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Cases in Mathematics Teacher Education¹

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Since Lee Shulman first proposed “case knowledge” as a component of “teacher knowledge” in 1986, cases have gained momentum as important tools in the professional education of teachers. As an antidote to what many see as an overly theoretical approach to teacher education, many teacher educators have been drawn to cases because they capture the complexity and authenticity of instructional practice. Unlike theories, propositions, principles, or other abstractions, the particularities of cases vividly convey the profusion of events that constitute the moment-by-moment lived experience of classrooms. Merseth (2003, p.xvii) argues “good cases bring a ‘chunk of reality’ into the teacher education classroom to be examined, explored, and utilized as a window on practice.”

Although there are a variety of interpretations of what constitutes a case, Shulman (1986) argued that to call something a case is to make a theoretical claim – that is, any story that is called a case must be a case *of* something. Hence, not every video or narrative that portrays an aspect of classroom life qualifies as a case. A case must make salient some idea, principle, or theory that is central to mathematics teaching and learning more generally – that is, the particulars portrayed in the case must be instances of larger, more generalized ideas. In addition, a case should be specifically designed to stimulate engagement and discussion.

In Chapters 2 through 11 of this monograph, mathematics teacher educators provide rich illustrations of the ways in which they have used specific cases to help teachers develop their knowledge base for teaching (i.e., knowledge of content, pedagogy, and students as learners) and the capacity to reflect on and learn from teaching. In this chapter we provide a general overview of cases and their use in mathematics teacher education and highlight the contributions of the individual chapters.

The *What* and *Why* of Cases

Materials that can effectively support teachers as they develop their pedagogical practice must do more than transmit general mathematical and pedagogical propositions that apply broadly across a range of situations. They must assist teachers to develop a capacity for knowing when and how to apply such knowledge, a capacity that depends on the ability to connect the specifics of real-time, deeply contextualized teaching moments with a broader set of ideas about mathematics, about teaching, and about learning. To develop this capacity, teachers must learn to recognize events in their own classrooms as instances of larger patterns and principles. Then they can formulate ways of acting and interacting that are thoughtful, principled, and effective (Shulman, 1996). As Shulman has noted:

Teachers learn quickly that the heart of teaching is developing the capacity to respond to the unpredictable. Teaching begins in design, but unfolds through chance. And cases – as the narrative manifestations of chance – offer teachers the opportunities to contemplate the variety of ways in which the unpredictable happens. Case-based teacher education offers safe contexts within which teachers can explore their alternatives and judge their consequences (1996, p. 214).

Case use in teacher education has drawn heavily from the experience of case use in the professional fields of law, medicine, and business (Merseeth, 1996). Although these fields are quite diverse, there appears to be a general belief that cases can address effectively a common tension in the design of experiences for professional education. A professional education curriculum seeks both to deliver a theoretically based knowledge base and to teach reasoning skills and strategies for analyzing and acting professionally in novel settings. Such a curriculum is grounded in the obligation of professional education to prepare practitioners for a practice that is simultaneously routine and uncertain (Sykes & Bird, 1992). Both of these aspects of professional education seem well suited to cases.

Although it is unlikely that cases alone are sufficient as a source of professional learning (Patel & Kaufman, 2001), they can be a critical component of a curriculum for teacher education, providing a focus for sustained teacher inquiry and investigation (Ball & Cohen, 1999) and an opportunity to make connections to experiences (vicarious or lived) and to theoretical classifications and general principles (Shulman, 1996). According to Smith (2001), cases also create opportunities for teachers to begin to develop new visions of mathematics teaching and learning and provide a common experience for teachers to discuss, analyze, and reference.

Cases Materials

Cases can be divided into two broad categories, *exemplars* and *problem situations* (Carter, 1999). Exemplars can be used to exemplify a practice or operationalize a theory. They provide vivid images of teachers in real classrooms that ground abstract ideas related to content and pedagogy. For example, the cases discussed by Silver and his colleagues (Chapter 8) exemplify key features of instruction associated with the implementation of cognitively challenging mathematical tasks (Smith, Silver, & Stein, 2005a, 2005b; Stein, Smith, Henningsen, & Silver, 2000) and invite the reader to analyze the pedagogical moves made by the teacher and the ways in which these moves support or inhibit a student's learning of mathematics. These cases are intended to assist teachers to develop an understanding of mathematical tasks and how they evolve during a lesson and enhance their ability to reflect critically on their own practice guided by a framework based on these ideas (Stein et al., 2000).

Problem situations, on the other hand, can be used to examine the complexities of teaching and the problematic aspects of performance. They often provide dilemmas (either mathematical or pedagogical) to be analyzed and resolved. For example, the case discussed by Morris (Chapter 2) poses a situation that occurred during instruction that the teacher had not anticipated and invites the reader to explore different courses of action and to consider the trade-offs in selecting one over another (Barnett-Clarke & Ramirez, 2003). By learning how to analyze "messy and complex situations," teachers can learn to make well-informed decisions in their own classrooms (Barnett & Ramirez, 1996, p.11).

Regardless of the type of cases used, cases are intended to help teachers develop the knowledge and skills needed to respond to the complexities and demands of real-time teaching and begin to think like teachers. According to Richardson (1996, ix), one challenge of teacher education is to help teachers "begin to develop practical knowledge that will allow them to survive the reality of the classroom." Cases appear to be one way of facilitating teachers' development of this practical knowledge.

The first book of mathematics cases was published in 1994 (see Barnett, Goldenstein, & Jackson, 1994) and launched a new era in the education of teachers of mathematics. Since the publication of this volume more than a decade ago, many additional mathematics casebooks have been published (e.g., Merseth, 2003; Schifter, Bastable, & Russell, 2007; Seago, Mumme, & Branca, 2004; Stein, Smith, Henningsen & Silver, 2000). (See the Appendix for a more complete listing.) These casebooks vary greatly in terms of content focus (e.g., specific mathematical ideas, students' thinking about particular pieces of mathematics, the pedagogy used to support student learning of mathematics), grade level (e.g., elementary, middle, high school), type (i.e., narrative or video), and authorship (i.e., written by teachers describing their own practice vs. written by a third party describing some aspect of classroom instruction). Despite these differences, cases in mathematics education share a common feature of providing realistic contexts for helping teachers "develop skills of analysis and problem-solving, gain broad repertoires of pedagogical technique, capitalize on

the power of reflection, and experience a positive learning community” (Merseth, 1999, pp. xi-xii).

Learning from Cases

Learning from cases is not self-enacting. Reading a case does not ensure that the reader will automatically engage with all the embedded ideas or will spontaneously make connections to his or her own practice. Most of the case materials currently available (see Appendix) provide suggestions to support a facilitator’s use of the cases. In fact, several casebooks have companion facilitation guides that provide explicit and extensive suggestions regarding how to use the cases.

Although there is no standard protocol for how cases are to be used, many case authors suggest having teachers begin their work on a case by first solving the task on which the case is based. Steele (Chapter 6) makes this point, arguing that working on tasks and cases *together* enhances the learning of mathematical, pedagogical, and pedagogical content knowledge.

Group discussion, deliberation and debate, however, are key to learning from cases (Shulman, 1996). The success of a case discussion depends in large measure on the skill of the facilitator in managing active learners with multiple (and often conflicting) viewpoints and in highlighting the question, “What is this a case of?” This question is of critical importance in stimulating learners “to move up and down, back and forth, between the memorable particularities of cases and the powerful generalizations and simplifications of principles and theories” (Shulman, 1996). Like an experienced teacher, a facilitator must decide “when to let students struggle to make sense of an idea or problem..., when to ask leading questions, or when to tell students something” (NCTM, 1991, p. 38). The choices made by the facilitator have an influence on the direction of the discussion, on the depth and range of issues that are brought to the fore, and on the opportunities participants have to gain new insights, question current practices, and continue to learn and develop as professionals. Goldsmith and Seago (Chapter 11) highlight the role of the facilitator in keeping the discussion focused on the goals of the professional development session in which the case is being used and characterize the moves made by the facilitator that help to focus teachers’ attention on key aspects of the case. The identification of these discussion moves is of critical importance in helping novice teacher educators begin to embrace the case approach.

Although the decisions made by the facilitator during the discussion are critical, Silver and his colleagues (Chapter 8) and Kazemi and her colleagues (Chapter 3) highlight the importance of the decisions made by the facilitator in selecting and sequencing cases that will engage teachers in discussing issues which the facilitators have identified as important aspects of teachers’ learning. Hence, deciding what case to use for what purpose is critical. According to Sykes and Bird (1992), the selection and sequencing of cases with other elements of teacher education is a complex curricular issue. Ball and Cohen (1999) caution us to design professional education experiences so as to avoid “simply reproducing

the kind of fragmented, unfocused, and superficial work that already characterizes professional development” (p. 29).

Research on Learning from Cases

Although there is considerable enthusiasm for using cases in teacher education, and many claims regarding the efficacy of this approach (e.g., Merseth, 1991; Sykes & Bird, 1992), establishing an empirical basis for these claims has been a slow process. In 1999 Merseth noted “the conversations about case-based instruction over the last two decades has been full of heat, but with very little light” (p. xiv). One coherent attempt to define an empirical basis for the use of cases in teacher education is the book entitled, *Who Learns What From Cases and How?: The Research Base for Teaching and Learning with Cases*, edited by Mary Ludenberg, Barbara Levin, and Helen Harrington (1999). The chapters in this book report the findings of a series of studies, mostly descriptive or naturalistic, conducted by the authors in an effort to determine what students enrolled in their teacher education courses learned. Although the book edited by Ludenberg and her colleagues and many other research studies that are identified by the authors of the chapters in this volume provide support for case methods, additional research is needed to explore issues of teacher learning (e.g., what do teachers learn from different types of cases and how they learn it) and how what teachers learn impacts their teaching performance. Chapter 5, written by Henningsen, provides one example of the way in which a case discussion can impact a teacher’s practice.

The Case Chapters

The chapters presented in this monograph are a first step in examining the use of cases in mathematics teacher education and highlight the diversity of cases themselves and the contexts in which cases can be used. For example, Chapter 7 (Hillen and Hughes) provides a detailed accounting of the use of lengthy narrative cases (Smith et al., 2005b) in a graduate-level methods course, with preservice and inservice teachers spanning nearly every grade level K-12. By contrast Chapter 4 (Shifter and Bastable) describes the use of a short narrative case (Shifter et al., 2007) with inservice elementary teachers. Finally, Chapters 9 (Romagnano, Evans & Gilmore), Chapter 10 (Van Zoest & Stockero), and Chapter 11 (Goldsmith & Seago) highlight the use of video cases. These chapters illustrate that “case strategies” applicable to written cases generalize to video cases. Table 1 provides an overview of the chapters, including the setting in which the case was used, the grade level(s) of the participating teachers, and the source of the case(s) discussed.

Many of the chapter authors have provided examples of how a case can be used for a purpose that may be somewhat different from what the authors of the case materials might have intended. Generally, when casebooks are written, the authors think of them being used “in their *entirety*.” So, for many of the case resources found in the Appendix, it is not unusual for the case authors to provide guidance in how to use the materials as a stand-alone professional development program. Indeed, we all know instances of such use and how valuable this can

be (Chapters 3, 10, and 11 in fact describe situations where the materials were used in their entirety). *Decomposing* case resources and making choices to limit use to just one or two cases naturally requires artful orchestration. Many of the chapters in this volume provide thoughtful reports of ways that single or a few cases have been extracted from more comprehensive resources and how these extracted cases have been carefully sequenced with other materials to help teachers develop their capacity to analyze and reflect on practice. Such discussions of case adaptation are certainly a “first” for the case literature. As readers of this monograph reflect on the uses of cases described here, we hope they will begin to consider additional ways in which cases might be used, particularly when it is not feasible to use an entire case resource. We encourage readers to continue the discussion and sharing that have begun with this set of manuscripts.

Table 1. Overview of each chapter in the monograph

Chapter	Chapter Author(s)	Setting	Grade Level of Teachers	Source of Cases Discussed
2	Morris	Methods Course (Preservice)	Elementary	Barnett-Clarke & Ramirez (2003)
3	Kazemi, Lenges, & Stimpson	Professional Development (Inservice)	Elementary	Schifter, Bastable, & Russell (1999)
4	Schifter & Bastable	Professional Development (Inservice)	Elementary	Schifter, Bastable, & Russell (2008)
5	Henningsen	Methods Course (Preservice)	Elementary	Smith et al. (2005b)
6	Steele	Graduate Methods Course (preservice & inservice)	Elementary Middle High	Smith et al. (2005c)
7	Hillen & Hughes	Graduate Methods Course (preservice & inservice)	Elementary Middle High	Smith et al. (2005b)
8	Silver, Clark, Gosen, & Mills	Professional Development (Inservice)	Middle	Smith et al. (2005a, 2005b); Stein et al. (2000)
9	Romagnano, Evans, & Gilmore	Content Course (Preservice)	Middle High	Seago, Mumme, & Branca (2004)
10	Van Zoest & Stockero	Methods Course (Preservice)	Middle	Seago, Mumme, & Branca (2004)
11	Goldsmith & Seago	Professional Development (Inservice)	Middle	Seago, Mumme, & Branca (2004)

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