Teaching Matters Again: Studying, developing, and implementing brain-based pedagogies.

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Recent dissemination of brain-based research on how students learn and how they learn science best has focused our research on how children construct their knowledge, think about their learning, and the context in which meaningful learning takes place. Two of the articles in this issue of EJSE utilize this research to better understand children's construction of meaning and learning in science. But, as science education researchers we have long known that the single most influential factor for students' learning in schools is the classroom teacher. Studying teaching practices that support children's learning as we understand it today is critical for teacher formation and development. As Sherwood and Hanson remind us in their analysis of recent NSF funding, more financial support is needed from the science community for these studies.

My own recent experience in working with many of the new NSF-sponsored science curricula at the elementary and middle grades level and their design addresses much of what we know about how children learn science. Yet, I begin to worry about the success of these new research-based curricula on student learning if we don't pay close attention to supporting our teachers in its implementation. Teachers who are new to pedagogical approaches that look at student conceptions, in-depth learning, true formative assessment, learning in context, and use of metacognitive tools may be quickly overwhelmed during teacher workshops and in subsequent teaching. In such instances they will do what they know best to do, potentially thwarting curriculum designers' intents. Yet, as practitioners, teachers also know effective ways to reach their children and implement curriculum in their school contexts. Curriculum designers may once again have taken the approach of 'one size fits all' when it comes to implementation and use. This harkens back to earlier NSF sponsored reforms of the 1960s and the 'teacher-proof' curricula that emerged. We learned from that era what we will likely learn again, that some teachers implement it well with high student learning gains, while other teachers struggle to see any gains over more traditional and well-known approaches. Further progress in meaningful student learning in science will once again come down to the teacher in the classroom.

So, in our renewed effort to study pedagogy that supports reform in science education through brain-based research on student learning, let's always be mindful that teachers of science are not all the same, and the skills, abilities, and attitudes to enact a reform-based curriculum will vary from teacher to teacher. With this in mind we need to ask ourselves in a constructivist manner, how can we build a bridge (or scaffolding) for teachers from where they are to where we want them to be? Even more radical than this, how can we build a bridge between our current knowledge of student learning and teachers as they are while still maintaining the integrity of best practice for meaningful science learning?