

Applying SENCER to Mathematics Courses

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SENCER

Science Education for New Civic Engagements and Responsibilities (SENCER) is the signature program of the National Center for Science and Civic Engagement, which was established in affiliation with Harrisburg University of Science and Technology. It was initiated in 2001 under the National Science Foundation's CCLI national dissemination track with the goals to get more students interested and engaged in learning science, technology, engineering and mathematics (STEM) courses, help students connect STEM learning to their other studies, and strengthen students' understanding of science and their capacity for responsible work and citizenship. SENCER promotes the development of courses that teach science and advanced mathematics through “compelling contexts,” i.e., complex, capacious, and unsolved public issues. The existing SENCER models are for higher-level science and mathematics courses, predominantly at four-year institutions.

Project Quantum Leap at LaGuardia Community College

The Project Quantum Leap (PQL) at LaGuardia, adapted the SENCER approach of teaching to a new setting and population: high-risk, urban community college students in basic skills mathematics classes. The project was initially funded (\$500,000) by the U.S. Department of Education, Fund for the Improvement of Postsecondary Education (FIPSE) for three years

(2006-2009), and then received a no cost extension to continue the program for another year through September 2010.

The focus of PQL was to improve students' learning in basic skills mathematics courses and to specifically address the needs of the students who have often had unsuccessful experiences with math, viewing the subject as uninteresting, and irrelevant. PQL sought to transform developmental mathematics instruction at LaGuardia in order to strengthen student engagement in the mathematics learning process, increase student success in key gatekeeper courses, and advance student retention and completion. The improvements in these area were shown by increased student engagement in and satisfaction with math courses (Measure: CCSSE and ACT surveys), improved math course retention of participating students, and improved pass rates of participating students.

Project Quantum Leap achieved these positive outcomes primarily through a sustained professional development process that combined curriculum development with pedagogical change. We developed a curriculum and a pedagogy that "contextualized" the process of learning mathematics skills and concepts. Introduction to Algebra (MAT095) was contextualized with issues of energy, climate change, and environmental science; Elementary Algebra (MAT096) with issues of personal and public health; and College Algebra and Trigonometry (MAT115) with issues of economics and personal finance.

Over the course of 4 years, we conducted a series of year-long monthly seminars designed to help mathematics faculty successfully implement this integrative curriculum and explore ways to

integrate specific mathematics skills within the context of the course. Faculty participating in the seminars contributed to the development of a collection of activities, projects, and lessons, called the PQL Sampler. Examples of lessons in the PQL sampler are: Asthma and Air Pollution, The Diaper Debate, Paper or Plastic?, Basal Metabolic Rate, Swine Flu – H1N1, Car Buyers in Asia, and Modeling Data Related to Health Care in the U.S. The PQL Sampler is a resource for the Mathematics Department to introduce a new faculty to PQL and to provide tutors and part-time faculty concrete examples that illustrate the PQL pedagogy.

The qualitative and quantitative data gathered for Project Quantum Leap indicates that the project was a positive and productive experience for faculty and students. The results of this analysis will be shared in the presentation.

Introductory Statistics with Community Based Projects at Metropolitan State University

Metropolitan State University has been actively involved with SENCER and designing curriculum using the SENCER approach since 2006. In 2006, faculty at Metropolitan State University received a NSF sub-award to begin curriculum development on an introductory course in statistics with semester long community based projects. This course was offered for the first time in the spring semester of 2007. Incorporating semester long community-based projects into Statistics I was an attempt to connect the discipline of statistics to students' lives and to increase their awareness of the powerful tools that statistics can provide to better understand their world.

Statistics I is a general education math course required by many majors at the university but also taken by many students to meet their general education requirement. To achieve the goals of the course, the curriculum was developed with an emphasis on understanding statistics through various social issues culminating with a semester long group project based on the students' own interests. Daily in-class group projects and discussion projects were carefully chosen to highlight civic and social issues. Students were encouraged to read their free online *New York Times* on a daily basis and to present articles at the beginning of each class that involved statistics. The theme of social awareness was begun on the first day of class and carried on throughout the semester.

The social issues that students investigate in their community-based projects are based on the students' personal interests. Samples of topics studied and presented by the groups since 2007, include *Crossing the Border: Online Drugs from Canada*, *Mercury in Minnesota Lakes and Fish Consumption Advisories*, *Domestic Abuse: Gender, Race and Language*, and *Housing Foreclosures in Ramsey County*.

To present their findings to the class, the teacher and the university community, a poster session is held at the end of each semester. Students summarize their findings in a poster and orally support those findings during the session. In addition, students must write an action letter at the end of the semester to a community group who would benefit from the findings in their projects. Examples of groups that have received action letters in the past include the American Hmong Partnership, the Court Watch Project, a local St. Paul senior citizen community group, the Minnesota Animal Humane Society and local and state government officials.

Evaluations of the course and student learning were conducted through Metropolitan State University institutional assessments and the SENCER Student Assessment of Learning Gains (SALG). Students were administered the SENCER SALG both at the beginning of the course and at the end of the course to determine the students' confidence in their ability to understand statistics and its applications to social issues. The results of these assessments, details of the course along with grading rubrics, and future directions of the course will be discussed in the presentation.

Future Plans

LaGuardia Community College and Metropolitan State University are the lead institutions on a National Science Foundation TUES proposal *Engaging Mathematics: Developing a National Community of Practice*. The project will develop a community of practice among mathematics educators that focuses on teaching mathematics through “real world” problems based on civic issues. This proposal has been submitted and is awaiting notification of acceptance.

The goal of *Engaging Mathematics* will be to significantly increase the use of the SENCER model by a national community of mathematics scholars capable of creating, implementing and sustaining reforms in mathematics education and to determine the impact that “engaged mathematics” makes in students' lives and lifelong learning. The lead institutions will be partnering with two and four-year institutions in New York, Illinois and Minnesota to form the foundation of this community of practice and to develop curriculum for multiple courses, ranging from introductory mathematics courses through differential and integral calculus.