

EXAMINING PEDAGOGICAL CONTENT KNOWLEDGE

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Examining Pedagogical Content Knowledge

The Construct and its Implications
for Science Education

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The ambitious task of putting together a volume such as this is daunting at best. Although it may not be obvious, the completion of chapter contributions by the authors is far from completion of the project. The individual chapters must then be put together into the text you are now holding. This task involves the creation of subject indices, author indices, table of contents, and extensive copy editing, not to mention general formatting of the text into a coherent whole. As you might imagine, this is a thankless task. We would like to acknowledge the significant contributions and extensive efforts of Mary K. Gfeller, Renée S. Schwartz, and Shiang-Yao Liu, members of the Academy for Excellence in Science and Mathematics Education at Oregon State University, in helping us bring this text to fruition. We are permanently indebted to these individuals for freely volunteering their valuable time to this project.

FOREWORD

The summer of 1983 was quite hot, particularly in Texas. I had been invited to give a lecture at a national research conference on the study of teaching held in Austin at the University of Texas. I purposely chose as my topic the ambiguous title “The Missing Paradigm in Research on Teaching.” To my delight, the title had apparently stimulated serious discussions among the participants in anticipation of my lecture. What, they wondered, did Shulman have in mind as “the missing paradigm?” Speculations abounded. Many predicted that I would identify “teacher cognition,” the central theme of Michigan State’s Institute for Research on Teaching (IRT) which I had directed, as the missing paradigm. Others nominated “context.” Still others speculated that it would be “teacher personality .” Although I didn’t take a formal poll, it appeared that not a single member of the audience anticipated the aspect of teaching and its investigation that I declared missing. Indeed, even as I approached my concluding remarks at the end of a hill hour’s lecture (I am not, alas, known for my economies of expression), most were shocked when I declared that the missing paradigm was the study of subject-matter content and its interaction with pedagogy.

Perhaps it should not have surprised me, since the centrality of content had eluded me as well for many of the preceding years. I had criticized the reigning program of process-product research for many reasons in the past, primarily its relentless attention to teacher behavior rather than teacher thinking as the focus of “process,” and its reliance on standardized achievement tests as the sole indicators of “product.” But the more cognitive approaches to the stud! of teaching, which I had so enthusiastically supported, had treated teachers as generically in their thoughts as Nate Gage or Tom Good had treated them in their actions.

There was an interesting irony in my blindness as well. A major influence on my studies of teachers’ thinking had been the research I had conducted from 1968 through the mid-1970s on the reasoning processes of physicians. Perhaps the most salient finding from our studies of medical reasoning (see Elstein, Shulman, & Sprafka, 1978) had been the *domain-specificity* of clinical problem solving. That is, contrary to prevailing medical lore that assumed a general trait of diagnostic acumen in which some physicians were generally better diagnosticians than others.

we had demonstrated that diagnostic competence was domain specific rather than general. Nevertheless, although our experience in studying the reasoning and decision processes of physicians was a major influence on the development of new approaches to the study of teaching, we transplanted the emphasis on cognition, but not the insights regarding domain-specificity. Thus, for example, when we studied teacher planning in the IRT, we did so generically.

The ideas that became “pedagogical content knowledge” (or PCK as it we fondly dubbed) first saw the light of print in two key papers. the first. “Those who

understand: Knowledge growth in teaching,” was my April, 1985 Presidential Address to the *American Educational Research Association* and was published about one year later in *Educational Researcher*. The second, “Knowledge and teaching: Foundations of the new reform,” was published about a year later in the *Harvard Education Review*. A good deal had happened between the winter of 1985 and the winter of 1987. The earlier paper was one of my first reports of our research on the development of secondary-school teacher knowledge. With support from the Spencer Foundation, we were longitudinally studying the interaction of content knowledge and pedagogical development among a cohort of prospective teachers of science, mathematics, social studies and English at Stanford. During the next two years, I was drawn heavily into directing the research on the assessment of teaching in support of the incipient *National Board for professional Teaching Standards*. This latter project, supported by the Carnegie Corporation of New York, built directly on the theoretical foundations we had erected in the Teacher Knowledge project (which continued concurrently through 1987).

Our notions of PCK had some interesting consequences for those subsequent initiatives. For example, the National Board opted for a structure that designates domains of certification by content areas as well as developmental levels of students (leading to more than 30 National Board assessments). The Board’s view of “what accomplished teachers know and are able to do” is predicated on the age and domain-specificity of pedagogical content knowledge. Moreover, the structure of the Board’s teaching portfolios, which include unit design, documentation of teaching, analysis of student work, and substantial reflective analysis of practice, rest heavily on the conception of “pedagogical reasoning and action” that is offered in “knowledge and teaching.”

Other scholars have added substantially to our understanding of the interaction of content and pedagogy. For example, the work of Pamela Grossman and Susan Stodolsky demonstrated how orientations toward content in high school departments of mathematics and English can have a pervasive impact on the faculty members’ orientation toward the reform of schools and of teaching. This emphasis on “content as context” has been a productive line of work. It also built on Stodolsky’s earlier research on the role of content differences in elementary school pedagogy, persuasively presented in Stodolsky’s aptly titled “The subject matters.”

Similarly, the contributions of Gaea Leinhardt to the pedagogies of mathematics and of history have helped us to understand the distinctive characteristics of both the discourse and the pedagogies of those fields. Leinhardt and her colleagues have also helped us see that subject-matter domains may well be narrower than their disciplines. Deborah Ball and Hyman Bass are making important inroads to understanding the subtleties of pedagogical content knowledge in the discourse of elementary mathematics classrooms.

An unexpected development was the interest in PCK from the world of higher education. The field of teaching in higher education had been limited by the features of a generic or technical view of teaching. Generic student evaluation forms of teaching, and the more general strategies of teaching improvement characterized by many university centers for teaching and learning had contributed

to the view that the quality of teaching had nothing to do with the quality of scholarship in a discipline. Nevertheless, a rhetoric abounded that claimed that teaching and research were closely connected. But how could they be when teaching was seen as generic while research was clearly discipline or domain specific? The concept of pedagogical content knowledge was therefore welcomed in higher education circles because it buttressed the claim that teaching, like research, was domain specific. This implied that teaching as “the transformation of understanding” rested on depth, quality and flexibility of content knowledge and on the capacity to generate powerful representations and reflections on that knowledge. Subsequent projects on the peer review of teaching in colleges and universities, that I pursued in collaboration with Pat Hutchings and Russ Edgerton of the American Association for Higher Education, rested on much of our work on teacher assessment, and grew out of those ideas about PCK.

The Teacher Knowledge and Teacher Assessment projects were blessed with a remarkable group of graduate student scholars who contributed immeasurably to its successes, and who have generally extended the work and corrected its earlier limitations through their own subsequent independent efforts. They included some of the authors who contributed to this volume, such as Jill Baxter and Bill Carlsen, as well as Pam Grossman, Sigrun Gudmundsdottir, Maher Hashweh, Liping Ma, Miriam Gamoran Sherin, Gary Sykes, Suzanne Wilson, and Sam Wineburg, among many others.

A few months ago, a new PhD now embarked on his professorial career approached me at the American Educational Research Association meetings. He was interested in pedagogical content knowledge, the topic of his recent dissertation, and wondered if anyone was working on “it” any more. I assured him that, while I wasn’t certain how many people continued to use the phrase, there was every indication that concern with discipline and interdisciplinary pedagogies of substance remained both significant and necessary. I am no more sanguine now than I was fifteen years ago that generic conceptions of teaching are sufficient. I am also far less insistent that general conceptions of pedagogy are illusory (see Greta Dersheimer’s chapter in this volume for a cogent argument in this direction). If we are going to make significant advances to our understanding of the pedagogy of both pre-collegiate and post-secondary education, however, I believe we need to nurture a “scholarship of teaching” that is built upon those same concepts from which we developed our work on pedagogical content knowledge.

Every educational idea is inherently incomplete and probably seriously flawed. An idea is useful to the extent that it can stimulate the thinking and scholarship of others. I trust that our work on pedagogical content knowledge may meet those standards of utility. I hope that those who use these ideas now and in the future will give more attention than I did to the connections between teachers’ knowledge and the ultimate consequences for students’ learning and development. My current work attends more seriously to those relationships. I am grateful to the editors and authors of this volume for the critical care with which they have approached these ideas, and the combination of respect and skepticism with which they have been treated. I look forward to a continued interest in the pedagogies of substance that

will connect the very best scholarship on learning and teaching from the elementary grades through graduate school.

Lee S. Shulman
Carnegie Foundation for the Advancement of Teaching