Teaching and Teacher Education 31 (2013) 1–12

Contents lists available at SciVerse ScienceDirect

Teaching and Teacher Education

journal homepage: www.elsevier.com/locate/tate

Re-storying practice: Using stories about students to advance mathematics education reform

Tesha Sengupta-Irving [a,*], Elizabeth Redman [b], Noel Enyedy [b]

[a] University of California, Irvine, 3000B Education, Irvine 92697-5500, USA
[b] University of California, Los Angeles, 330 Charles Young Drive, P.O. Box 951619, Los Angeles, CA 90065, USA

HIGHLIGHTS

- Case study of U.S. math teacher experimenting with new practices to promote equity.
- Applying literary definition of story to teacher reflections makes equity explicit.
- Teacher stories are reflective & prospective, revealing views on what is possible.
- Stories of individual students can govern evaluation of new practices for all.
- Re-storying involves collaborative analyses with teacher educators and teachers.

ARTICLE INFO

Article history:
Received 27 February 2012
Received in revised form
15 October 2012
Accepted 22 October 2012

Keywords:
Stories
Teacher learning
Reform
Mathematics education

ABSTRACT

We apply a literary definition of story (struggle, protagonist, and resolution) to an American primary school teacher's reflections on experimenting with new teaching practices. This definition makes issues of equity explicit and revealed what the teacher saw as possible for changing her practice. By re-storying her stories – offering evidence from interviews, video, and surveys to affirm or complicate interpretations – we consider the power of storytelling to deepen commitments to reform and challenge skepticism. When done collaboratively between teacher educators and teachers, restorying could be a generative analytic process of learning from practice.

Published by Elsevier Ltd.

1. Introduction

There is great diversity in practice throughout mathematics classrooms around the world (Clarke, Keitel, & Shimizu, 2006). In much of the world, however, mathematics education reforms emphasize conceptual development and connected thinking through exploration and discussion. Students become active learners who explore problems through sustained engagement with complex ideas. In China, which arguably represents East Asian math reform efforts more generally (Leung & Li, 2010), teachers are moving from memorization toward inquiry, analysis, problem solving, and communication. Similarly, the Singapore Ministry of Education aims for secondary math students to "develop mathematical thinking and problem solving…recognise and use connections among mathematical ideas…develop the abilities to reason logically, [and] to communicate mathematically" (CPDD, 2007). In Britain, the Association of Teachers of Mathematics (ATM, 2006) responded to new frameworks by emphasizing student engagement in sustained joint activity and discussion with peers and the teacher. Finally, in Australia, mathematics frameworks focus on both basic arithmetic skills and also the development of a comprehensive and connected understanding of number and operations (Leonelli & Schmitt, 2001). In the United States, where this study takes place, the role of conceptual development, connecting thinking, reasoning, and problem-solving in mathematics education are also prioritized (NCTM, 2000; NGA Center & CCSSO, 2010; NRC, 2001). Math education reforms are not, however, just about what students learn and do; they are also fundamentally about transforming teachers' practices. This call for a transformation of practice comes with significant challenges to teacher education.

In parts of the world, classroom mathematics instruction has yet to reflect reform efforts. The Trends in International Mathematics

* Corresponding author. Tel.: +1 949 824 2348; fax: +1 949 824 2965.
E-mail addresses: tsengupt@uci.edu, t.s.irving@uci.edu (T. Sengupta-Irving), elizabeth.redman@gmail.com (E. Redman), enyedy@gseis.ucla.edu (N. Enyedy).

0742-051X/$ – see front matter Published by Elsevier Ltd.
http://dx.doi.org/10.1016/j.tate.2012.10.007

and Science Study (TIMSS) collects data every four years from classrooms in approximately 50–60 countries including Germany, Japan, Chile, Australia, Switzerland, the Czech Republic, Hong Kong, and the Netherlands. TIMSS video data from the United States, for example, show that math classrooms continue to reflect "the kind of traditional teaching that has been documented during most of the past century…[where] the nature of mathematical thinking and reasoning, and the conceptual mathematical work, remain unaligned with [reforms]" (Jacobs et al., 2006). This is especially significant given mathematics education reforms in the U.S. began six years earlier in 1989, when the National Council of Teachers of Mathematics produced the first *Principles and Standards for School Mathematics* (and arguably before then, see Davis, 1990). In a meta-analysis of Canadian mathematics education reforms, Ross, Mcdougall, and Hogaboam-Gray (2002) suggest that evidence "abounds of superficial implementation and barriers to enactment [of reforms]" (p. 122). In Indonesia, the mathematics education reform movement based on Realistic Mathematics Education (or PMRI, locally) began in the mid-1990s in collaboration with Dutch researchers, and exemplifies the considerable efforts required to implement reforms across varied schools and classrooms (e.g., Hadi, 2012; Gravemeijer, 2010; Saito et al., 2006; Widjaja & Dolk, 2006). Thus the problem of realizing and sustaining reform remains a significant challenge in the field.

Although several factors contribute to the success of reforms, the role of teacher education is a meaningful place to start. As Fullan, Galluzzo, Morris, and Watson (1998) argue, reform is a "proposition so profound that the teaching profession itself…will have to undergo total transformation in order for substantial progress to be made" (p. 68). In the aforementioned meta-analysis of Canadian math reforms, the authors argue that the most promising strategies for encouraging reform come from working with practicing teachers on their conceptions of math teaching, and the practices they employ (Ross et al., 2002). In the U.S., Drake and Sherin (2006) offer a specific view of this by focusing on the role of practicing teachers' narratives in adapting reform-oriented mathematics curricula. The authors found the teachers' unique patterns of adaptation were related to prior experiences with math learning. These outcomes suggest that math education reform may require not only a transformation in teachers' practices, but also in how they make sense of changes to practice. This study asks: How do math teachers make sense of reforms in practice? What might a teacher draw on to determine the viability of reforms for future use?

We describe how a mathematics teacher makes sense of reform-oriented practices through stories about particular students in her class, and then uses those stories to justify either adopting or abandoning reforms. Stories provide a useful framework for research on teacher sense making and perspective (Carter, 1993; Noddings, 1996). Thus this study falls within a history of work recognizing that teachers understand much of their practice through stories (Clandinin, 1985; Clandinin & Connelly, 1996; Zeek, Foote, & Walker, 2001), including new practices (Adler, 1998; Clandinin, 1985; Drake & Sherin, 2006; Zeek et al., 2001), and generally communicate professional knowledge through stories (Craig, 1999). Narrative inquiries have also drawn significant attention to the profound role of teachers' stories (Clandinin, Downey, & Huber, 2009; Doyle & Carter, 2003). Such studies examine teacher identity and development (Conway, Hansen, Schulz, Stimson, & Wozniak-Reese, 2004; Sakui & Gaies, 2003), student–teacher relationships (Uitto & Estola, 2009; Uitto & Syrjälä, 2008), and the precarious position teachers and teacher educators occupy in a shifting educational landscape worldwide (Clandinin et al., 2009; Frost, 2010; Kelchtermans, 2005).

Our perspective on teacher stories is cast in light of advancing mathematics education reforms. Our study is different from prior research in that we never sought stories explicitly, and yet stories emerged as significant to the teacher in evaluating the viability of reforms. Therefore unlike most studies of teacher stories, we narrow our attention to stories the teacher tells *about students* (not themselves) when implementing reform-oriented curricula. We also use a very specific definition of "stories," as Western European literary studies often do, that involves an arc: a situation of struggle wherein a protagonist acts with purpose leading to a resolution (Scholes, 1982 as cited by Carter, 1993). We argue that this definition, when used to filter a teacher's reflections on reforms, results in significant episodes around which decisions about reforms pivot: what Drake and Sherin (2006, p.180) call "turning points." We propose that this type of "storied knowledge" (Carter, 1993) warrants greater attention in advancing mathematics education reforms.

2. Conceptual framework

Elbaz (1991) contends, "story is the very stuff of teaching…within which the work of teachers can be seen as making sense" (p. 3). Stories are also emotive accounts of teacher learning, coping, and being socialized into the profession (Noddings, 1996). Building on what Connelly and Clandinin (1985, 1990) termed "personal practical knowledge," stories provide an inextricable link between the personal and professional (Carter & Doyle, 1996; Doyle & Carter, 2003; Ritchie & Wilson, 2000). This has led to explorations of teacher identity, professional history, beliefs, and knowledge building (Adler, 1998; Johnson & Golombek, 2002; Sakui & Gaies, 2003; Zeek et al., 2001). It has also led to understanding stories as changing with experience (Hargreaves, 2005): from pre-service (e.g., Noddings, 1996) and novice teachers (e.g., Conway et al., 2004; Ladson-Billings, 2001), to career teachers (e.g., Kelchtermans, 1993; Pomson, 2004). The enduring focus on teacher stories provides the foundation for considering how the increasingly global imperative of educational reform might complicate, and perhaps heighten, the need for understanding how teachers make sense of practice.

Prior studies of teachers' identity and emotions reveal the complexities of realizing educational reform. In a special issue of this journal, for example, researchers from Canada, the Netherlands, and the U.S. showed how reforms not only impose changes to practice, but require teachers to reconcile reforms with beliefs about 'good teaching' and one's professional identity. In the study of U.S. secondary school teachers, Schmidt and Datnow (2005) argued that the experience of classroom-level reforms provoked reactions from teachers in a way that school-wide reforms did not. This suggests studying reform through individual classroom instantiations can uniquely contribute to understanding the state of reforms more generally. Drawing on narrative-biographical work with teachers in Belgium, Kelchtermans (2005) explained how reforms invoke micropolitical responses (resistive or proactive) in teachers. Such responses suggest the viability of reforms is related to the specific structural and cultural working conditions of teachers (see also Marz & Kelchtermans, 2013). In mathematics education, the importance of understanding teachers' sense making of reform is similarly clear. Rousseau (2004) demonstrated, for example, how a professional community of mathematics educators abandoned their initial efforts at collective reforms in part because of inconsistency between their beliefs and the target practices. Similarly, Frost (2010) showed how teachers' past histories and beliefs about math teaching shaped their perspectives on reform initiatives. Drake and Sherin (2006) took this a step further by making explicit links between the way a teacher adapts, for example, math reform curriculum, and the narrative accounts of his or her history with math. These studies collectively demonstrate the value of placing teacher sense making