

CONNECTING THE SENCER APPROACH TO CRITICAL NEEDS IN STEM DISCIPLINES

A RESEARCH PRESENTATION

Cynthia Maguire, Texas Women's University

EXTENDED ABSTRACT

Science Education for New Civic Engagements and Responsibilities (www.SENCER.net) is an NSF-funded innovative STEM pedagogy in use since 2000. SENCER teaches through a complex civic issue to make content knowledge relevant, then requires students to use new knowledge to better their community.

This presentation includes how SENCER has been implemented at Texas Woman's University and assessment showing the value of this approach to teaching and learning in a variety of courses, including STEM disciplines.

SENCER improves science education by focusing on real world problems and, by so doing, extends the impact of this learning across the curriculum to the broader community and society. This is accomplished by developing faculty expertise in teaching "to" basic, canonical science and mathematics "through" complex, capacious, often unsolved problems of civic consequence. Using materials, assessment instruments, and research developed through SENCER, faculty members design curricular projects that connect science learning to real world challenges (Sheardy, 2010).

The SENCER understanding of learning acknowledges a debt to the philosopher, William James, who wrote in his "Talks to Teachers" in the 1890's

Any object not interesting in itself may become interesting through becoming associated with an object in which an interest already exists. The two associated objects grow, as it were, together: the interesting portion sheds its quality over the whole; and thus things not interesting in their own right borrow an interest which becomes as real and as strong as that of any natively interesting thing. The odd circumstance is that the borrowing does not impoverish the source, the objects taken together being more interesting, perhaps, than the originally interesting portion was by itself.

More contemporaneously, SENCER's work is informed by the National Academies' commissioned reports on learning, notably *How People Learn* and *Knowing What Students Know: The Science and Design of Educational Assessment*. SENCER Ideals have been applied to develop field-tested courses for many disciplines on a broad range of topics.

SENCER aims to: (1) get more students interested and engaged in science, technology, engineering, and mathematics (STEM), (2) help students connect STEM learning to their other studies, and (3) strengthen students' understanding of science and their capacity for responsible work and citizenship. By 2015, the growing and vibrant SENCER community of practice included more than 2,000 educators, administrators, and students from more than 430 two- and four-year colleges and universities, educational associations, government agencies, and non-governmental organizations in 46 states and 11 foreign nations.

The SENCER Student Assessment of Learning Gains (SALG, www.salgsite.org) allows students to rate how well specific activities in SENCER courses help their learning. The assessment tool also asks students to report on their science skills and interests, as well as the civic activities in which they engage. The primary purpose of the SALG is to provide useful, formative feedback to faculty interested in improving their teaching. Students rate how well class activities such as lectures, discussions, or labs help their learning. The SALG also provides a snapshot of student skills and attitudes at the beginning and end of courses, allowing instructors to gauge the effectiveness of their instruction in specific areas. The SALG is unlike the traditional Faculty Course Questionnaire in that it does not ask students to rate the competencies of their instructors.

SELECT REFERENCES

- Carroll, S. (2012). SALG Results Show SENCER Faculty Achieve in Raising Higher Order Learning Gains. *SENCER eNews*. Retrieved from <http://serc.carleton.edu/sencer/newsletters/61795.html>.
- Maguire, C., Shepard, L. and Wallis, A.N. (2012). Communicating Your Science in Common Language: Creating Effective Dual Posters. In R. D. Sheardy and W. D. Burns (Eds.) *Science Education and Civic Engagement: The Next Level*. ACS Symposium Series, Vol. 1121; pp. 145-153. American Chemical Society.
- Mirsaleh-Kohan, N. and Maguire, C. (submitted for Summer 2016 publication). Incorporating Photo-Book of Concepts in Physics and Environmental Chemistry Courses. *Science Education and Civic Engagement: An International Journal*. <http://www.secej.net>.
- National Research Council. (2000). How people learn: Brain, mind, experience and school. Committee on Developments in the Science of Learning; J. D. Bransford, A. L. Brown and R. R. Cocking (Eds.) Washington, DC: National Academy Press.
- National Research Council. (2001). Knowing what students know: The science and design of educational assessment. Committee on the Foundations of Assessment. Pelligrino, J., Chudowsky, N., and Glaser, R., editors. Board on Testing and Assessment, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.
- Robb, J., Rylander, D. and Maguire, C. (2013). Building Trans-Disciplinary Sustainability Studies into the College Curriculum. *The International Journal of Sustainability Education*; Vol. 8; Issue 2, pp.61-72.
- Sheardy, R. D. (2010). In R. D. Sheardy (Ed.) *Science Education and Civic Engagement: The SENCER Approach*. ACS Symposium Series, Vol. 1037; pp 45-61. American Chemical Society.

For further information, contact the lead presenter:

Cynthia Maguire
Senior Lecturer & Co-Director of the SENCER for Innovation (SCI)–Southwest
Department of Chemistry & Biochemistry
Texas Woman’s University
P.O. Box 425859
Denton, TX 76204-5859
Phone: (940) 898-2563
E-Mail: CMaguire@twu.edu