The Pedagogical Content Knowledge and beliefs of newly hired secondary science teachers: the first three years

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ABSTRACT

The first years of teaching are often discussed with reference to all teachers. More studies focusing on early career content specialists are needed in order to ensure that teachers are supported adequately as they learn to teach in their content area. In this study, we followed 76 newly hired secondary science teachers to determine how their teaching beliefs and knowledge changed over a three-year period. This study used qualitative and quantitative data collection and analysis techniques. Interviews and classroom observations were collected and analyzed quantitatively using teachers as a group and the teachers' induction programs as a subgroup. The findings from this study suggest that over time new teachers are more influenced by their school cultures than by their induction programs. However, from the data it is evident that beliefs and practices are malleable, but that they are impacted differently and by different factors. As a result of this study, we suggest new directions for science teacher educators in their work and potential research regarding newly hired science teachers.

KEYWORDS: pedagogical content knowledge, beginning teachers, induction teachers, beliefs, newly hired teachers

Resumen (Conocimiento Pedagógico del Contenido y creencias de profesores de ciencias de secundaria recién contratados: los primeros tres años)
Los primeros años de enseñanza son a menudo discutidos con referencia a todos los profesores, no con relación a aquellos que imparten un nuevo contenido. Se requieren más estudios diseñados para los especialistas en contenidos de carrera temprana, para asegurar que están apoyados adecuadamente conforme aprenden a enseñar en su nueva área de contenido. En este estudio seguimos a 76 maestros de ciencia de la secundaria para determinar cómo sus creencias y conocimientos se transformaban durante un periodo de tres años. En él se utilizaron técnicas de análisis y colecta de datos tanto cualitativas como cuantitativas. También se emplearon entrevistas y observaciones de clase, y estos datos se analizaron cuantitativamente con el uso del grupo de los profesores y los programas de inducción de los profesores como subgrupo. Los hallazgos de este estudio sugieren que los nuevos profesores están muy influidos por la cultura de su escuela. No obstante, a partir de los datos resulta evidente que sus creencias y prácticas son maleables, pero que se ven impactadas de forma variada por diferentes factores. A partir de este estudio se sugieren nuevas recomendaciones para los educadores de profesores de ciencia, tanto para su trabajo como para su investigación potencial, con relación a profesores de ciencia recién contratados.

Palabras clave: conocimiento pedagógico del contenido, profesores principiantes, profesores de inducción, creencias, profesores contratados recientemente

The first years of a science teacher's career are marked by rapidly changing beliefs, knowledge and instructional practices (Davis, Petish, Smithey, 2006; Luft et al. 2011). For some teachers, the changes result in significant departures from constructivist, conceptual change, or learning-oriented traditions (e.g., Bransford, Brown, & Cocking, 2000; Mintzes, Wandersee, & Novak, 2005; Posner, Strike, Hewson, & Gertzog, 1982). These teachers adopt ways of teaching that emphasize the student as a recipient of science knowledge, a teacher-centered orientation. For other teachers, the changes result in the adoption or solidification of orientations that embrace the student as a learner. The latter approach to science instruction provides the student with opportunities to engage in knowledge production, which could include engaging with natural phenomena, developing arguments, or constructing explanations. This is often referred to as student-centered instruction.

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Our understanding of the development of a newly hired teacher can help guide the teacher towards a more student-centered orientation (Luft et al., in review). The beliefs and knowledge that a teacher holds may play a significant role in the development of this orientation (e.g., Abell, 2007; Jones & Carter, 2007). These beliefs and knowledge are a result of the newly hired teachers' experiences during elementary and secondary school, an initial certification program, or the first years of teaching (e.g., Fletcher & Luft, 2011; Loughran, Mulhall, & Berry, 2008).

Even though newly hired teachers have malleable beliefs and practices, they are at least familiar with and experienced in student-centered forms of instruction. After all, they have just emerged from initial certification or teacher preparation programs that provided them with opportunities to embrace student-centered instruction. Most new teachers are influenced by the context in which they teach (e.g., Bianchini & Cavazos, 2007; McGinnis, Parker, & Graeber, 2004). This context can constrain, sustain, or strengthen their beliefs and knowledge. Among newly hired teachers, beliefs and knowledge are often constrained by the context of their workplace (Luft et al., 2011).

One way to circumvent a slide toward teacher-centered instruction is to provide support to the teacher in his or her first years (Luft, 2007). In this study, newly hired secondary science teachers were followed for their first three years as they participated in one of four different induction programs, which lasted two years. The different induction experiences of the teachers in this study included science-specific university programs that worked with local schools and districts to support secondary science teachers; electronic mentoring programs offered by universities and national associations to a large number of science teachers; general induction programs offered by school districts that were developed for all of their teachers; and alternative certification programs that provided coursework towards certification while teachers began their education career. The first two programs specifically focused on the teaching of science, while the other programs addressed the general instructional needs of the teachers. By following the newly hired science teachers as they participated in these different programs, we had an opportunity to explore the development of teachers' knowledge and beliefs, as captured in this research question:

How do the beliefs and pedagogical content knowledge of newly hired teachers change in their first three years, as they participate in different induction programs?

The hypothesis associated with this study suggests that induction programs focused on science will have a greater impact on the beliefs and pedagogical content knowledge of newly hired teachers than will induction programs focused on general teaching strategies.

Framing of Study

This study is framed within science teacher development and assumes that there are distinct phases in a teacher's career. Feiman-Nemser (2001) has provided an important overview of these phases within early career teacher development. Within this overview, we focus on two phases of teacher development. The first phase involves the initial certification program that supports future teachers as they build their knowledge and skills. The second phase takes place during their first years in the classroom, as the newly hired science teachers expand and refine their instructional competencies.

Feiman-Nemser's (2001) framework for early career teacher learning articulates central tasks for each phase of development. During initial certification programs teachers develop preliminary skills, knowledge bases, and beliefs. During the first years of teaching and beyond, the tasks take on complexity and result in enhanced skills, knowledge, and beliefs that can guide equitable and sound instructional practice. In order to support this development, it is important that early career teachers purposefully interact with their colleagues and other education professionals.

In order to enhance the work of Feiman-Nemser (2001), Luft (2012) infused a discussion about subject matter knowledge into the learning continuum. By explicitly addressing the teaching of science, Luft (2012) suggested a preliminary progression about learning how to teach science. The focus on subject matter knowledge allows early career science teachers to purposefully extend and deepen their subject matter knowledge, which in turn impacts their pedagogical content knowledge and classroom practices. As their beliefs develop, the use of student-centered science instruction is strengthened. An expanded discussion of the learning continuum for early career science teachers can be found in Luft (2012).

Related Literature

Beliefs

Research by several educational researchers guides the view of beliefs used in this study. Drawing upon the work of Jones and Carter (2007), Nespor (1987), Pajares (1992), and Richardson (1996), we define beliefs as personal constructs that are important to a teacher's practice; beliefs guide instructional decisions, influence classroom management and shape the way teachers represent their subject matter. The beliefs of teachers consist of both core beliefs and peripheral beliefs. Core beliefs are formed during prior educational experiences. From these core beliefs emerge peripheral beliefs, which are shaped in response to new experiences (Rokeach, 1986). In science education, a teacher has core beliefs about teaching, but then develops peripheral beliefs about teaching science, which ultimately guide the acquisition of knowledge and practice.

Research on the beliefs of newly hired science teachers has explored the relationship between beliefs and instructional practice. In the area of initial certification programs,