sequence gave Orlando developmental access to safety in and ownership over his learning. Second, the coherence of the preparation program allowed Orlando multiple opportunities to make connections between theory and practice. Finally, blogging provided Orlando space to engage in interpretation work, work through emotions, and engage with like-minded professionals.

Discussion and Implications

Using identity development as a lens to Orlando's learning experiences, we are better able to understand the challenges and supports that may be unique to being a *preservice* reform-minded science teacher; informed by these findings we can identify implications for future program design. A programmatic sequence in which appreciation for reform-based practices is fostered concomitantly with numerous, developmental experiences to try-on reform in various settings nurtures a confidence in and understanding of reform. Providing authentic learning-to-teach activities, both within and out of school, provides multiple opportunities for pre-service teachers to connect theory to practice. Unlike any other reflective practice, public blogging offers professional learners access to a unique package of powerful learning opportunities such as the ability to be self-directed, the opportunity to receive support and recognition from others, and the opportunity to serve as "knowledge broker" by advocating for a certain position or vision (Luehmann, in press). Giving pre-service teachers access to a variety of supports for interpretation and recognition is essential to supporting professional learning with reform-based teaching.

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