Black, P.J., and A.M. Lucas, eds. 1993. *Children's informal ideas in science.* London: Routledge.

Driver, R., E. Guesne, and A. Tiberghien, eds. 1985. *Children's ideas in science.* Milton Keynes: Open University Press.

Driver, R., J. Leach, R. Millar, and P. Scott. 1996. *Young people's images of science.* Buckingham: Open University Press.

Harvard-Smithsonian Center for Astrophysics. 1997. *Minds of our own.* Science Education Department, Science Media Group.

Haslam, D., and F. Treagust. 1987. Diagnosing secondary students' misconceptions of photosynthesis and respiration in plants using a two-tier multiple choice instrument. *Journal of Biological Education* 21(3): 203–211.

National Research Council (NRC). 1996. *National science education standards.* Washington, DC: National Academy Press.

Osborne, R., and P. Freyberg, eds. 1985. *Learning in science: The implications of children's science.* London: Heinemann.

Stein, M., and C. Barman. 2007. Probing beliefs in life science: Analyzing written explanations for identification of alternative views. Paper presented at the annual meeting of the Association for Science Teacher Education, Clearwater, Florida.

Stein, M., C. Barman, and T. Larrabee 2007. What are they thinking? The development and use of an instrument that identifies common science misconceptions. *Journal of Science Teacher Education* 18: 233–241.

Lessons Learned From Test Writing

This past summer, I, like many other science educators, found myself relishing the thought of freedom—freedom to decide how to relax and freedom to choose the types of engagements to best prepare me for the future. Last summer, I chose to participate in a test-writing work-

shop for the Utah State Office of Education (USOE), not because I particularly wanted to, but because I thought I needed to.

The motivation

As a former high school and middle school science teacher and now a university science educator working with future science teachers, I have always found testing to be my least favorite aspect of teaching, or in my mind, the necessary evil of education. Perhaps I should go a step further and say summative assessment is my least favorite. I want students to learn science. I want to know where students are in their science education journey and how far they have come. In the end, however, the thing I really want most for students is authentic engagement—the kind of engagement that supersedes testing in importance, that is experienced, and that, as Parker Palmer (1998) describes, moves beyond objective truths to subjective reality that has touched lives.

It is this passion for students' authentic engagement in science that I think influenced my decision to heed the USOE's call for test writers. As standards documents (AAAS 1993; NRC 1996) call for instruction embedded in the lives of students and centered on inquiry experiences, the preservice teachers I work with in science methods classes are constantly considering standards as measures used to gauge their effectiveness as teachers. While the preservice teachers in methods courses work to design and implement inquiry experiences where students ask questions, design procedures, carry out their procedures, and make conclusions to be shared with peers, the constant question that continually emerges is, "What about the tests?" The question I really want to emerge, however, is "What about the learning?" and this is why I chose to take a leadership role within my state through the USOE test-writing workshop.

The workshop offers science teachers across the state the opportunity to craft test items used in Utah's state assessment, the Utah Criterion Referenced Tests. These test items capture the extent to which students are learning the Utah Core Curriculum (USOE 2003). Therefore, I saw the USOE workshop as a chance to help shape items that would measure the kind of learning that is embedded in the lives of students and centers on inquiry experiences. I also felt that my efforts would help allow inservice and preservice teachers to worry less about the tests and more about their students' learning.

The workshop

Each year, 50–100 secondary science educators across Utah are encouraged to participate in the USOE test-writing workshop. USOE explains the importance of these workshops on its website:

"Related to CRTs [Criterion Referenced Tests], the Utah State Office of Education has the goal of developing high quality, valid, aligned, reliable assessments to measure student understanding of core content specified concepts to appropriately inform instructional and accountability decisions. Teacher involvement is crucial to this process. USOE achieves this by recruiting teachers for item writing workshops, as well as a variety of item and test reviews prior to CRTs being administered. This involvement ensures Utah perspectives and un-

derstandings are reflected in these tests. This involvement also supports the validity of these assessments" (USOE 2007, p. 1).

Participating teachers are offered instruction on creating test items for CRTs before they spend the majority of the three-day workshop in groups creating, submitting, receiving feedback on, and finalizing items that will, after further review, be included in the state assessment.

As a participant in the workshop this past summer, I found myself grappling to create questions that would capture student learning aligned with the Utah Core Curriculum and that would support inquiry experiences in science classrooms. This experience has not only allowed me to more closely examine the Utah Core Curriculum, but has also allowed me to help shape assessment items that I believe will empower teachers to engage students in inquiry experiences. Ultimately, the workshop helped me to get at what I have termed "authentic engagements in science" and what Utah articulates as its most important goal, whereby "[s]cience instruction should cultivate and build on students' curiosity and sense of wonder" (USOE 2003).

Opportunities to empower students

Through this experience, I feel more attuned to my state's curriculum and an increased level of ownership for what is happening in Utah science classrooms. I now recognize the difficult task of USOE in accommodating for our large population of students. I also recognize the importance of writing tests that encourage inclusion of student-directed inquiry and rigorous science content in our classrooms.

There are many avenues that allow teachers to make a difference if we are willing to pursue them. In Utah, these types of opportunities can be found on the USOE Science home page (see "On the web," p. 78). In other states, state education websites and state science teacher association home pages are potential

Idea Bank

starting points for identifying such opportunities.

Through sharing this experience, I hope as other science educators across the nation look ahead to this summer, they will consider potential opportunities, test writing and otherwise, to make the difference they set out to make when they started their teaching careers. As teachers of science, we should take steps to continually move in directions that will empower students through science.

Todd Campbell (toddc@ext.usu.edu) *is an assistant professor in the Department of Secondary Education at Utah State University in Ephraim, Utah.*

On the web

Utah State Office of Education Science website: *www.schools.utah.gov/curr/sci*

References

American Association for the Advancement of Science (AAAS). 1993. *Science for all Americans*. New York: Oxford University Press.

National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academy Press.

Palmer, P. 1998. *The courage to teach: Exploring the inner landscape of a teacher's life*. San Francisco, CA: Jossy-Bass Publishers.

Utah State Office of Education (USOE). 2003. K–12 core curriculum. *www.uen.org/core/science/9-12.shtml*

Utah State Office of Education (USOE). 2007. Utah performance assessment system for students. *www.usoe.k12.ut.us/eval/DOCUMENTS/Science_ItemWritingAnnouncementiRegister.pdf*