

Investigating teacher growth in the context of content innovation

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Abstract: Our study expands current literature on the professional growth of experienced teachers in educational innovations. Using a case study approach, we investigate changes in instructional practice of an experienced science teacher over two cohorts of students in the context of a content innovation, and reveal the reasons behind these changes. The Interconnected Model of Teacher Professional Growth framework is used to interpret findings.

Introduction

Teachers continually draw upon a range of experiences and information to help mediate their learning and teaching in new contexts, but these vary according to their beliefs, attitudes, and perceptions (Clark & Hollisworth, 2002). Although theories and models of teacher learning and growth already exist, most studies focus on novice teacher learning, and very few have examined teacher learning and growth for more than a year (Henze et al., 2009; Mouza, 2009). Our study-in-progress investigates the changes in instructional practice of an experienced science teacher over two cohorts of students. We compare changes in instructional practice when novel nanoscience content is taught for the first time in 2008 and again in 2009. We make the assumption that when teachers implement innovations learned through professional development (PD), they undergo stages of change that are a result of underlying factors across various salient domains (Mevarech, 1995).

Theoretical Framework and Research Questions

Drawing from novice-expert and cognitive science literature, we define professional growth as a process of change in teachers' mental models, beliefs, and perceptions regarding children's minds and learning, and knowledge and competencies concerning teaching (Richardson & Placier, 2001). There are several models that offer explanations for teacher professional growth. Sprinthall et al. (1996) classify them into three categories: craft, expert and interactive. Interactive models integrate both craft and expert models and recognize that growth is enhanced through reflection of experiences and supported by PD. The Interconnected Model of Teacher Professional Growth (IMTPG) is one such model (Clark & Hollisworth, 2002). According to IMTPG, change occurs through mediating processes of reflection and enactment in four distinct domains: personal practice; consequences; and external. IMTPG acknowledges the non-linearity of professional growth by identifying the multiple growth pathways between domains. It also posits that any interpretation of growth requires an appreciation of the changes across these interconnected domains. As this interactive perspective aligns with our belief that teachers should be actively involved in professional growth through reflection and enactment, we chose IMTPG as our analytical tool for interpreting the changes in instructional practice of the teacher as he repeats the implementation for the second year. Two research questions are formulated: 1) how do the instructional practices of an experienced teacher in a content innovation change from the first to the second year of implementation; and 2) what are the reasons for these changes?

Methods

This study is a slice of a larger project aimed at increasing opportunities in science for students and teachers in underserved schools. Our project specifically addresses knowledge and workforce development goals in the emerging field of nanoscience. Teachers participate in a three-week summer PD workshop, where they construct and pilot nano-related curricular units anchored in cognitively rich pedagogies, real-world applications, and information and educational technologies. The participant for this study was Mr. R, an eighth grade science teacher in a small public K-8 school with six years teaching experiences. The students had Mr. R as their science teacher for at least two years thus he had a good understanding of students' prior knowledge and aptitudes in science. A case study approach was adopted to compare the two cohorts of students (C1 and C2) as they engaged in activities to learn about nanoscience in the fall semesters of 2008 and 2009. The same researcher observed every 'nano' lesson over the two years. Field notes were analyzed for themes that indicated changes in his instructional practices through an iterative process together with the primary investigator of the larger project. Teacher interviews conducted at the end of each implementation gave insights into the reasons for the changes.

Preliminary Findings and Discussion

Mr. R conducted the same activities for both cohorts of students. These included experiments, a problem-based learning project and a digital media production. We illustrate in depth only one difference in the implementation due to space constraints; the other difference had to do with Mr. R's shift in instructional emphasis from simply delivering the novel content and fulfilling the requirement of the project to facilitating deeper student understanding of the novel content. In terms of general sequence and structure, Mr. R infused the new

nanoscience content within the atomic theory unit of physical science curriculum for C1, whereas for C2, the new content was introduced only after the atomic theory unit had been taught. Mr. R explained that the change in the implementation sequence was for organizational coherence in the way the content was taught and the prerequisite understanding of other concepts.

[It is] organizationally *easier* to do nano at the end of the standard unit. I want to complete the syllabus first before I go into nano. Last year, it was some nano, then atomic theory, then nano again. It's *messy*. So this year, I tried a different approach . . . Because I teach 8th grade, not high school, I have to teach so much of the background stuff first before I can get to the problem. I *can't* teach about unique properties of nanotechnology if the kids don't know what properties are. (Interviews, Oct 22 and 24, 2009)

We used IMTPG to map the reasons for the changes: i) For C1, Mr. R infused nanoscience concepts into the curriculum because he was told to do so during the PD. This is a straightforward case of an external domain enacting on the domain of practice; ii) The instructional sequence resulted in a change in Mr. R's domain of consequence as he reflected that the organization of the curriculum was "messy"; iii) Subsequently for C2, Mr. R tried a new sequence with the knowledge and experience of the first year outcomes; iv) With the second experimentation, a more coherent sequence was developed; v) Mr. R reflected and preferred the revision. His belief in this new organization was affirmed, causing a change in his personal domain. The observation of his initial implementation corroborates Mevarech's (1995) findings where experienced teachers in implementing innovations were observed to depend extensively on the inservice designers and mentors in applying the new knowledge in classroom practice, behaviors consistent with those of novice teachers. The follow-up observations of the subsequent implementation allow us to see the changes and infer the active processes of enactment and reflection undertaken by the experienced teacher. This suggests that while the external domain may have initiated the innovation and dictated how it is implemented, the domains of consequence (i.e., outcomes) and practice (i.e., experimentation) play a more significant role in the adaptation of the implementation. And although still at a preliminary stage of analysis, anecdotally we observed that student products for C2 showed greater depth of understanding of the novel content. The improved student learning outcome may also have served to reinforce Mr. R's preference in his revised organization.

Conclusions and Implications for Further Research

Few studies have compared changes made by experienced teachers to the instructional practice between the first and subsequent implementations of educational innovations. However, such investigations are crucial because they give important feedback to professional developers on how and why innovations are adapted and/or sustained. In our study, we have identified domains of consequence and practice playing significant roles in the adaptation of our innovation. From this finding we suggest that PD incorporates scaffolds to help teachers during the implementation, especially one that encourages both classroom experimentation and reflection as deliberate active processes of change, may enhance the success of innovations in terms of adaptation to specific classrooms and sustainability. Developing such a scaffold will be our long term research goal. Further research will also include other teachers with different characteristics (e.g. age and teaching experience) engaged in similar innovations for a more generalizable and definitive conclusion.

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Acknowledgement

This research is supported by a National Science Foundation Grant: ESI 0737437, and the University of Pennsylvania, Graduate School of Education graduate assistantship funding.