Chapter 1

PCK: Its Genesis and its Exodus

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Background

When the contributing authors of this book met together at what became known as the PCK Summit, the first session was a video conference with Lee Shulman who offered a personal glimpse into his thinking about the issues, times and events that have shaped PCK. Shulman typically presented a coherent, thoughtful and well-structured presentation and invited the audience into his thinking in ways that gave insights into the history of PCK; a history that is important in understanding why this seductive construct has attracted so much attention from researchers for so long.

The chapter that follows is an edited transcript of Shulman’s presentation and as quickly becomes apparent, brings the construct to life in ways that builds a deep understanding of PCK, its value and the place of sophisticated knowledge in teaching.

The birth of PCK

In some ways I feel a little uncomfortable talking authoritatively about Pedagogical Content Knowledge now. I feel like the biological father of a baby that was raised in its infancy and then given away for adoption or foster care when it was about five years old. During the years that followed, the youngster was raised by many parents and played with many peers. Now that it has survived adolescence and reached emergent adulthood, most of you know far more about PCK than I possibly could because you have been living with, developing, elaborating, revising and applying that set of ideas in serious research and pedagogical work.

I have been caught up in a number of other topics in the last 30 years. Therefore, the most appropriate thing for me to do on this occasion is to take us back and re-think with you where this idea came from and what I had in mind when it was first conceived. What was its provenance? What was my motivation? And now, looking back at PCK and its evolution, what do I see as its strengths, but also what do I see as its weaknesses? I think that any idea, however generative, is a product of its time and circumstance. Any idea must be understood as a contribution to the conversation of which it was a part, not as a universal truth or generalization. PCK certainly has weaknesses and I trust that many of you are shoring up those deficiencies, elaborating and going beyond its initial formulation, as should be the fate of any reasonably good idea.

**A discipline can be organized in different ways**

I have tried to ask myself what were the very first roots of this idea that I can remember? And what I remember is sitting in an undergraduate classroom at the University of Chicago with Professor Joseph Schwab in 1957 or 1958. Schwab was either teaching a course in the biological sciences or a course in the history, philosophy and methods of science—I don’t recall which because I was blessed with the opportunity to be his student in both those yearlong courses. Schwab was regularly talking about a painfully difficult idea— the structure of the subject matter. He was wrestling with concepts of the structure of subject matter, the organization of knowledge, and how disciplinary organization relates to how people come to KNOW a discipline. He would later refer to the distinction between the substantive and syntactic structures of subject matter, and I believe he was engaging with the precursors of those ideas as he taught.

The “summit” at which we are now engaged has been organized by BSCS, the Biological Science Curriculum Study. As Schwab described it to me (we remained close until he died in 1988), the scientists who were trying to invent BSCS as a curriculum in the late 50s and early 60s had come to a stalemate. They were attempting to create the biological curricular equivalent of the “new math” and the “new physics.” But they seemed unable to make any progress. Instead, they were constantly arguing. As he described the situation, Schwab and a couple of others had this great insight. Their insight was that the reason they were arguing is that tacitly they had competing conceptions of what counted as biology. And if you can’t agree on what a subject entails, it’s rather difficult to design a curriculum to teach it. Schwab and his co-conspirators made the modest suggestion that they should divide biology into three variations, divide the developers into three compatible groups, who then create three parallel
Giving PCK up for adoption

curricula rather than continue trying to develop an elusive consensus on just one. Thus three BSCS curricula emerged—cell biology, structure-function biology, and ecology (forgive me if I have these wrong)—each representing contrasting starting points and syntactic and substantive structures for the discipline. The notion that the content of a discipline was not a “given” but was a decision, a construction, a matter of debate and deliberation, left an indelible impression upon me. A discipline did not necessarily have but one structure (contrary to those who insisted on discussing “the” structure of a subject matter); its structures depended upon how one organized the discipline for both inquiry and for teaching.

Connecting subject matter to pedagogy

Five years after arriving at Michigan State for my first post-PhD academic appointment, during which time I was primarily engaged in studying the problem solving processes of teachers (a continuation of my doctoral dissertation), I was invited to join the faculty of Michigan State’s new medical school because I was doing research on complex problem solving and because I understood some of the factors associated with developing new methods for teaching novices how to engage with medical problems. We were inventing a novel curriculum for this new school, in which medical problem solving was one of the organizing principles of the entire school, along with the importance of doctor-patient interaction, empathy and communication. I was able to take my extant research program on teacher thinking and I shifted it entirely to looking at how physicians think and how physicians solve problems in the processes of medical diagnosis. Among the findings of this body of research, which we pursued for almost ten years in collaboration with my close friend and colleague Professor Arthur Elstein (Elstein, Shulman, & Sprafka, 1978) was the domain-specificity of clinical diagnosis. It was quite striking that although medicine was traditionally taught as if there was some generic cognitive skill called “Diagnostic Ability”, there was no evidence of the presence of such a general cognitive skill. Indeed, what we discovered about the ability to think like a physician-- as we studied outstanding specialists in general internal medicine and how they worked on complicated medical problems--the great surprise that we brought to the medical world was there wasn’t such a thing as Diagnostic Ability, that diagnostic knowledge and competence was domain specific. Physicians didn’t have generalized diagnostic knowledge. They had domain specific knowledge. If your specialty was cardiovascular medicine, and you encountered a patient who presented with a case of neurological dysfunction or of renal dysfunction, we could not presume that you would be very good at diagnosing it. Here was perhaps the most important finding of our
studies in medical problem solving, a finding that influenced both assessment and teaching in medical education, and I didn’t immediately see its relevance for my primary field, the study of teaching at the primary and secondary levels.

In the mid-1970s, my MSU colleagues and I took our general strategies and methods for studying medical thinking and applied them to the study of pedagogical reasoning and decision making among teachers. We took a cognitive (though not yet a domain-specific) approach to the study of teaching, and using that model we received substantial government funding to create the Institute for Research on Teaching (IRT) at Michigan State. The big contribution of the IRT was to shift the focus of research on teaching, from the then-dominant behaviorist paradigm for research on teacher behavior that was called process-product research, to research on teacher thinking, teacher knowledge, teacher planning, teacher decision-making, teachers’ conceptions of their subject matter and how that related to how they performed. It was really quite a major shift, and it helped lead the field in quite new directions. What strikes me looking back on those years, for some of which we were doing the medical and pedagogical research concurrently, is we were so invested in looking at teacher knowledge and thinking that we never connected questions of subject matter content to that. We never examined how teacher thinking was domain-specific. The work on teacher planning was work on teacher planning generically. It was not differentiated to look at the differences between planning in the teaching of mathematics and the teaching of history.

And so it was that in the early eighties, shortly after I moved to Stanford after two productive decades at Michigan State in the teacher education programs, the medical school and the Institute for Research on Teaching, that the notion that there was a “missing paradigm” in the study of teaching and teacher education hit me between the eyes. It was embodied in the title that Susan Stodolsky later gave to her important book The Subject Matters (Stodolsky, 1988). It really matters. The deep problem of process-product research was not simply that it ignored teacher thinking and only looked at teacher behavior. It treated the skills of teaching simply and generically. Indeed, even the cognitive approaches that we pioneered at the Institute for Research on Teaching could be indicted on those grounds. That’s when we began the work that became the work on Pedagogical Content Knowledge. But where did this notion of Pedagogical Content Knowledge come from in more immediate terms?
Inferring the existence of PCK without actually locating it

I look back on the speculations regarding PCK as similar to the way in which astronomers discovered the planet Neptune. We were comfortable using the idea of teacher content knowledge; we knew that there was a category called content knowledge. There had been a lot of research on content knowledge and one of the striking things about the empirical relationship between content knowledge and the quality of teaching was that the coefficients and beta weights were far weaker than we thought they ought to be and there was a lot of variation in those values. By the same token we had several decades of experience measuring generic pedagogical skill and knowledge and those constructs appeared to have better correlations with teaching and a teaching practice than content knowledge alone. And yet pedagogical skill was relentlessly domain-independent and generic. I think it was only when we began to think that way that we were able to put together the much older findings from medicine and think, “You know what? If the work of a physician and the quality of a physician’s diagnoses and treatment decisions are domain specific, isn’t this the case with teaching as well? Isn’t there a missing ‘planet’ between content and pedagogy that defines the essential missing aspect of teaching?” Thus did the work on Pedagogical Content Knowledge begin.

Evolution of PCK: Teacher knowledge is domain specific and contextualized

The research began with a multi-year study called The Teacher Knowledge Project supported by a grant from the Spencer Foundation. With the participation of several generations of remarkable graduate students, we studied how new secondary school teachers learn to teach within the content areas of science, math, English and history. Slowly but surely the knowledge grew. Studies were conducted within disciplines as well as between them. Maher Hashweh studied how middle school teachers’ instruction on topics in physical sciences and biological sciences (often taught together in the “general science” middle school curriculum) were taught quite differently depending on the depth and quality of a given teacher’s grasp of both the content and associated pedagogy of those topics. Pam Grossman discovered how the same teacher’s approach to teaching English literature changed when teaching the same students the rules of grammar. Bill Carlsen described how biology teachers’ planning and teaching within a year-long biology course for the same class changed when they moved from aspects of biology whose content and pedagogy they knew well, e.g., ecology or the physiology of organ systems, to topics they found more difficult to teach, e.g., genetics.
As we were pursuing this research and moving ahead in articulating a conception of content knowledge, pedagogical knowledge and PCK (Shulman, 1986, 1987) there arose a very critical challenge and opportunity. Gary Sykes (also among the cohort of graduate students) and I were invited by the Carnegie Corporation’s Commission on the Future of the Teaching Profession to do a policy analysis of whether a medicine-like National Board would make the kind of sense in teaching as it did to define and govern standards of medical knowledge and practice.

In the policy paper we wrote, A National Board for Teaching: In search of a Bold Standard, (Shulman & Sykes, 1986) we came to three conclusions. One was that a National Board was a fine idea, well worth establishing and supporting. Teaching ought to have its own National Board with an associated program of quality assessment. The second conclusion was that it couldn’t have just one board and a single assessment because teaching was not a singular practice. Really accomplished teaching had to be looked at contextually which meant it had to be content specific. So we proposed that there be different boards for different teachers who taught different subject matters at different age levels. The third thing we argued was if you try to measure accomplished teaching and the understandings and skills needed to engage in such teaching by using the kinds of assessment methods that were currently extant, more harm than good would be brought upon the teaching profession. Extant assessment methods tended to be some combination of multiple-choice tests of teaching and generic observation schedules used generally by principals who visited classrooms for thirty minutes at a time, and didn’t need to know the subject matter being taught.

The challenge to develop a theoretical rationale for a National Board was turned on its head when I was given the challenge by the Carnegie Corporation to lead a research group to design this National Board assessment for teachers that Sykes and I had described in principle, primarily by calling attention to what it should avoid. When I accepted that challenge, it was clear that any assessments of teaching competence would have to be domain specific. A new assessment wasn’t going to look like the one-size-fits-all National Teacher’s Examination of ETS. The assessment system we created, designed, revised, field tested and handed over to the newly organized National Board during that period reflected our research and thinking about Pedagogical Content Knowledge. It is domain specific. It is also development level specific, vis-à-vis the students being taught. We initially devoted two years to developing very complex assessments that were simulations of the many facets of domain specific teaching. Our cases-in-point were elementary level mathematics and
Giving PCK up for adoption

secondary history. When we appreciated the limitations of the simulation-based four-day assessment center (it was not an inexpensive endeavor), we turned to a portfolio-based system that was field-tested in elementary language arts and secondary biology. Angelo Collins, who later led the science standards project for the National Academy of Sciences and was the founding executive director of the Knowles Science Teaching Foundation program, directed our work in secondary biology. In all this work, attention was carefully directed at the intersection of pedagogy and content, at what teachers needed to know and be able to do in order to teach the content and skills of the curriculum to students of different ages and backgrounds. It was applied PCK on steroids.

The reason we shifted from a simulation-based assessment system to a year-long portfolio-based assessment documenting in a structured fashion the teaching and learning that occurred in teachers’ classrooms foreshadows the comments I shall soon make about some of the limitations of the original PCK idea. We moved to portfolios because we came to recognize that domain-specific teacher knowledge couldn’t be rendered operational unless it is also contextualized. Paraphrasing Schwab’s commonplaces, teachers teach what they teach to specific students in some setting. Unless you have a mode of assessment that could document the students they were teaching, the specific content, the instructional setting and, in some manner, the “historical” context in which they were teaching over a school year (early or late, during a heavy testing period or before the holidays), you would have a much impoverished measure of teaching competence. The subject mattered, but so did lots of other things.

Challenges of defining a domain

The claim of domain-specificity is very important and also highly elusive. What counts as a domain? Is it a discipline, specific topics or problems within a traditional discipline, a broad hybrid space that encompasses several disciplines, a field of practice or policy? It’s different in different settings, in different kinds of schools and cultures and what functions as a domain will depend on the interaction of all those factors. I was stimulated by a note that Deborah Ball and Magdalene Lampert wrote to me many years ago from the perspective of teaching practice, that suggested that the “strategic knowledge” I had posited as a critical feature of PCK was not to be construed as “something” that teachers had in their heads but was a more dynamic construct that described the processes that teachers employed when confronted with the challenge of teaching particular subjects to particular learners in specific settings. It is a place in your thinking and acting as a teacher that you know you have to address every time you get to teach in these situations. There are indeed some kinds of knowledge such as
powerful pedagogical representations (e.g., analogies, metaphors, narratives, physical models) that can be acquired and transformed by teachers when designing instruction in predictably difficult areas, for example, aspects of evolutionary biology and conceptions of chance, adaptation and survival. But these forms of high-leverage knowledge and the teaching practices associated with them are a generative starting-point for teachers. They are not the sum of their pedagogical know-how.

Limitations of the original PCK formulation

What are some of the real weaknesses and limitations of the original formulations of what we now fondly know as PCK? Let us remember that the idea was put forward at a particular point in time, in the midst of a set of conversations and debates about education as theory, practice, policy and moral action. The form that PCK took in those years was a function, in large measure, of the discourse that was ongoing at the time. It was a response to a set of prevailing views that treated teaching as process without content, and teachers as skilled actors without minds, emotions and careers.

The first limitation is that Pedagogical Content Knowledge as I originally conceived it was devoid of emotion, affect, feelings, and motivation, all of the non-cognitive attributes. It also gave short shrift to the moral character of teaching, an aspect of my work that so annoyed one of my former teachers, Philip Jackson. I was so intent on combatting the missing paradigm of content that I did not devote attention to affect and motivation, nor to moral judgment and reasoning in teaching. This is such an important missing piece. The affective aspects of teacher understanding and action are important both because a lot of what teachers “know and do” is connected to their own affective and motivation states, as well as their ability to influence the feelings, motives, persistence and identity formation processes of their students. All of this is also related to their normative vision for the kind of world to which they aspire to contribute as professional educators and as citizens in democratic society. If you think about how important social justice perspectives have been in teacher education in the last twenty years, part of it is because the notion of a good society, of an equitable society, of a just society and all of the feelings that go along with that should not be ignored. I did not pay attention to those issues in our original work, but anyone working on this area cannot afford, as I did thirty years ago, not to pay really close attention to the affective and moral dimensions of teaching.
Second, my conception of PCK was relentlessly intellectual; it was attentive to the life of the pedagogical mind, and it didn’t attend sufficiently to pedagogical action. Nate Gage once accused me of leaving teachers “lost in thought.” He was among the heroes of “process-product” approaches, and the idea of process was a description of what teachers actively do. The idea of PCK needs to place much-needed emphasis on teacher thought and emotion, but not by ignoring the role of action in teaching practice. If you look at the work on Pedagogical Content Knowledge in the early days it so emphasized teachers as thinkers, as problem solvers, as decision makers. It was almost as if they were sitting in some ivory tower. It wasn’t sufficiently about “what am I going to do with all this thinking I am doing?” It’s a flaw that a number of current teaching scholars are trying to repair now. It simply doesn’t make much sense to be reflective about practices you’re not skilled at performing, and teaching IS a form of skilled performance.

A third limitation was that PCK was insufficiently attentive to questions of the broader social and cultural context. Culture and context are huge envelopes within which we find many of the determinants of teaching and learning. PCK must be pedagogical content knowledge, but also pedagogical culture knowledge and pedagogical context knowledge. It is also about language, religion and identity as features of the lived settings in which teaching, learning and development occur. I now understand that the big idea within PCK was that all teaching must be mindfully situated in the disciplinary, cultural, personal and social settings in which it occurs. PCK is about the importance of situating teaching in all those “cultures” in the sense of ‘culture’ that we use in science, as a medium within which things grow (or die).

Fourth, in the early work on Pedagogical Content Knowledge, there really wasn’t enough about outcomes. When we threw out process product research we replaced the behavioral processes with intellectual processes, but we managed to ignore questions of products or outcomes of instruction. We did not attend to the relationships between how teachers thought and evidence of learning in the students they instructed. The relationship between measured teaching and measured learning is not only an artifact of the accountability policies of government agencies; we have a moral obligation to ask how our teaching is affecting the minds and hearts of our students.

I’m sure I have not exhausted the litany of ways in which the original ideas of PCK had limitations. There are certainly more. Every theory is limited by the very need to set boundaries around the aspects of life that the theory aims to explain. So it is with PCK as well.
PCK as a policy claim about teachers as professionals

One of the motivations for inventing the notion of Pedagogical Content Knowledge was not only to do a better job of educating teachers, to have a better theory of teaching; it was a policy claim, an ideological claim. That’s why it so rapidly led to a National Board for Teaching. That’s why we took pride in the fact that only 35% of the candidates for the Board pass the assessment when they first take it, much less people who have never been trained nor taught. Teachers are professionals, who like other professionals, develop a body of understanding that is so special and so unique that they deserve to be treated as professionals by the society around them with respect, with autonomy, and yes, with compensation. Teaching is demanding and difficult mental and physical work that only the most well-educated and mentored professionals can accomplish. PCK is an attribute that teachers develop, and it cannot be found among mere subject matter experts, or among those who are “good with kids”. It was really a policy claim about how special teachers were and how they ought to be regarded and respected.

Domain specific pedagogies and a domain specific identity

The last thing I will say is that a lot of what I did as president of The Carnegie Foundation for the Advancement of Teaching was to lead a twelve-year program of research on how people are educated across the professions. We conducted extensive multi-year studies that led to books on educating lawyers, engineers, clergy, physicians, nurses and business leaders. We addressed the education of teachers and scholars in different ways. I urge you to look at some of those studies, because in many ways, teaching and the preparation of teachers shares many features with other learned professions. One of the things that stands out was that in every one of these professions we identified what we called Signature Pedagogies (Shulman, 2005). These are profession-specific modes of teaching that we associate with that profession, that seem to fit what it means to learn to be a member of that profession, to learn to think like a lawyer, to learn to act like a nurse, to learn what it means to think like an engineer who is a designer. One of the fascinating things that has emerged from that work on Signature Pedagogy, was that, on the one hand, these pedagogies of the professions are indeed domain specific. Educating physicians uses pedagogies distinctly different from educating lawyers, engineers or ministers. Each field has developed its own PPK, a kind of pedagogical professional knowledge. The practices of medical and nursing teaching rounds are quite different from the case dialogues of law or the studio practices of design or architecture.
Even though the surface structures of professions are distinctive one from the other, I now think I understand that there are underlying principles of professional education that are the deep structure of all those pedagogies and are common across them. What’s even more fascinating (and disturbing) for us as teacher educators is that most of those deep structure principles of the signature pedagogies of the professions are absent in most teacher education programs. One of the things I am concerned about now is why doesn’t teacher education have a fully developed intentionally practiced powerful set of signature pedagogies like other professions? That, mercifully, is a topic for another essay.

One final observation was that in those other professions what were especially important were the habits of mind, habits of heart and habits of practice that a candidate learns to become a professional. All the habits of technical practice, ways of thinking and professional values you learn come together in the formation of professional identity. An engineer learns how to mess with the world, but also that she is then responsible for the mess she has made. The responsibilities of a nurse are organized around his role as an advocate for patients, which serves as the central pivot for that profession’s powerful sense of professional identity. I have a feeling that when the dust settles, and we think about what it means to truly learn to be a science teacher or a math teacher, we will recognize that to become a mature teacher of science, you don’t only learn to think certain ways and practice certain ways, it also involves developing an identity, a sense of self, of personhood. I think the whole notion of what constitutes the professional identity of a superb teacher of science is not one to be ignored.

**Concluding thoughts for the work of the Summit**

I urge you to build on the tradition of BSCS, in the spirit of the story I told you about Schwab’s contributions in recognizing that even though there was not one singular structure of biology that didn’t mean that asking about structures of biology was a vain effort. It meant that if you looked for a single monolithic unifying effort then there will be very good reasons why you will argue endlessly and accomplish little. Similarly, there will be plural perspectives on PCK, more than one legitimate, exciting, and fruitful way of thinking about Pedagogical Content Knowledge. No one can think of everything simultaneously; we’re just not constructed that way as human thinkers. Can we get two or three of these in balance, more or less? Which three do you want to give priority in a given situation? How such competing conceptions related to what the major challenge of educating teachers is in your country? Maybe if you’re in Germany or the Netherlands, teacher content knowledge is not your primary concern. It’s their ability to do pedagogical transformations and representations.
In elementary math and science teaching in the US, the content knowledge of teachers is a serious challenge because so many of the people who decide to become elementary school teachers were not well prepared in math and science and may have acquired negative identities as learners in those areas. As you juggle with the many aspects of teaching and learning, keep all these balls in the air but recognize that as you contextualize things and link PCK to the normative needs of the society that you’re working in and of the global society, different factors will come to the forefront and others will have to take a backseat.

Having given PCK up for adoption nearly a quarter century ago, I am deeply appreciative of the care with which you have raised the baby into adulthood. PCK is now a citizen of many nations, traveling the world with many passports. I have met PCK in China and in Germany, in Norway and the Netherlands, in Australia, Brazil and in BOTH Israel AND PALESTINE, as well as in California and Massachusetts. You have been very good foster parents. Your work is not yet complete.

References


