Commentary on Section 2: Attending to Teachers in Mathematics Teacher Education Research

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Attending to Teachers in Mathematics Teacher Education Research

It is widely accepted that the teacher is the critical classroom factor that determines students' opportunities to learn mathematics (cf. Sanders and Horn 1998; Sanders and Rivers 1996). Thus, research that seeks to understand how teachers, both pre-service and in-service, view themselves and the ways in which teachers develop the knowledge, skills, and dispositions to enact ambitious teaching (Franke et al. 2007; Kelly-Peterson 2010; Lampert et al. 2010; Lampert and Graziani 2009; Newmann and Associates 1996) is timely and critically important to the field of mathematics education.

The four chapters in this section frame research on teachers and their learning in different ways, but all are consistent with the notion of helping teachers develop ambitious teaching by attending to various aspects of their beliefs or identities. Although each is different, the four chapters have much in common. Two chapters (Chao, DePiper) deal explicitly with teachers' identities and how they position themselves in various contexts; the other two chapters (Keazer, Wilson et al.) deal explicitly with supporting teachers as they attempt to change their practice. Two of the chapters (DePiper, Wilson) also look at how teachers position students with respect to mathematics learning. I first provide a brief overview of each chapter and then discuss implications for teacher education and future directions for this type of research.

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The Chapters

Chao illustrates a way researchers can adapt research methods used in other fields, in this case social work and nursing, and apply them to teaching. Using the method of photo elicitation, in which teachers bring photographs that they have identified as significant to them in some way and connected to their teaching of mathematics to an interview, Chao uncovers teachers' identities as people outside of the classroom and ways in which their identities outside of the classroom intersected with the work of mathematics teaching. In particular, he highlights how two Latino secondary mathematics teachers reflect on their experiences as ethnic minorities and the ways this status influenced their thinking about teaching.

Wilson et al. set out to study the ways elementary school teachers used their knowledge of student learning trajectories (LTs) to shape instruction, but what arose from the professional development sessions was a focus on the ways that teachers talked about their students and their abilities to learn mathematics. The authors use attribution theory to describe the sources to which teachers attributed student success and failure. As a result of opportunities to learn about LTs, teachers began to include this language in their discourse about student success and failure in mathematics.

DePiper documents the ways preservice teachers struggled with positioning students and themselves in the context of the sociopolitical demands of public school classrooms and the ways this context clashed with their desires to engage in ambitious mathematics teaching. She also highlights the ways that teachers' identities were constructed by the discourses of teacher education and of the schools in which they completed their field experiences.

Keazer shares the journeys of four teachers attempting to implement practices related to reasoning and sense making (National Council of Teachers of Mathematics 2009) into their secondary mathematics classrooms. She presents the teachers' journeys using mathematical functions as analogies for their paths, using the teachers' points of view to help us understand teachers' perspectives on professional development and instructional change.

These four chapters highlight how much can be learned from small-scale, qualitative studies that shed a fairly small circle of light on the large field of mathematics teacher education. Gaining an in-depth look at a particular set of teachers in specific circumstances raises questions for the reader to consider in one's own teaching, professional development work, and research. Playing off of the work of Pollock et al. (2010), DePiper poses the question "What can I do?" with three different emphases: What *can* I do? What can *I* do?, and What can I *do*? As mathematics teacher educators and researchers, it behooves us to take up the third question and consider what we can *do* as individuals and as a field to help both preservice and in-service teachers enhance their ability to enact ambitious instruction. Thus, in the remainder of this chapter, I offer some possible answers to this question that were prompted by my reading of these chapters.

Implications for Teacher Education

Embracing Reality

Three of the four chapters speak to the idea of change—changing instructional practices, changing individuals' beliefs and practices, and changing identities. Keazer's chapter, in particular, offers us glimpses of teachers' perceptions of their efforts to change their instructional practices. As I think about how to support teachers as they seek to enact ambitious instruction, I am reminded of an idea posed by Tsamir and Tirosh (2000), who said that our task as teacher educators is to prepare teachers to be bicultural—to exist in schools as they are today and to be agents of change. The preservice teachers and the in-service teachers with whom we work must be able to succeed in the current educational system, regardless of whether we or they agree with every aspect of it. If they do not succeed in the system as it is currently constituted, they will have little credibility when they try to implement change, in their own classrooms and in wider venues.

This tension underlies much of the research that has been done on teachers' beliefs to date. Many studies show that some teachers who hold more progressive beliefs enact classroom practices that are more traditional than their espoused beliefs would suggest. Both the DePiper and Keazer chapters give us some insight into how preservice and in-service teachers feel constrained by this tension of trying to succeed in the existing system while also being exposed to ideas about changing the system (or at least their practice within the system).

As teacher educators and researchers, sometimes we fail to acknowledge the enormous impact of "the system" on teachers' lives, even the lives of preservice teachers. We sometimes present ideas in teacher education as though they should be implemented immediately and that implementing them is simply a matter of will. We assume that teachers have seen enough of the status quo on a daily basis in schools, so we must present them with ideas from the opposite end of the spectrum in hopes that their practice will somehow become a reasonable melding of the two. I suggest that we do our cause and our teachers a disservice when we take this approach of extremes. I suspect that we would get far more buy-in from teachers and that teachers would be far more successful if we admitted up front that teaching mathematics, at least in this day and age, is a balancing act between the progressive or reform-oriented ideas espoused in teacher education and the more conservative/traditional ideas that are often the norm in schools. DePiper argues for helping teachers "trouble" the discourses that exist in schools, such as discourses about ability grouping/tracking and mathematics as being about speed and accuracy. To trouble these discourses, we must admit that they exist and that there are rationales behind them.

I have heard former students say, "I feel so horrible when I give my students a worksheet," which suggests to me that I have painted teaching as entirely too black and white (worksheets = bad, group work = good) and have failed to acknowledge

and help them appreciate the competing masters that teachers must serve. Particular instructional practices are neither inherently good nor bad; context matters. If I stood outside a classroom and peeked in through the narrow glass window in the door without being able to hear what is happening in a classroom, I would be likely to conclude that rows of students seated quietly in desks is bad instruction, whereas groups of lively energetic students engaged with one another is good instruction. The problem with these assumptions is that I cannot really tell what the students are doing. The students sitting in rows could be engaged in the "think" part of "think–pair–share" with an enriching mathematical task, and the students sitting in groups could be off task or working collectively on lower level recall tasks or "fun" activities with little mathematical substance. Perhaps, too often we give our students extreme definitions of what constitutes good and bad mathematics instruction, which may drive them to the oft-cited practices of relying primarily on survival advice from their mentor or peer teachers and of seeing university-based mathematics teacher educators as living in ivory towers and lacking understanding of what happens in "real" classrooms. The teachers in DePiper's study provide authentic examples of the challenges many teachers face as they try to enact ambitious practices in their classrooms.

Facilitating Discourse

The Wilson et al. and DePiper chapters suggest that teacher educators can help preservice and in-service teachers acquire language to talk about students, learning, curriculum, assessment, and other contemporary issues in mathematics education and can provide spaces in which they can try out discourses on such topics. The teachers in these studies were struggling to make sense of new ideas and about their places and the places of their students in an ever-changing system. The Wilson et al. chapter offers an example of a professional development project that provided teachers with both knowledge of and language about children's learning trajectories in early rational number reasoning. The authors found that teachers used both the ideas and the language from the learning trajectory when describing students' successes and failures with mathematical tasks. It is also very encouraging that teachers did not attribute student success or failure to gender, race, or socioeconomic status.

DePiper's chapter provides an example of a teacher educator engaging preservice teachers in discourses around students, testing, accountability, and instruction. In this case, the teachers were enrolled in a voluntary seminar outside of mathematics education instruction, but the ideas could be incorporated into a student teaching seminar or as part of a course that runs parallel to an early field experience. In order to foster such discourse, however, it is imperative that teacher educators first seek to understand what is happening in schools and not simply degrade the experiences of preservice teachers and suggest alternatives. As DePiper notes, "troubling" these ideas is not easy ground to tread, and resolutions will not occur in a single discussion.

Abandoning Deficit Models of Teachers

Keazer's study raises the notion that, in the same way we avoid using a deficit model when talking about students, we need to examine our discourse to ensure that we are not employing a deficit model of teachers. Certainly there is a lot of deficit discourse about teachers in the press, but I hear it from teacher educators, too, although not usually in print. For instance, I hear that preservice teachers are interested only in grades and not learning, that classroom teachers are taking professional development workshops just for the stipend, or that we will never make a dent in the local school district because there are so many teachers and administrators who "don't get it." With students, we are asked to consider what they *do* know and to think about how we can leverage existing knowledge in service of new learning. If we take this same approach with teachers, then we seek to meet them where they are and to provide learning experiences within their zone of proximal development (Vygotsky 1978). If we assume that teachers have come to their views for rational reasons and seek to understand them, then we will have a much better basis on which to build future instruction.

For instance, a common deficit view of preservice elementary teachers laments that they often expect their methods courses to provide them with a "bag of tricks," a "recipe book," or a collection of "cute activities" they can use in their classrooms. I find that preservice teachers often come to these views through one of three paths. Many of them have had negative experiences as learners and are therefore looking for ways to make mathematics "fun" and less painful for their students; thus, they are looking for cute activities. Others have been very successful as mathematics learners because they are good memorizers and are good at executing procedures, so they believe that teaching mathematics is all about explaining things clearly and sometimes cleverly; thus, they are looking for a recipe book that tells them the correct order in which to teach things for the greatest success. Other preservice teachers' experiences with mathematics have been neither overwhelmingly positive nor negative, but they have developed an instrumentalist view of mathematics (Ernest 1989) due to their experiences as learners, and thus they seek a recipe book and tricks to make learning easier. It is easy to take a deficit view of these teachers, but if we accept that they have arrived at these conclusions logically through their own experiences, then we frame our task in teacher education as showing them a different view of mathematics as opposed to correcting the error of their ways. This perhaps seems like a subtle shift of language, but it implies substantive differences in our approaches to instruction. For me, showing them a different view of mathematics entails, in part, engaging them in mathematics learning experiences that mirror those we want them to provide for children, and then debriefing those experiences by discussing the nature of the task I posed; how I responded to their questions, requests for help, and errors; how concrete or visual materials were used; the ways in which the experience was intellectually and socially enjoyable (a reengineered definition of "fun"); and many other topics. This type of discussion can lead to building a bridge between where they have been as mathematics learners to where we want them to go as mathematics teachers.

Recognizing and Embracing Multiplicity

The Chao, DePiper, and Keazer chapters all remind us that teachers are complex individuals, shaped by multiple personal and professional forces in their lives. As teacher educators, we would do well to seek to understand teachers as people first and then as mathematics teachers. For example, many of us have our preservice teachers write mathematics autobiographies the first week of classes to draw out beliefs about mathematics teaching and learning. Perhaps we should ask students to write autobiographies of themselves as learners and/or ask them to illustrate their autobiographies with photos, similar to Chao's use of photo elicitation. We might then learn who has an affinity for languages, for taking things apart, for poetry, for playing piano, or for running. We might learn something about their families and how they valued schooling. We might learn something about how the teachers view teaching and learning mathematics in contrast to other content areas. As Chao illustrates, we might learn something about the teachers' cultural identities that is profoundly influencing the ways they learn about the teaching and learning of mathematics. We may be able to leverage what we learn to connect mathematics teaching and learning to other aspects of teachers' lives, or we may simply be able to connect with them on a personal level in a different way, which may lead to them viewing our instruction differently.

Another common task in a methods course is to have preservice teachers write lesson plans, teach them, and write reflections on them. Asking preservice teachers to provide a bit of narrative about how the topic of the lesson was chosen; how it fits into a larger instructional sequence; and what expectations were provided by the mentor teacher with respect to standards to be covered, materials and tasks to be used, and methods of instruction would help us see how the lesson is shaped by the school context (as noted by Keazer). Preservice teachers sometimes tell me, for instance, that their mentor teacher has said that his/her students cannot work in groups because they will not behave, which constrains what the preservice teacher can do. I have also seen teachers hand preservice teachers complete lesson plans and tell them to follow them to the letter. We might have preservice teachers write elaborated lesson reflections in which they describe changes they would make to the lesson if they were to teach it in the same circumstances again, as well as what circumstances they would change along with why and how those changes would affect instruction.

Implications for Future Research

Some might argue that research on beliefs and identity is past its prime, but these four chapters make a convincing argument that it is important to continue to look in depth at small numbers of teachers to better understand how they view themselves and the enterprise of mathematics teaching and learning. The chapters also spur some thoughts about future research on beliefs and identity.

Chao's study reminds me that education is a field made of many disciplines and that most of our research methods are borrowed and adapted from other disciplines. Chao used the method of photo elicitation, borrowed from social work and nursing, to gain deeper insights into teachers' lives than one typically uncovers in a standard question-and-answer interview. Many of the methods of studying beliefs have well-known limitations, and methodological advances have been few. If this line of inquiry is to continue in fruitful directions, it will be necessary for researchers to borrow, develop, or adapt new methods that allow for scalability and/or that have greater validity than those now in use (such as Likert scale questionnaires).

It may be beneficial for researchers to back up a bit, giving teachers a chance to tell us about the variety of influences in their lives, rather than immediately honing in on beliefs and identities related to teaching mathematics. Chao introduces us to one method, photo elicitation, for taking a wider lens on teachers' experiences, but existing and popularly used methods could be retooled to start at a different grain size. In a related vein, DePiper's study reminds us that teacher education programs are not the only influences on preservice teachers; they are shaped by the experiences they have in schools. Much research on preservice teachers seeks to document the "impact" of the teacher education program on teachers' beliefs and practices, and much of that research shows little evidence of significant impact, at least in the short term. Studies that seek to make sense of the ways in which teachers process and prioritize the many competing messages they hear could be useful to the field in designing teacher education and professional development programs.

I mentioned above that teacher educators would do well to examine their discourse for evidence of a deficit model of teachers and of teacher learning. A similar admonition applies to research on teachers. I urge us to examine our stance toward teachers by looking at the way we frame studies in grant proposals, the interview protocols we use, the analytical tools we use, and the ways we write about teachers to become aware of when and how we are explicitly or implicitly taking a deficit view of teachers in our research. One way in which we implicitly take a deficit view of teachers that has received some attention in the literature is the focus on gaps between teachers' beliefs and practices. Leatham (2006) has offered the field another way to look at teachers' beliefs and actions as a sensible system that gets us out of the deficit approach.

The Wilson et al. study shows how existing research can be used to leverage new research. Wilson et al. designed a professional development program around existing research findings on learning trajectories and sought to understand teachers' uptake of these ideas in instructional decision making. This layering of research programs is one way that we can help shape the body of research in our field from a collection of stories (Cooney 1994) to a coherent thread of research that builds over time into a solid theoretical frame. The work on SimCalc (http://www.kaputcenter.umassd.edu/projects/simcalc/) provides a nice example of a body of work that has been built up deliberately over time. The work began with research on students' learning about change and variation and proceeded to the development of software to illustrate these ideas, then to the development of curriculum materials to teach these ideas, then to pilot studies, and on to scale-up studies. What would research

on beliefs or identity look like if we tried to plot a similar trajectory for a systematic research program? I will not pretend to have the answer to this question, but I submit that it is worth the collective time and attention of those who are passionate about research on beliefs and identity.

Conclusion

The chapters in this section offer much food for thought about our work as mathematics teacher educators and researchers, both as individuals and as a collective. From the practical to the theoretical, these chapters have both immediate and long-term implications for our work as we seek to support teachers as they engage in ambitious instruction and to understand what it means for teachers to do so.

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