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TEXTO

A PRACTICE-BASED THEORY OF MATHEMATICAL KNOWLEDGE FOR TEACHING

INTRODUCTION

A central challenge of professional education is to prepare novices for skilful beginning practice. Doing this depends on robust theory about the relationship between teaching practice and teacher education. Theories of instruction provide a foundation for a professional curriculum centred on learning the practice of teaching.

One particularly vexing problem has been to determine the mathematical knowledge needed for teaching. Teachers need to do more than simply *know mathematics*. They need to be able to *use* mathematics in the work of teaching pupils. Research on teachers' mathematical knowledge has investigated what practicing teachers do know, and our literature is replete with studies that show the lacks in teachers' content knowledge. Others have created lists of what teachers *should* know, based usually on the curriculum they are responsible for teaching or on expert opinion about what would be good for teachers to know. These lists are not empirically connected to the work of teaching – that is, we do not know whether teachers who know these things actually teach better than those who do not. Although important, neither of these approaches to identifying the mathematical knowledge needed for teaching is tied to the work of teaching, and hence, neither is warranted by the demands of the work.

The introduction of *pedagogical content knowledge* (Shulman, 1986) as a special domain of teacher knowledge was important for distinguishing the personal knowledge of content (knowing content for oneself) from the special amalgam of content and pedagogy needed to teach the subject. Important here was the naming of a type of content knowledge uniquely needed by teachers – a subject-matter-based form of professional knowledge. The notion of pedagogical content knowledge quickly caught the imagination of researchers, not only in mathematics but also in science education. Still, the term was underdefined, and scholars and teacher educators used the notion in different ways.

MATHEMATICAL KNOWLEDGE FOR TEACHING

Our research group decided to investigate the question more directly by asking, "What do teachers *do* in teaching mathematics, and how does what they do demand mathematical reasoning, insight, understanding, and skill?" We oriented our investigation of the mathematical knowledge needed for teaching in studies of the practice of teaching. We sought to uncover the ways in which mathematics is involved in contending with the regular day-to-day, moment-to-moment demands of teaching. Our analyses lay the foundation for a *practice-based theory of mathematical knowledge for teaching* (Ball & Bass, 2003). This approach can be seen as a kind of job analysis, similar to analyses done of other mathematically intensive occupations that range from nursing and engineering physics (Hoyles, Noss, & Pozzi, 2001; Noss, Healy, & Hoyles, 1997) to carpentry and waiting tables.

By "mathematical knowledge for teaching" (MKT), we mean the mathematical knowledge *needed to carry out the work of teaching mathematics*. We focus on the tasks involved in teaching and analyse the mathematical demands of these tasks. Obviously, because teaching involves showing pupils how to solve problems, answering learners' questions, and checking their work, mathematical knowledge for teaching

requires understanding the school curriculum. However, it also requires mathematical understanding beyond what can be seen on the tables of contents of school textbooks or in curriculum frameworks.

The fundamental questions that orient this theoretical approach are:

1. What are the recurrent tasks and problems of teaching mathematics? What *do* teachers do as they teach mathematics?

2. What mathematical knowledge, skills, and sensibilities are required to manage these tasks?

By "teaching", we mean everything that teachers do to support the learning of their pupils. Clearly we mean the interactive work of teaching lessons in classrooms, and all the tasks that arise in the course of that work. But we also mean planning for those lessons, evaluating pupils' work, writing and grading assessments, explaining learners' progress to parents, making and managing homework, attending to issues of equity, and justifying one's decisions to the school head.

Central to the progress of this work has been a large longitudinal database, documenting an entire year of the mathematics teaching in a grade 3 public school classroom. The records collected across that year include videotapes and audiotapes of the classroom lessons, transcripts, copies of pupils' written class work, homework, and quizzes, as well as the teacher's plans, notes, and reflections. Records of practice from a range of other U.S. classrooms have complemented this database. A second major resource has been the fact that our research group comprises individuals from a wide range of different disciplines and experience. By analyzing these detailed records of practice, with different perspectives and knowledge, we seek to develop a theory of mathematical knowledge as it is entailed by and used in teaching (Ball, 1999). An important weakness of this work is the gap left by building this theory on teaching practice in a single country (the United States). Given that teaching is a cultural practice (Stigler & Hiebert, 1999), the theory we are developing may be limited for explaining the mathematical demands of teaching in other cultural settings. Scholars have begun to test the validity of the theory in other countries (see Delaney, 2008, 2009; Delaney, et al., 2008), with promising results for the robustness and revisability and extension of a more culturally broad version of a practice-based theory of mathematical knowledge for teaching.

Extraído de: Ball, D.L.; Thames, M.H.; Bass, H.; Sleep, L.; Lewis, J.; Phelps G. A Practice-Based Theory of Mathematical Knowledge for Teaching. Proceedings of *33rd Conference of the International Group for the Psychology of Mathematics Education*, v. 1, pp. 95-98. Thessaloniki, Greece: PME.

Responda as questões a seguir, com base no texto dado.

Questão 1. (valor: 2,0) No segundo parágrafo da Introdução do texto, os autores indicam uma lista de pontos investigados na pesquisa sobre o conhecimento matemático de professores. Que crítica os autores apontam a respeito dessa lista?

Questão 2. (valor: 2,0) Por que, segundo os autores, a introdução do conhecimento pedagógico de conteúdo por Shulman (1986) foi importante?

Questão 3. (valor: 2,0) Como os autores orientam sua investigação sobre o conhecimento matemático necessário para o ensino?

Questão 4. (valor: 2,0) Para os autores, o que é conhecimento matemático para o ensino e o que esse conhecimento requer?

Questão 5. (valor: 2,0) Que fraqueza os autores apontam em relação ao próprio trabalho?