Chapter 8. Voices over the shoulder: A dialogic interlude

In *Dialogue Concerning the Two Chief World Systems*, the 1632 book by Galileo Galilei that got him vehemently suspected of heresy by the Catholic Church, he explored the implications of the Copernican and Ptolemaic models of the motion Earth, Sun, moon and planets through means of discussions between two philosophers and a layperson. In the introduction Galileo writes:

> *I have thought it most appropriate to explain these concepts in the form of dialogues, which, not being restricted to the rigorous observance of mathematical laws, make room also for digressions which are sometimes no less interesting than the principal argument.*

In this chapter, I wish to also make room for interesting digressions, many of which arise as a consequence of following the learning-to-teach pathways of the six individuals in this study.

My own capability to look at an issue from multiple perspectives comes from the idea of "walking a mile in someone else's shoes" that I learned as a young child. Under the guidance of my graduate school professors, particularly multicultural education scholars Gloria Ladson-Billings and Carl Grant, this idea transformed into a valuable analytic tool for doing educational research. At each stage of this study, I imagined that people I knew—sometimes only by their writing—were looking over my shoulder to appraise my work. It was helpful to think about what they might say, and the frames through which they might interpret particular findings, especially when I thought they would be different from my own perspectives.

As a way to share these productive yet entirely imaginary conversations with the readers of this book, I present myself here in a fictional roundtable dialogue with the following four individuals, each representing and giving voice to a particular viewpoint regarding the practice and theory of science teacher education:

> **Lorenzo Briggs:** Coordinator for a secondary science teacher education program at a large university.
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> **Diana Versity:** Teacher education researcher who studies the preparation of teachers for diverse classrooms.

Bob Erlenmeyer: University science faculty member with an interest in teacher education.

Carla Fordham: A senior policy fellow at a conservative foundation and proponent of deregulating teacher certification.

In Galileo's *Dialogue*, the character "Simplicio" plays a defender of the Earth-centered view, and good part of the trouble he found himself in with the Inquisition arose from the fact that Pope Urban VIII found some of his own words—shared with Galileo decades earlier when he was just Cardinal Barberini—in the mouth of a character who was presented as a fool. I have endeavored here *not* to include a Simplicio-like character. Instead, in my own imagined dialogue, I genuinely attempt to present each perspective in the ways that such individuals would hopefully recognize as their own, and I put forth their arguments in good faith to the best of my abilities. Though I do permit each of them to critique each other's viewpoints as they reasonably would. And with that, let's begin the conversation.

Doug Larkin: Let me first welcome everyone, and express my appreciation for your interest and willingness to be a part of this conversation. I know you've all had a chance to read the case studies, so I'd like to begin our discussion by asking each of you to talk a little about what you take from them as a whole.

Lorenzo Briggs: In many ways, this study confirms much of what I already know about the difficulty and complexity of preparing someone to teach science. To be blunt, learning to teach science at the secondary level is a system with many moving parts. What was interesting to see here was how each student teacher seemed to have one or two things of central importance to them, and everything else seemed to fall within the boundaries set by these priorities. For example, Tyler's principal activity was the production of accurate grades, while Roberta structured much of what she did around the goal of creating a comfortable environment for her students' learning. It was amazing to see how so much of their experiences were filtered through these aims.
For me, the major implication of this study concerns the student teacher/cooperating teacher relationship. In nearly every case, it seemed the student teacher saw the act of teaching as the force behind their learning to teach. While this was certainly true to some extent, they really needed sustained feedback from the cooperating teacher and time for reflection. By itself, practice as a classroom teacher wasn't enough.

Diana Versity: As I read this study, I couldn't help but think that some of the issues it raised about individuals' conceptual change in learning to teach were deeply related to university education writ large. Really, changing how one thinks about race or culture seems a deeply embedded aspect of a liberal arts education. I wonder if by streamlining teacher education as vocational preparation we haven't lost something of an ability to critique social power structures and participate in political processes in everyday social interactions. Paolo Freire (1970) pressed educators to develop a critical consciousness, inviting them to analyze the operation of power and act upon the world to address injustice. So my interest was drawn to the parts of these cases where that development of a critical consciousness might be occurring.

Kathy's story nearly broke me. Here we have a young woman with an actively moral dimension to her social consciousness, but not once in her whole teacher education program was she given an opportunity to develop it. Everything was problem-solving, and diversity—as presented to her in her student teaching experience—was almost always considered as a problem. Where was her liberal arts education in all this? Roberta seemed to do a better job with asking the right questions, but even she had her blind spot about race.

For me, this study reminds me that even though we've come far from that oversimplified era in teacher education when we looked for best practices to replicate, our student teachers still spend too much time trying to become more efficient practitioners and not enough time considering the underlying reasons for those practices. It almost makes me want them to spend *less* time as a student teacher with classroom responsibilities in order to free up more time for analyzing and reflecting upon what they're doing and why they're doing it.

Bob Erlenmeyer: I viewed this study somewhat differently. I recognize that there are achievement gaps along lines of race, ethnicity, and culture, and I appreciated the effort expended in this research to examine what role teacher preparation might play in addressing those gaps. That said, I couldn't help but be stunned by the inflexibility of the science content knowledge of the student teachers in the study. What science they knew impacted their ability to teach in diverse classrooms, sure, but it also shaped their capacity to be good science teachers at all. Clearly, they were smart people in good university programs, and they all earned degrees in their subject areas, yet their limited abilities to adapt their content knowledge for teaching was surprising.

I am reminded of some of the graduate students who work in my lab. When they first join our group, they may know a lot of the science, but it takes time for their knowledge to be flexible enough to think productively about our research problems. I was feeling the same

way about the student teachers in the cases, Corrine in particular. Here she was with a Ph.D. in genetics, yet it was through learning to teach that she uncovered some very basic misconceptions in her own knowledge of biology. Only then was she able to think about the misconceptions held by her students.

I know we sometimes fool ourselves into thinking our students know more science than they do. When you've got a lecture hall with 300 undergraduates, you almost have to just put the burden of learning squarely on the shoulders of the students. They find the way through the material that makes the most sense to them, get their grade, and go on. These case studies, however, makes me reconsider what it means to "know" a science topic.

After reading this study, it seem that to actually teach a topic to a student is a monumental task. I'd have to beat a topic to death, giving each student multiple ways of understanding the material. Armando thought a teacher needed to know enough about each topic to have six or seven ways to teach a lesson on it, but honestly, I don't think that's something I have the time or inclination to support. The alternative is to radically overhaul how we teach science at the university level, as a few of my colleagues bravely suggest (Lewis & Lewis, 2008; Mazur, 1997). Still, the undergrads who join my lab eventually figure things out, once they're trained in what we do. I'm not certain that is as true for prospective teachers, given this study's illustration of the uncertain supports that individuals received.

Carla Fordham: But they'll learn it as they go, won't they? I mean, everyone's knowledge is incomplete in some way, but once you're in a school and you know what you have to teach, that's extra incentive to learn your content, isn't it? The main message I took away from this study was that university teacher education programs are mostly unable to offer the necessary supports for teacher learning. The Delorenzo University case, which represents a resource-rich boutique program, was the exception that proved the rule. All of the diversity coursework seemed to add little to student teachers' understandings of these complex problems. My opinion is that this noise about multiculturalism and diversity has very little to do with actually teaching science to learners. Science is science. Though, I will concede that there are specific skills needed for effectively teaching English language learners, but they are not really unique to science teaching.

The question I'd like to raise here is this: What "value-added" is teacher education in these cases? Why couldn't these teachers just be learning to teach on the job? You are all aware of how I generally feel about schools of education, namely, that they are cash-generating operations that add little intellectual heft to a university's academic mission. It seems to me that a degree in a science field is enough to get new teachers started. Any

reforms designed to support content knowledge learning could be targeted at their undergraduate science learning experiences.

Lorenzo Briggs: I have a vested interest in the survival of teacher education in the university—so I'm certainly biased here—but I think Carla is woefully underselling the substance of teacher education. Suppose this research had been done back when I was working on my own Ph.D. thirty years ago. A qualitative study like Doug's might have needed to state a null hypothesis up front, and it would have sounded an awful lot like what Carla just said, something like, "The null hypothesis for this study is that teacher education has no effect on individuals' conceptions about the pedagogical implications of student diversity." But there is clearly plenty of evidence in these cases to reject this hypothesis. There seemed to be quite a bit of conceptual change going on. Maybe there wasn't as much as we would have liked, but it certainly seems attributable to the teacher education programs. That's your value-added right there.

Carla Fordham: I disagree. A proper null hypothesis would have posited no difference between those in a teacher education program and those new teachers entering the classroom in a similar full-time situation with some sort of mentor analogous to the cooperating teachers' role.

Doug Larkin: Pam Grossman actually did that study for her dissertation, and wrote about it in her 1990 book, "The Making of a Teacher." There was definitely a difference.

Carla Fordham: Okay. But still, I'm fully willing to recast teacher education as some sort of skeleton structure that supports new teachers in the classroom. The issue here is really the value-added of the coursework.

Diana Versity: I'm not saying that teacher education coursework is unproblematic, not by a long shot. But the research is very clear on the value of university-based teacher education, which my colleague Linda Darling-Hammond (2008) did a nice job in summarizing in the last *Handbook of Research in Teacher Education*. The fact is… that teachers without the benefit of a university-based teacher education program are less likely to receive enough support in learning to teach, don't last as long on the job, and perhaps most relevant to this conversation, have not organized their subject matter content knowledge in ways that permit them to be effective teachers.

Bob Erlenmeyer: That's the piece of this study that's got me thinking. The cognitive metaphor I'm playing with is that of moving into a house. Learning the subject matter of science, at least initially, *is* something of a transmission process—Doug, I think you were perhaps a bit too negative about this in your portrayal of the student teachers. In the

moving metaphor, I get all my boxes and furniture delivered to my new house, just like I learn biology initially by being told the names of living things, processes, and some of the basic concepts. Once all of that stuff has been delivered to me—and I'll agree it's easier when it all doesn't arrive at once—it's up to me to organize it all in a way that I can live with. Having a misconception is like keeping your sofa in the kitchen for a while, until you decide that it makes better sense to put it in the living room.

Carla Fordham: I agree on the necessity of organizing one's content knowledge for teaching. I've known my share of really smart people who were terrible teachers. Clearly this is something that takes time; I just don't see why it has to happen in university teacher education programs. It isn't like the participants in this study made tremendous headway in reorganizing their content knowledge during the year Doug followed them, and whatever they've started will likely continue as they get hired.

Lorenzo Briggs: Again, I think you're both underestimating the well-documented challenges that new science teachers face (Davis et al., 2006), and we haven't even talked about equity and diversity yet. It's interesting that this discussion right now is about prospective teachers' subject matter knowledge, because quite frankly that isn't something that any science teacher education program I know of pays much attention to. We make the assumption—based on coursework, degrees, and state certification tests—that our preservice teachers have an adequate knowledge base in their scientific discipline, and we spend most of our time on pedagogy. We spend time on lesson planning, assessment, inquiry approaches to teaching, and the importance of addressing student misconceptions. If we get into science content at all, it relates to studying the nature of scientific practice, a topic that often gets overlooked in undergraduate education. Outside of the science methods courses, our preservice teachers get a few foundations courses, a teaching for diversity course, teaching reading in the content areas, etc. Spending time with preservice teachers with the goal of helping them organize their disciplinary knowledge is something that's barely on our radar.

Carla Fordham: That's what my colleague Rita Kramer (1991) found when she traveled the country spending time in different schools of education. I think you're making my case for me that Schools of Education aren't preparing teachers for teaching, because they ignore the importance of content knowledge.

Lorenzo Briggs: Not at all. I would advocate that all of those things we're currently doing are absolutely necessary. The thing is, after reading this study, I'm questioning the effectiveness of how well we're currently doing them. It seems to me that having a coherent vision of good science teaching is important, and I think we have this in our program's teacher education standards. It's that enactment question that's so thorny. Just

because they know what to do doesn't mean they can do it. We can't exhort our student teachers to teach for diversity any more than we can exhort them to teach for inquiry.

Doug Larkin: I think what I'd like to argue for here is a conceptual change approach for learning to teach science. This isn't a new idea (Hewson, 1992; Russell & Martin, 2007), but I'm wondering how much it's really been put into practice. As science teacher educators, too often we haven't taken into consideration our prospective teacher's prior ideas about teaching, learning, student diversity, or science. I'm also going to disagree with an aspect of Bob's metaphor, and point out that the house was never empty to begin with.

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Diana Versity: All right, you've all danced around the topic long enough. We're here for some diversity talk, so let's get to it.

Carla Fordham: Doug, it really isn't clear to me what you would have student teachers do differently. It almost seems to me that you're asking for your student teachers to engage in some sort of affirmative action with students who are different from themselves in terms of race, ethnicity and culture. Given that most science teachers in this country are White, that means doing something special for students of color, doesn't it?

Doug Larkin: As I watched the teachers in this study, I often thought of the suggestion offered by Grant and Sleeter (2007) who said, "We use demographic characteristics to alert us to the diversity of the class, then listen carefully to students themselves to figure out what their diversity might mean" (pp. 48-49). I think we as teacher educators have underestimated the difficulty of this approach, and not just for White preservice teachers. I think that really being able to attend to student diversity pedagogically requires a sophisticated probabilistic thinking (Keynes, 1921; Nickerson, 2004; Taleb, 2007). This is hardly a skill that comes easily.

Look how difficult it was for Roberta to think about the graduation rates at her school. Teachers need to be able to continually gather data on their students to assess the likelihood that their students will have had certain life experiences or hold particular ideas. New teachers resist doing this because they think it's stereotyping, but estimating how many of your students might have faced institutional discrimination in past science classes is functionally no different from figuring out how many might have a misconception about the science topic you're about to teach. Both require estimates of probability that ought to influence a teacher's planning and pedagogy.

Bob Erlenmeyer: There's also the undercurrent in your writing that you somehow expect the science to be different. I can see changing one's pedagogy to accommodate the learning styles of students. And I think you make a fairly good case that relevance isn't just for motivation. Culturally congruent forms of communication and well-chosen examples are certainly going to help facilitate learning from a cognitive perspective, and they seem like the types of things that could be thoughtfully woven in to a coherent teacher education program. But the content itself? I mean, there's no such thing as a multicultural atom, is there?

Doug Larkin: James Banks once described a multicultural atom as an atom all kids can understand (in Tucker, 1998). When science is positioned as a wisdom to be received, rather than constructed, it feeds into the belief that there is only one acceptable and official form of knowledge (Apple, 1993). This is why knowledge construction is considered an essential element in multicultural education (Banks, 1995) and culturally relevant pedagogy (Ladson-Billings, 1994). While the accumulated wisdom of science is indeed impressive, and scientific uncertainty has to be distinguished from genuine ignorance, the authority for this knowledge comes from a robust understanding of how it came to be (Rudolph, 2007). This is an all too rare aspect of science classrooms today, where many students, still see schoolwork as a series of right answers (Willingham, 2009).

What I would have student teachers do differently is to cultivate the habits of mind that allow them to carefully examine linkages between their teaching and students' learning. To do this they must understand the ways that that race, ethnicity, and culture influence thinking, both for their students as well as themselves. I genuinely believe that we can teach people to do this without defaulting to mainstream stereotypes or oppressive ideology. What I'm less certain about is whether attending to student thinking in this way can be sustained beyond the period of teacher education without the development of a critical consciousness.

Diana Versity: I'm more interested in what this study says about the process of learning about race, ethnicity, and culture in terms of the knowledge base for teaching. If I read into Doug's argument correctly, he's suggesting that of all the things we teacher educators try to do to prepare preservice science teachers for student diversity, the effort to focus their attention on student thinking seems to have the greatest payoff. Doesn't that have implications for us as teacher educators? Seems to me like something we ought to prioritize.

Lorenzo Briggs: True, but it's more complicated than that. I think Fuller's (1969) analysis of student teacher concerns still holds. Initially, they're concerned with

themselves and their own actions. I think of this as the "bubble" stage of learning to teach, because the majority of their attention seems to be within arm's reach. Then they gain some confidence and become primarily concerned with classroom tasks. I think some of us in teacher education fail our prospective teachers because we construct an image of teaching as a series of well-designed learning tasks, as Doug describes the Briggstown SAMTEP program doing. If we do things right and our student teachers gain enough confidence in their ability to perform classroom tasks, then they can focus on their learners. It's a clear developmental sequence that I've seen over and over in student teachers. Even when they reach that point, they're still at the beginning of their professional learning as teachers (Feiman-Nemser, 2001).

Diana Versity: I don't doubt that you've seen this sequence, but it seems to me that the pervasive discourse of educational psychology in teacher education has people thinking in terms of developmental stages a bit too often. Armando was *ready* to look at student thinking. He just needed someone to help him do it.

Carla Fordham: But no one in his teacher education program did.

Diana Versity: Well, that's not to say it wasn't possible. In fact, given the strong emphasis in Armando's program on planning-by-activity and managing the science classroom environment, the support he received was entirely consistent with the goals of his program. We've been talking about multiple paths through the subject matter—if teacher knowledge is *our* subject matter, how many paths to understanding are we allowing for our preservice teachers? Armando wasn't following Fuller's developmental path. Is that all we have for him? I'm thinking about the way Cornbleth (2008) described the preservice teachers in her study as following different pathways, only one of which allowed for what we might call effective teaching for diverse classrooms. Shouldn't the orientation of the student teacher have an influence on the pedagogy we use to prepare them to teach?

Doug Larkin: I'd agree that Armando was constrained, but I don't think his teacher education program closed off any of those learning pathways for him. In fact, had he continued in the program, his placement would have been at a public urban charter school with a social justice focus. The SAMTEP placement process carefully considered both the needs and preferences of the individual, and in his case, the school would have been an excellent fit.

Bob Erlenmeyer: Isn't this notion of "providing multiple pathways" expecting a bit much from teacher education? I mean, shouldn't Armando be able to extract what's valuable to him from his coursework and fieldwork without it being explicitly tailored to

meet his needs? If you want a different pathway, pick a different program. That's part of the nature of higher education.

Diana Versity: That's an intriguing point, and it says quite a bit about how university educators view their responsibilities. Isn't it interesting that, controlling for all other factors, we also have a racial disparity in academic performance at our own university? I've just come from a committee meeting where we studied the data on our university's 6-year degree completion rate for the past decade, and it's consistently been higher for white students by about 20%. Even a little worse than that for science majors.

Bob Erlenmeyer: I'm a little uncomfortable with what you're implying.

Diana Versity: I'm suggesting that's it's nearly effortless for some to assume that there are limited pathways to understanding, and that students need to find their own way to those pathways. Recognizing that those who might start out at different places on the map sometimes need different pathways—ones that might even be unfamiliar to ourselves—is much more difficult. It's easy to teach learners *equally*. It's much more complex a task to teach *equitably*, particularly in the diverse classrooms of universities and the schools in this study.

Lorenzo Briggs: That was Jethro's issue. He only saw one pathway for learning physics, and it led through calculus. Is that something his teacher preparation program could have addressed?

Diana Versity: It was Corrine's issue too. The pathways her African American transfer student was permitted to learn and demonstrate his knowledge of the subject matter was limited by individualistic conceptions of academic achievement.

Doug Larkin: As well as by her cooperating teacher's constraints on what Corrine herself was permitted to do.

Carla Fordham: Perhaps these are accurate assessments, but then again maybe you're all expecting too much of prospective teachers. At what point do you say you've taught them enough about teaching in a teacher education program, and allow them to be in a classroom teaching students? What is it exactly that they learn from you that they can't learn from experience?

Doug Larkin: I would argue that in powerful teacher education programs, teachers learn how to reframe the problems of practice in order to identify different solutions. Without teacher education, it's less likely they'll be able to step outside the narrow boundaries of

their own "common sense" to access different ways of thinking about their teaching. The analogy I cannot resist making is that of a cross-cultural experience—and in some ways it isn't an analogy, it's really a shift of cultural frames. Unless prospective teachers experience a different way of looking at teaching and learning, they're likely to replicate their own experiences with a new group of students.

Lorenzo Briggs: There's also the issue of who you consider to hold knowledge about teaching. Though Armando was clearly reflective about his practice, it seemed like he lacked the necessary supports to take advantage of this spirit of inquiry. There was neither the time nor structure in his program to support reflection about teaching. All of the knowledge about teaching in his program seemed to be delivered wisdom from his professors.

Doug Larkin: All true, but I'll add a gentle reminder that this is precisely what Armando wanted. He was extraordinarily disappointed with the quality of his own science education in the Dominican Republic, and was actively seeking a new vision of teaching. You are correct however, in noting that this vision did not include Armando himself as a generator of this knowledge. If anything, his program expected him to be an accumulator of knowledge through experience. In such an intense one-year program, there was little time for much else.

Carla Fordham: You make my argument so easy. I'm going to quote Marilyn Cochran-Smith and Susan Lytle, two of your most cherished teacher educators. They said that they were "concerned about the way practitioners were being positioned in the discourse about teacher education and professional development and with the way university-generated knowledge was assumed to encompass everything there was to know about teachers, teaching, and reforming the schools," (Cochran-Smith & Lytle, 2009, p. 88). This is my concern too, that teacher educators have invested all the authority about teaching knowledge in themselves. Jethro bought this hook, line, and sinker, and when it didn't work for him, he was left without any recourse.

Diana Versity: Ah, but Cochran-Smith and Lytle would have a bit to say about Jethro's program. If Jethro was becoming a teacher on their watch, I suspect he might be forced to examine aspects of his practice more systematically. We're not claiming teacher education is perfect. We're not even claiming everyone has to follow a university pathway—even if the alternate routes your foundation cherishes end up taking detours through our gates anyway.

Lorenzo Briggs: You claimed the Delorenzo University program is a "resource-rich boutique program," but what if that's the right amount of support for prospective

teachers, and we're doing it on the cheap at all these other places, Carla's "cash-cow" comment notwithstanding? Look at the case of Roberta; she's in a two-year program, half-time *and* full-time student teaching, in a professional development school, has supervisors who are certified science teachers, and a time-intensive reflective portfolio process with the sole goal of supporting her development as a teacher. She's as supported as a preservice teacher is going to get in our country. Suppose that's the *minimum level* of support new teachers need?

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Diana Versity: Anyone else notice how the conversation shifted away from race again?

Doug Larkin: I'd like to get your collective take on the question of how people change their mind about the meaning and operation of race. I'm also interested in ethnicity and culture of course, but understanding how ideas about race change seems particularly important because of the long and uneasy history between science and the concept of race (Fields & Fields, 2012; Gould, 1981).

Bob Erlenmeyer: The science education research is fairly clear on the fact that people hold scientific misconceptions about all sorts of phenomena. If I read into your question a bit, now that I've read the cases, you're suggesting that people hold misconceptions about race. This seems reasonable, given what we know about stereotypes. In my university science lectures, I have a pretty good idea of the misconceptions my students enter with, and this helps me design my teaching. If a student in an undergraduate physics class thinks that an object will fall twice as fast if it is twice as heavy, doing a demonstration with a whiffle ball and a baseball clears up that misconception right away.

Lorenzo Briggs: Does it really? I think perhaps in teacher education we've invested too much in the notion that evidence disconfirming misconceptions will be self-evident. Students can clearly reject an idea that doesn't fit the data in terms of your falling object example, but maybe the evidence isn't so clear when it comes to conceptions about race.

Diana Versity: I'm thinking about the observation that urban tutoring programs sometimes have the unintended effect of reinforcing prospective teachers' negative conceptions about race and class (e.g. Haberman & Post, 1992).

D**oug Larkin:** Though I didn't discuss them much in the study, I can vouch that was certainly the case for at least half of the SAMTEP cohort. They couldn't wait to get out of Moshi Middle School and teach somewhere else. Their minds were made up, and the longer they stayed, the more deeply entrenched their ideas about race became.

Lorenzo Briggs: But aren't teacher education experiences like that grounded in theories about cognitive dissonance? The rationale is that one must create dissatisfaction with an idea—stereotypes for example—before any change can occur. We have a tutoring requirement in our program, and we make sure to place our preservice teachers in settings with diverse populations of students. I think we've been pretty successful in this, particularly in the ways our prospective teachers start developing relationships with students who are different from themselves.

Diana Versity: I don't disagree that such placements are valuable for a variety of reasons, but perhaps to our prospective teachers, the relationships they form with individual students also serve to support the individualistic orientations to student diversity many of them possess. This might hold true even as some more simplistic misconceptions about different racial, ethnic, and cultural groups are broken down.

Bob Erlenmeyer: Sounds to me a little like the resistance to new paradigms that Thomas Kuhn described in *The Structure of Scientific Revolutions* (1970). Like scientists, the student teachers tend to discount evidence that doesn't fit the paradigm under which they operate, and accommodate the evidence that does.

Lorenzo Briggs: If I understand the broad strokes of Doug's work here, he's arguing that this discounting of evidence occurs across multiple domains. Whether we are talking about learning in science, learning about teaching, or learning about race, it seems that evidence doesn't always change people's minds.

Bob Erlenmeyer: The evidence was simply interpreted in the light of each individual's existing conceptual scheme.

Carla Fordham: What do you mean by "conceptual scheme?" Sometimes I think you academics just make up ivory tower jargon that the rest of us would mock if we knew what you meant.

Bob Erlenmeyer: Not at all. The idea of a "conceptual scheme," was put forth by James Conant in the 1950s. You've heard of him perhaps, Carla.

Carla Fordham: Of course! The Harvard president who wrote "The Education of American Teachers," (Conant, 1963). I consider it a classic critique of teacher education efforts in the university. He and others at the time singled out weak academic standards and poor content knowledge preparation in schools of education. Much of his criticism still holds, in my view.

Bob Erlenmeyer: I'm unfamiliar with that aspect of his career, but he was a marvelous historian of science and a mentor to Kuhn, among other things. Anyway, he describes a *conceptual scheme* as a "hypothesis on a grand scale," (Conant, 1951, p. 47) consisting of a collection of linked concepts that have explanatory power and are fruitful of further experimentation.

Diana Versity: Sounds like "theory*"* without the vernacular baggage.

Bob Erlenmeyer: Perhaps. Conant talks about science as an activity directed towards reducing the need for empirical data to explain phenomena. He contrasted the manufacture of glass lenses to synthetic rubber production as an example. The linked concepts from geometry and optics form a nice conceptual scheme to explain the behavior of light rays in glass. If we want a lens with such and such a focal length in a particular type of glass, the conceptual schemes tell us exactly what lens curvature is needed. No trial and error is needed. Contrast that with the empiricism needed to make synthetic rubber. We have only the barest of theoretical guidance for this process, and as a result synthetic rubber has yet to match the quality of natural latex rubber (Mann, 2011). Our conceptual schemes for understanding rubber aren't good enough yet to serve as a practical guide, and therefore a great deal of empirical work is necessary to explain why certain changes in the rubber manufacturing process have the outcomes they do. A good conceptual scheme—you can even call it a scientific model if you want—offers a good explanation.

Doug Larkin: I would say that right now in teacher education, we are still operating with a high degree of empiricism. Many of the approaches we use to teach the pedagogical implications of student diversity to preservice teachers, like racial autobiographies, cross-cultural tutoring experiences, and urban fieldwork placements are used because they are perceived empirically to be successful. But I'm not sure we can always explain why.

These teacher education practices trace roots back to two related ideas, one social, and one psychological. The first concerns Allport's (1979) observation that discrimination decreases with opportunity for contact between groups, what Allport called "the effect of contact." The second comes from cognitive dissonance theory (Festinger, 1957; Gregoire, 2003), which says that people are motivated to change their minds when confronted with evidence that creates disequilibrium among their thoughts, beliefs, and attitudes. These foundational ideas are certainly valuable, and probably explain why those teacher education experiences work when they do. But the issue is that they *don't* always work.

Lorenzo Briggs: So then you're saying that viewing learning to teach as a process of conceptual change helps explain why certain teacher education practices appear to work in some cases and not in others.

Doug Larkin: The conceptual change model of learning suggests that dissatisfaction with one's current conceptions alone may be insufficient for learning. Although such dissatisfaction or cognitive dissonance is a necessary precondition for change, it simply lowers the status of the existing conception. If an alternate conception is available, it must have better explanatory power than the concept it is meant to replace or modify.
The conceptual change model suggests that in educating teachers for student diversity, teacher educators must be able to present ideas for consideration to preservice teachers that have the potential to be evaluated and given higher status. The implication for teacher educators is that they'll have to pay close attention to the thinking of their preservice teachers, and be ready to offer alternate conceptions for consideration at the right time.

Diana Versity: Ideas shown to support student learning in diverse classrooms, right? Such as the idea that student communication patterns are a resource that can be leveraged for learning (Emdin, 2010; Villegas & Lucas, 2002) or that high expectations need to come with scaffolding to support academic success without marginalizing the cultural identities of students (Ladson-Billings, 1994; Zeichner, 1996).

Carla Fordham: I'm still not convinced that learning about race has much to do with learning to teach. You're talking about all of this as if the curriculum is fully in the hands of the classroom teacher, but to me that's part of the larger problem. I think teachers have far too much autonomy in the classroom. Race matters in the classroom because we let it matter. If we had a more prescribed curriculum, why should we expect race to enter into the picture? Just teach the science.

Bob Erlenmeyer: I'll admit that Carla has a persuasive argument there.

Doug Larkin: Race will always enter the picture because the pernicious effects of racism don't always operate at the level of the individual. Think of the no-go list at Roberta's school. I genuinely doubt there was a single malicious individual behind that list, but nonetheless its existence had a corrosive effect on the kids who were on it, especially when they eventually looked around and didn't see any white kids missing field trips. Even if the curriculum was completely prescribed—not something I'm advocating, by the way—teachers would still need to develop their knowledge of how race operates in society in order to address issues in their individual classrooms and schools.

Diana Versity: There are a few different ways the literature talks about how individuals understand race and cultural diversity throughout their lives. The racial identity development models like the one developed by Helms (1990), the Spindlers' (1994) work on cultural therapy, and even recent anti-racist teacher professional development programs (e.g. Singleton & Linton, 2006) all have a notion of socially mediated cognitive conflict at their theoretical core. Granted, they all make space for individuals to deliberate their beliefs, but their fundamental mechanism for change boils down to the idea that people change their minds given contradicting evidence.

Doug Larkin: That's precisely the cognitive dissonance argument that's been made historically, but I'm saying that just providing opportunities for cognitive conflict might not be enough to change minds for a few reasons. In the case of the resistant urban tutors, evidence might simply be interpreted selectively or in unintended ways to fit an existing worldview. Even if they do accept the evidence of their own experiences, they might alter their conceptual scheme slightly to accommodate that evidence.

Lorenzo Briggs: What you're also arguing then Doug, is that your use of this conceptual scheme for how people learn race may also offer an explanation for the individualistic orientations to student diversity that seem so common in preservice teachers (Paine, 1990), this notion that categorical differences are negligible because each individual is so different. The development of this orientation may be a direct result of an inability to deploy the concept of race to resolve cognitive conflict.

Doug Larkin: I'd agree with that. Explaining away the salience of race on an individual level removes the threatening prospect of being perceived as someone who stereotypes, yet also avoids the difficulties inherent in probabilistic thinking.

Diana Versity: Freire's notion of developing a critical consciousness doesn't fit this conceptual change model though, and I'd argue that this is really the orientation to develop in all of our teachers.

Carla Fordham: Not all of us think so.

Diana Versity: Anyway Doug, I'm afraid your conceptual scheme falls short here in providing a cognitive explanation for the process of developing a critical consciousness. Even if you include the emotional influences on conceptual change, I still think there is more theoretical work necessary if that is your goal. There may also be competing explanations out there for how people "learn race." Rebecca Bigler and her colleagues (Bigler & Hughes, 2009; Bigler & Liben, 2007) have done some interesting work on the formation of ideas about race in young children, looking at how children need to first

become aware of categorical distinctions as labels before they learn to attach any meaning to those labels. Neither can we forget the work of people like Claude Steele (2010) and Beverly Tatum (2003, 2007) who foreground the role of identity and social interaction in the learning of race. I'm not saying that conceptual change theory might not be fruitful —as you put it—in exploring these other theories of learning race, I just don't see it as a silver bullet quite yet.

Doug Larkin: I'll certainly take that into consideration as I write up my concluding chapter. Once again, I'd like to thank everyone here for taking time out of your imaginarily busy schedules to be a part of this conversation.

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