Chapter 4

Been There, Done That, or Have We?

Yew-Jin Lee*

Writing an unbiased commentary on something that one endorses upfront is never straightforward: What else can be said if there is more than polite affirmation on the substantive points raised in this chapter by Kelly and Sezen? Will there be catalysts for extended and dialogic conversations rather than uttering a resounding but monotonous "Yes!" every time I turn the pages? Although the two authors might not be too disturbed by these potential threats to objectivity, they certainly make my task here difficult because they have sketched a succinct albeit powerful and wide-ranging agenda of what counts as quality in science education for young people over the next 2 or 3 decades. Even if a fraction of our policymakers heeded the authors' suggestions, there is little doubt that youth would have a better chance to be educated in that proper sense of knowing what and how to act in a fragile world facing impending environmental catastrophes. Yet if I maintained this congratulatory position, my role would be akin to a cheerleader who would be "pumping the crowd" regardless of how well the team actually played, a professional stance I find unsatisfactory. After some thought, I have decided to adopt instead the trickster or jester as my authorial persona. Throughout human history and cultures, these entertainers were loved (depending on who was asked) for their impudence and wit; but more crucially they were sanctioned, even rewarded, to speak truth to power (Janik 1998). Privileged to declare the nakedness of kings, jesters have assumed chameleon-like roles that are part clown, sage, folk-hero, political commentator, and social activist, which perhaps is obligatory now that critique has to be laminated with praise. Let me attempt this rhetorical juggling—a universal process-skill of my persona—along two fronts: I suggest that what Kelly and Sezen propose is consequential only because of the general state of obduracy in our field that has defied change and unfamiliar ways of viewing/doing research. It does seem that Kuhnian normal science reigns and manifests itself in the form of conceptual change research, which was the primary impetus for organizing the

* Y.-J. Lee, National Institute of Education, Singapore

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Springer forum in the first instance. Secondly, even if all these visions for science education in a post-conceptual change world were implemented, which I honestly doubt they would, a direct consequence of the previous point, the devil is always in the details. Effective and large-scale change processes in schools will continue to elude us despite our best intentions.

Been There

In a nutshell, Kelly and Sezen articulate a social form of epistemology—an important and necessary message for all educators not just in science—that is part of a more protracted development that has been described in the education literature writ large. We have heard about the verbal duels between those who describe human learning by an acquisition metaphor versus those who felt that participation in salient communities provided more holistic and reasonable arguments (e.g., Barab and Plucker 2002). It is unnecessary to revisit these age-old debates as both metaphors are valid despite one being the more fashionable currently in academia. As well, the linguistic turn that Kelly and Sezen mention has matured tremendously as a worldview within the humanities and social sciences for well over 100 years. Lest I am misunderstood, I do not oppose viewing cognition, identity, and literacy in science learning as diffusing from the singular to the plural, from accounts relying solely on computer-like brains humming in isolation towards encompassing knowing as agents-in-settings (e.g., other humans and cultural-historical artifacts consistent with activity theory). Rather, I claim that it was only a matter of time before science educators played "catch-up" with the rest of the social sciences notwithstanding rare visionaries from earlier periods. The message Kelly and Sezen present—about teaching and learning science as an indissoluble social practice—is neither radical nor surprising. What is truly astonishing is that we as a discipline in the second millennium still need to be persuaded about its value for science education.

The smoking gun in this state of affairs has been the reluctance by science educators, at least some gatekeepers and prime movers in our community, towards accepting out-of-field theories and methods. Defining legitimacy only within narrow margins, scholars have been content to refine what they have been so well apprenticed to do, thereby never having to question familiar paradigms. Thus, things have been slow to change within science education research despite the proliferation of publication outlets that exist today. For example, I still struggle with publishing in the top science education journals as a newly-minted science educator who enjoys transcending academic disciplines just as I agonize when reviewing manuscripts with less conventional approaches—how do I balance the good faith of the editor who has entrusted me with a paper and my own desire to push the envelop of possibilities and educate wider audiences? I marvel that learning science in informal settings began to achieve an identity only about a

decade ago (Dierking et al. 2003) whereas a little later urban science educators started using those labels more frequently (Tobin 2009). Then, less than 3 years ago, the journal *Cultural Studies of Science Education* was formed as an avenue for those whose interests crossed the traditional boundaries of science education research. Whereas numerous other examples can be provided, suffice to say that for those who were sidelined or forced to conform so as to avoid censure and occupational disasters (see Roth and Tobin 2002), being finally able to write about science education practices in informal settings, urban education, and cultural studies and so forth was a godsend that was far too late in arrival. An old-timer in the field was surely accurate when he claimed that

> school science is arguably one of the last surviving authoritarian socio-intellectual systems in Europe (Ravetz 2002) with a teaching style which is over reliant on information transmission (Lyons 2006) and, until recently, curricula whose primary social function was that of training and selecting a future generation of scientific research workers. Presenting, as it does, a body of unequivocal and unquestioned knowledge with little opportunity to explore discursively the nature of what is offered, its relevance or applications, such a cultural practice does not naturally fit with the normative practices and goals of young people. (Osborne 2007, p. 107)

Coming back to Kelly and Sezen, they report to be merely providing "topics and questions to consider for paradigms in science learning." I do not dispute this but complain that if science educators had publicly recognized or acknowledged how scientists actually performed science or how kids learned content in complex ways in/out of school, if our discipline had been more welcoming of out-of-field developments and opportunities for cross-fertilization of theory, if scientism and the conceptual change paradigms had loosened their hegemony earlier, this chapter about the importance of social cognition in science would not have been needed, or at least its appearance would not have been so delayed until now.

Done That

The track record of curricular and pedagogical intervention work is not a happy one, even in science education. On the one hand, a promising innovation can eventually be shown to be inadequate from studies concerning its efficacy under ideal test conditions. On the other hand, effectiveness studies, that is, projects that endeavor to increase the scale of proven interventions (e.g., inquiry, scientific argumentation) will likely encounter numerous impediments in the real world of the classroom so much so that "variability in implementation can be seen as *the* major challenge for efforts to change instructional practice systematically in American schools" (Supovitz and Weinbaum 2008, p. 6). What this all means is that the kinds of new programs that Kelly and Sezen are advocating will, in all probability, suffer the same dismal fate of major curricular reforms in the past. And assuming that most of the major structural barriers, such as buy-in among stakeholders and resource provisioning—the things that I like to call the *big stuff*—can be overcome, there remain intractable problems associated with the

teaching event itself. The latter are the classroom interactions writ large that over time can defy and scuttle the most robust, intricately conceptualized, and theoretically sound plans by any curriculum designer or teacher (Lefstein 2008). Preferring to call it the *small stuff*, these basic molecules of social life in schools are by no means trivial for they are cumulative in nature and have been shown to exhibit deadly effects on learning in diverse subjects, including science and mathematics.

In the celebrated cases of mathematics reform implementation in California, we were introduced to committed and knowledgeable teachers who, during the course of their everyday instruction, subverted to a large extent the original aims of the new curriculum (e.g., Ball 1990). What was interesting was that these teachers believed that they were modeling the reforms in their classrooms when in fact their teaching interactions had evacuated the meaningful learning of concepts underlying those very innovations. Similar conundrums revolving around people, policy, and place during curriculum implementation have been reported in elementary science (e.g., Lee in press) though such frustrations are indubitably pervasive across all levels. A reflexive application of activity theory here would shed light on the degree of coordination work that communities have to accomplish or the contradictions that have to be overcome to accept new innovations such as Kelly and Sezen's social epistemology frameworks. Therefore, the implications are clear: What Kelly and Sezen propose are only baby steps on the road ahead. Much remains to be done in terms of mounting a practical curriculum with all its attendant issues of legitimacy and worth, which the authors have amply recognized as difficult and having a thoroughly politicized nature. What we know is that the mechanics of implementation in schools resist simple prescriptions and will continue to confound the routine production of teacher-proof curricula. Until we adequately come to grips with how science teachers and learners are jointly engaged in making sense for each other in contingent ways on a daily basis, we are living in a fool's paradise. This is fine for jesters, but not when the stakes are impossibly high for young people today.

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