

## Valerie Otero



Professor

STEM Education

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- [Curriculum Vitae](#)
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**Valerie Otero** is professor of science education. Dr. Otero's research explores the dynamic nature of the learning environment and how it influences (and is influenced by) the evolution of students' ideas. She also studies prospective and practicing teachers' conceptions of students' prior knowledge, and teachers' conceptions of the use of students' prior knowledge for teaching and learning. Her teaching interests are in the areas of elementary science methods, the nature of science, and physics for prospective elementary teachers.

Dr. Otero is a member of several professional organizations such as the American Association of Physics Teachers, National Science Teachers Association, National Association of Research on Science Teaching, and the American Educational Research Association.

### Education

PhD Physics Education, University of California, San Diego & San Diego State Universities, 2001  
MS Geophysics, University of California, San Diego, 1995  
BS Physics, University of New Mexico, 1991

### [Research](#)

My research explores the conceptual development of students in student-centered learning environments. I am interested in the evolution of the system as a whole, including students, tools, teachers, course materials, and the interactions among these components. Another current research interest stems from experience working with prospective and practicing K-12 teachers. Reform methods often encourage the elicitation of students' prior knowledge, but several different notions of what to do with that prior knowledge exist within the community of educational practitioners and researchers. I am currently working to understand how prospective and practicing teachers conceive of

students' prior knowledge and how they capitalize on it to empower students to inform their own teaching and as a resource on which students can build.

## **The Constructing Physics Understanding In a Computer Supported Learning Environment Project (CPU Project)**

In 1991, I began a five-year, NSF-funded project with Fred Goldberg, Patricia Heller, and colleagues. The purpose of the project was to develop materials for a 3-year workshop that could model student-centered pedagogy for teaching physics. The workshop was intended for high school teachers and college professors. During the pilot phase of the project, we implemented these modules in our course for prospective elementary teachers. My doctoral research stemmed from the observations made during the first two years of implementation in a physics course for prospective elementary teachers. Students were videotaped as they worked in groups for the purpose of understanding the role of the computer simulator versus laboratory apparatus in students' construction of physics knowledge, and the role of the construction of students' knowledge in shaping the social and material learning environment. (For more information on the CPU Project see <http://cpuproject.sdsu.edu>)

## **Constructing Physics Understanding for Prospective and Practicing Elementary Teachers**

In 2001, I began a five-year, NSF-funded project with Fred Goldberg from San Diego State University, and Steve Robinson from Tennessee Tech University. The project builds off the needs that were recognized during implementation of the CPU Project. The purpose of the project is to develop a three-tiered curriculum/professional development package for teaching physics to prospective and practicing elementary teachers, for thinking about students' thinking, and for recognizing and using students' prior knowledge. The third part of the package consists of professional development materials for physics instructors and professional development providers for the curriculum stated above. Research that accompanies this curriculum involves understanding how college physics faculty and prospective and practicing elementary teachers conceive of student prior and evolving knowledge. This understanding will inform the development and iterations of the new curriculum as well as elementary methods instruction in the same way that understanding students' conceptions in physics has informed the community's physics curriculum-development over the past 30 years.

### Teaching

My teaching interests are in the related fields of elementary science methods, content and educational research. I am committed to providing an environment, tools, and opportunities for prospective and practicing teachers to develop, modify, and support a strong set of beliefs about science teaching and science learning that will guide their instruction and their participation in science and educational communities. Of central importance is helping prospective and practicing teachers establish beliefs that will allow them to present science as an opportunity that is open to all students.

## **Courses frequently taught**

### **EDUC 5215: Elementary Science Theory and Methods**

This course is designed to provide in-depth science instruction on concepts in physical science, life science, and earth science. The nature and history of science are considered part of science content. A focus on strands within the National Science Education Standards and the American Association for the Advancement of Science Benchmarks for Scientific Literacy provide rich contexts for investigations of appropriate science content, processes and methods for K-6 instruction. The content addressed in this course is generally associated with strands that extend to K-6. A central concern in this course includes strategies for eliciting student's prior knowledge and strategies for using this knowledge to empower students, inform instruction, and enhance student learning.

### **EDUC 5315: Nature of Science and Science Education**

This course is designed for prospective and practicing secondary science teachers. The purpose of the course is to provide teachers with the opportunity to establish a personal system of beliefs about societal influences on science and by science, practices within the scientific community, how truth is established in science, and the meaning of objectivity in science. An important goal for this course is to establish a perspective that distinguishes between ideals, actual practices, and the role of the human in determining scientific truth. Another central focus is on making decisions about the purpose of science education in 6-12 instruction. Teachers are expected to establish a system of beliefs that will allow them to answer questions such as, "Why should my students learn physical, life, or earth science?"; "How do I balance preparation for students who will become scientists with preparation for students as critical citizens?"; "How do I provide my students with an understanding of science as a human endeavor in which all types of people participate?"; "How can I use science to help students understand the concept of risk assessment?" Several different perspectives on science and science education are discussed, including sociological perspectives, traditional and inquiry perspectives, multicultural perspectives, and feminist perspectives. It is expected that teachers will draw on the research literature, discussions, and classroom activities to establish, modify, and support a strong set of beliefs that have personal meaning and that will influence their science instruction.

### Selected Publications

(For complete list of publications, please see Valerie Otero's curriculum vitae.)

## **Selected Articles**

Otero, V., Pollock, S., & Finkelstein, N. (2010). [A Physics Department's Role in Preparing Physics Teachers: The Colorado Learning Assistant Model](#). Accepted to *American Journal of Physics*, doi: 10.1119/1.3471291

Goldberg, F., Otero, V., & Robinson, S. (2010). [\*Design principles for effective physics instruction: A case from physics and everyday thinking\*](#) (Vol. 78): AAPT

Otero, V. K., & Gray, K. E. (2008). [\*Attitudinal gains across multiple universities using the Physics and Everyday Thinking curriculum\*](#). *Physical Review Special Topics - Physics Education Research*, 4(2), 020104.

Otero, V., & Nathan, M. (2008). [\*Pre-service elementary teachers' conceptions of their students' prior knowledge\*](#). *Journal of Research in Science Teaching*, 45(4), 497-523.

Otero, V. (2006). [\*Moving beyond the "get it or don't" conception of formative assessment\*](#). *Journal of Teacher Education*, 57, 247-255.

Otero, V., Finkelstein, N., McCray, R., & Pollock, S. (2006). [\*Who is responsible for preparing science teachers?\*](#) *Science*, 313 (5786), 445-446.

Otero, V., Peressini, D., Anderson, K., Ford, P., Garvin, T., Harlow, D., Mears, C., Reidel, M., & Waite, B. (2005). [\*Integrating technology into teacher education: A critical framework for implementing reform\*](#). *Journal of Teacher Education*, 56 (1), 8-23.

Harlow, D., & Otero, V. (2005). [\*Collaboration physics: Elementary teachers and university researchers join forces to help students construct understanding of friction-and discover something of the nature of science in the process\*](#). *Science & Children*, 42(5), 35-39.

Otero, V., Johnson, A., & Goldberg, F. (1999). [\*How does the computer facilitate the development of physics knowledge by prospective elementary teachers?\*](#) *Journal of Teacher Education*, 181(2), 57-89.

## Refereed Conference Proceedings

Otero, V. (2010, June). Science Learning as the Objectification of Discourse, International Conference of the Learning Sciences, June 28-July 2, 2010, Chicago, IL.

Otero, V. (2009). Evolution of Theoretical Perspectives in my Research. In C. Henderson, M. Sebellia, & C. Singh (Eds.) 2009 Physics Education Research Conference Proceedings. Melville, NY: AIP Press.

Gray, K. & Otero, V. (2009). Analysis of former Learning Assistants' Views on Cooperative Learning. In C. Henderson, M. Sebellia, & C. Singh (Eds.) 2009 Physics Education Research Conference Proceedings. Melville, NY: AIP Press.

Gray, K. & Otero, V. (2008). Analysis of Learning Assistant's Views of Teaching and Learning. McCullough, L. Hsu & P. Heron, (Eds.) 2008 Physics Education Research Conference Proceedings. Melville, NY: AIP Press.

Otero, V., & Gray, K. (2007). Learning to think like scientists with the PET curriculum. In L. McCullough, L. Hsu & P. Heron, (Eds.), 2007 Physics Education Research Conference Proceedings. Melville, NY: AIP Press, 160-163.

Finkelstein, N., Turpen, C., Pollock, S., Dubson, M., Iona, S., Keller, C., & Otero, V. (2006). Evaluating a model of research-based practices for teacher preparation in a physics department: Colorado PhysTEC. In P. Heron, L. McCullough, & J. Marx (Eds.), 2005 Physics Education Research Conference Proceedings. Melville NY: AIP Press, 3-6.

Harlow, D. & Otero, V. (2007). Beyond Concepts: Transfer from inquiry-based physics to elementary classrooms., In L. McCullough, L. Hsu, and P. Heron (Eds.), 2006 Physics Education Research Conference Proceedings. Melville NY: AIP Press, 73-76.

Finkelstein, N., Trupen, C., Pollock, S., Dubson, M., Iona, S., Keller, C., & Otero, V. (2006). [\*Evaluating a model of research-based practices for teacher preparation in a physics department: Colorado PhysTEC\*](#). *Physics Education Research Conference Proceedings*, V. 818, pp. 3-6. Click [here](#) for article abstract found on the American Institute of Physics homepage.

Harlow, D., & Otero, V. (2006). [\*Talking to learn physics and learning to talk physics\*](#). *Physics Education Research Conference Proceedings*, V. 818, pp. 53-56. Click [here](#) for article abstract found on the American Institute of Physics homepage.

Harlow, D., & Otero, V. (2005). [\*Learning physics by listening to children\*](#). *Physics Education Research Conference Proceedings*, V. 790, pp. 105-108. Click [here](#) for article abstract found on the American Institute of Physics homepage.

Harlow, D., & Otero, V. (2004). [\*An examination of children's scientific argumentation\*](#). *Physics Education Research Conference Proceedings*, V. 720, pp. 145-148. Click [here](#) for article abstract found on the American Institute of Physics homepage.

Otero, V. & Nathan, M. (2004). [\*Elementary pre-service teachers' conceptions of students' prior knowledge\*](#). *Physics Education Research Conference Proceedings*, V. 720, pp. 141-144. Click [here](#) for article abstract found on the American Institute of Physics homepage.

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