

FY10 Annual Report

Center for Mathematics, Science, and Technology (CeMaST)

Accomplishments and Productivity for FY10

A. List the unit's goals and how the goals support Educating Illinois.

The Center for Mathematics, Science, and Technology's (CeMaST) three goals are aligned with Illinois State University's strategic plan, *Educating Illinois 2008-2014: Priorities for Illinois' First Public University*. The ISU campus community is committed to the pursuit of learning and scholarship, individualized attention, public opportunity, diversity, and civic engagement. CeMaST contributes to these core values by pursuing and supporting scholarship in STEM education for all students. In addition, CeMaST seeks to build on its stellar record of quality achievements in meeting the demand for leadership in curriculum, service, and research related to the integration of mathematics, science, and technology in education.

Goal 1: Stimulate and support activities and research on teaching and learning that align with campus, state, and national STEM priorities.

CeMaST pursues and supports the development of funded activities and research that promote the teaching and learning of science, technology, engineering, and mathematics. In addition, CeMaST strives to help shape campus STEM priorities by promoting the state and national STEM agenda to further educational innovation and research. This goal aligns with *Educating Illinois 2008-2014 Goal 2* – "Illinois State University will demonstrate excellence in scholarship, teaching, and learning at the undergraduate and graduate levels." In particular, Strategy 2, "ensuring that academic support structures promote excellence in teaching, scholarship, and creative activities," and Strategy 4, "assisting faculty and staff as they seek external funding, work to publish in their disciplines and continue to serve the University and its students," are consistent with this goal.

Goal 2: Provide leadership to and foster cross-disciplinary collaborative STEM activities and research on teaching and learning.

CeMaST strives to support connections between disciplines on campus as they pursue STEM activities and research. In addition, CeMaST fosters connections between all educational levels from K-12 through graduate school and between academia, industry, and professional societies. This goal aligns with *Educating Illinois 2008-2014: Goal 3* – "Illinois State University will enhance student, faculty, staff, alumni, and community pride in, and allegiance to, the University." Strategy 2, "fostering creative partnerships," Strategy 4, "building connections among local, state, national, and international partners are both consistent with this goal," and Strategy 5, "increasing the recognition of, and appreciation for, faculty, staff, and student service to individuals, committees, and organizations internal and external to the Illinois State community," are consistent with this goal.

Goal 3: Direct efforts to increase the diversity of STEM communities.

CeMaST has a long history of pursuing projects that encourage and assist individuals within underrepresented groups in attaining excellence in STEM fields. CeMaST is committed to continuing these efforts. This goal aligns with *Educating Illinois 2008-2014: Goal 1* – “Illinois State University will position students to excel in a globally competitive, culturally diverse, technological, and changing environment.” In particular, this goal is consistent with Strategy 1, “ensuring learning opportunities are accessible and affordable for a diverse poll of students,” and Strategy 4, “increasing enrollment and improve retention and graduation rates of underrepresented students.”

B. List major accomplishments for each goal.

CeMaST activities have focused on three main areas this past year, which all cut across the three major goals: Urban STEM-Ed, Outreach, and Engineering K-12 STEM education.

Urban STEM-Ed is an attempt to provide leadership at Illinois State in institutionalizing the efforts of the Chicago Teacher Pipeline within the STEM disciplines. It is also aimed at documenting (in the academic, research, and popular literature) the steps taken to become an urban serving institution in a non-urban environment. Due to the socioeconomic and under-represented nature of our urban population, this initiative particularly aligns with Goals 1 and 3.

Activities during FY10 include: hiring Dr. Robert Fisher as Assistant Director for Urban STEM-Ed (33% FTE), organizing alumni events in the Chicago-land area for STEM and STEM-Ed alumni, supporting and leading parts of the Robert Noyce Teacher Scholarship program, the two NSF SSTEM scholarship programs, the NSF Undergraduate Research Center with the City Colleges of Chicago, leading the NSF LS-AMP program, and being integral to Teacher+PLUS. It also involves taking leadership in developing a relationship with the Peoria Public Schools and the Peoria Mathematics, Science, and Technology charter school.

Outreach is an attempt to raise the profile of CeMaST as an important entity within Illinois State University that in turn is a major STEM active institution. (Aligns with Goals 1 and 2 with some Goal 3)

Activities during FY10 include: hiring Dr. Amy Bloom as Assistant Director for Outreach (25% FTE), resurrecting the 9th annual High School Research Symposium, starting the Illinois Summer Research Academy, supporting the Bugs for Kids, the Teach.chem CD program, and bringing the ACS regional Chemistry Exam Contest to ISU for the first time. For the second year, CeMaST is a major sponsor of Science and Technology week. We have also added sponsorships to the Solar Car Team, Expanding Your Horizons, and to the Teaching and Learning Symposium of CTLT. We are also developing and facilitating new outreach activities and programs for the Children’s Discovery Museum (Normal, Illinois) and the Sugar Grove Nature Center (McLean, Illinois).

Engineering K-12 STEM Education is aimed at helping drive the national discussion towards embracing the role of engineering education in K-12 schools. CeMaST recognizes that modern

problems are interdisciplinary and advocates for integrated solutions. Engineering education in K-12 schools is one way of achieving integrated solutions. (Aligns with Goals 1 and 2 with some Goal 3)

Activities during FY10 include: appointing Associate Directors Ryan Brown and George Rutherford to lead this effort, attending national and regional meetings about engineering education, lobbying the state and federal government to include engineering education in new legislation, and starting the Innovative Design Project to encourage students and faculty to work on the real problems of real people.

Operational Efforts to Support the Major Goals and Activities

Dr. Darci Harland has been hired as Assistant Director for Research and Publications (100% FTE). Her role is to support the research efforts of faculty in CeMaST and to make contributions to the permanent academic literature. So far this has resulted in two-book prospectus submission, four new CeMaST research studies on Urban STEM-Ed being initiated, and a new data-driven research agenda for the Mind Project. (Goal 2)

Ms. Sara McCubbins has recently been hired as a Project and Office Manager (100%FTE). Her role is to coordinate several CeMaST projects (including the six MSPs, the Flinn Chemistry project, Outreach, Urban STEM-Ed, and Engineering activities) as well as new grant submissions and to supervise office personnel. (supports all three goals)

We have also hired three graduate students and six undergraduate students to work on various projects and activities.

New Initiatives That Do Not Yet Rise to the Level of Accomplishment

We are also attempting (through support, inquiry, and stealth) to join the editorial board of the Journal of STEM Education. Our goal may be to eventually bring this journal to CeMaST.

We are starting a monthly newsletter, which will have an on-campus and an off-campus version.

We are supporting Dr. Tak Cheung's Biology Concepts podcasts with an eye to either professional development for teachers and schools, or an NPR-like general public education mission.

We have several new NSF and DoEd submission which we are working on right now, with submission in the near future: NSF GK12 Fellows, MSP- IMaST, MSP- Measurement, and MSP- Threatened Species.

Goal 1 Major Accomplishments: Stimulate and support activities and research on teaching and learning that align with campus, state, and national STEM priorities.

One of the major accomplishments of FY09 in achieving Goal 1 was the ability of CeMaST to use variance dollars to support faculty professional development grants. The grant proposals

were due February 26, 2009 and this initiative generated more interest in the center and further stimulated research in STEM education.

On-Campus

In FY09 we used \$44,000 to support Professional Development Grants, and in FY10 we have awarded \$36,910 in Professional Innovation Grants to faculty across campus. Awards were made to faculty in Curriculum and Instruction, Mathematics, Chemistry, Physics, Biological Sciences, Technology, and Health Sciences.

Off-Campus

We began supporting major outreach efforts to both support faculty initiatives and raise the profile of Illinois State as a STEM active/leading university.

CeMaST has resurrected the 9th annual High School Research Symposium, which will bring high school students and teachers from across Illinois to share their research projects with each other.

We have started the Illinois Summer Research Academy, a one-week summer experience for high school sophomores and juniors, in which they work with faculty members on a meaningful research project.

Bugs for Kids shares lesson plans, insect collections, and Lubber grasshoppers with schools around the country. We have sent out 30 terrarium and collections so far this year.

Teach.chem CD is a set of teaching materials developed by local chemistry teachers requested by chemistry teachers around the world. This year, we have sent out approximately 200.

State-Wide and Nationally

We wrote two grant proposals with faculty in Information Technology: STEM Talent Expansion Program (NSF STEP – \$1.4M – still under review) and IT/CS Scholarships (NSF S-STEM - \$600,000 awarded).

We continue to support four existing Mathematics and Science Partnership grants from the US Department of Education. We also helped write four new MSP Workshops and Institutes proposals, of which three were funded:

- Illinois EarthScope with Skip Nelson – Geography-Geology (\$550,000 awarded)
- IBiotech with ROE 45 (\$550,00 awarded – ISU portion \$125,000)
- Solidworks with Technology and C&I (\$550,000 awarded)
- PRE-STEM with Physics (not awarded)

We have developed a Federal Initiative request to support interdisciplinary engineering education, which was included in the ISU Federal Initiatives request to the Illinois Congressional Delegation.

We attended four regional and national conferences and meetings to support and lead efforts by state and national leaders to pass Engineering and STEM Education legislation.

Goal 2 Major Accomplishments: Provide leadership to and foster cross-disciplinary collaborative STEM activities and research on teaching and learning.

In FY10, we have used the new CeMaST marketing materials to generate new brochures, CDs, and project posters to further create a single CeMaST identity. We have also greatly expanded the New and Events section of our website. We have developed a listserv (ISU-CEMAST-HS-TEACHERS-L) to publicize our outreach events to teachers and their students. In addition, a wiki was developed for teachers (<http://cemaststudentresearch.wikispaces.com>) to interact and access resources.

In an effort to provide leadership, CeMaST representatives were very active in conducting national and state presentations. Examples include:

- Bloom, A.M., & Hunter W.J.F. (2010, January). *Sustainable Outreach Efforts: How CeMaST Helps Stimulate Projects While Avoiding Faculty/Staff Burnout*. Presentation at the 2010 Teaching and Learning Symposium, Sustainable Teaching, Sustainable Learning, Sustainable Living, Normal, Illinois.
- Bloom, A.M. (2010, February). *CeMaST and Resources for Educators*. Presentation at the East Central Resource Day for the Environmental Education Association of Illinois, Normal, Illinois.
- Harland, D.J. (2010, February). *Incorporating Research in the Classroom*. Workshop for teachers..., Illinois State University, Normal, Illinois.
- Hunter, W.J.F (2010, March) *An Urban University Teacher Preparation Program in a Nonurban Environment*. Paper presented at the annual meeting of the National Science Teachers Association. Philadelphia, PA.
- Brown, R.A. (2010, March) *Engineering in K-12 Schools in Illinois*. Paper presented at the Illinois Connections Conference. St. Charles, IL

To further achieve this goal, we hired a full-time soft-money Assistant Director for Research. So far this has resulted in two book proposals, and four new CeMaST research studies on Urban STEM-Ed being initiated.

In addition, CeMaST continued to assist in collaborative planning with the four MSP programs housed in the Department of Technology, Department of Chemistry Education, Department of Mathematics, and Department of Curriculum and Instruction.

In FY10, we continued to support the ongoing four MSP projects and added supporting three new Illinois MSP projects, EarthScope with Geology-Geography, IBioTech with ROE 45, and Solidworks with Technology.

Goal 3 Major Accomplishments: Direct efforts to increase the diversity of STEM communities.

CeMaST continued to provide leadership and support to the LS-AMP program in collaboration with the Julia N. Visor Academic Center. This long-standing collaboration between the two centers has resulted in a strong program aimed at increasing minority participation in the STEM disciplines.

C. Indicate measures of productivity by which the unit's successes can be illustrated.

Measure of productivity will be indicated by:

- Increases in external funding from federal, state, and private sources that can be attributed to CeMaST assistance.

- Ongoing grants that had CeMaST assistance:

There are five on-going NSF grants that are supported by CeMaST (Measurement, Mind Project, NSF URC CCC, Noyce, SSTEM- MathEd). Total funding: ~\$7 million

There are five federal grants that CeMaST has led (NSF LS-AMP, IMSP Chemistry, IMSP EIED, IMSP STEM-Leadership, and IMSP Middle Math and Science). Total funding: ~\$4 million

- New grants that had CeMaST assistance:

There is one new NSF grant and one US DoEd grant that is supported by CeMaST (SSTEM – IT/CS, and Teacher+PLUS). Total funding: ~\$13.3 million.

There are three federal grants that CeMaST has led (Illinois Earthscope, IBiotech, and Solidworks). Total funding: ~\$1 million.

The Department of Geography-Geology was recently selected as one of ten pilot departments across the nation to participate in the Association of American Geographer's (AAG) ALIGNED Project: "Addressing Information Infrastructure and Geoscience Needs," which is funded by the National Science Foundation. This program focuses on strategies for recruitment and retention of students from traditionally underrepresented groups in order to increase the diversity of higher education geography and geoscience students.

- Increases in submissions for major external funding by CeMaST as a unit.

- Explore the possibility of a submission to NSF STEM Talent Expansion Program (STEP) Grant.

This grant was submitted with ITK in September 2009 and is currently under review. Total funding: ~\$1.5 million

- Promotion of CeMaST through national exposure at meetings, conferences, and federal agencies.
- Increase in number of individuals (from national, state, and ISU campus) seeking out CeMaST to help them with grant writing, coordination, and evaluation.

In the past six months, 15 faculty members have explored a new grant or written a new grant as PI or co-PI with CeMaST personnel.

- Increase in number of individuals who will receive CeMaST Travel Awards to obtain funding.

We awarded Professional Innovation Grants to 12 faculty members, ten of whom had never received funding from CeMaST.

- Increase the number of CeMaST Fellows and the development of interdisciplinary gatherings where CeMaST Fellows can interact and connect with ideas and potential interdisciplinary funding.

We have started a series of brown bag lunches with faculty in STEM-Ed, with faculty and students in cross-disciplinary student organizations.

- Continued coordination, development, and participation with ongoing CeMaST and campus funding.

On-going.

Internal Reallocations and Reorganizations in FY09/FY10

Dr. William Hunter was appointed Director of CeMaST in August 2009.

Variance dollars were directed toward faculty professional development grants in support of CeMaST Goal 1. The grant proposals are due February 26, 2009 and we expect this initiative to generate more interest in the center and further stimulate research in STEM education.

In FY10, variance dollars we used to hire:

- Assistant Director for Research – Dr. Darci Harland – 100% CeMaST
- Assistant Director for Urban STEM-Ed – Dr. Bob Fisher – 33% CeMaST
- Assistant Director for Outreach – Dr. Amy Bloom – 25% CeMaST

- Project Manager – Ms. Sara McCubbins – 100% CeMaST
- Graduate Students – S. Boesdorfer, G. Schenck, & P. Karanja - 100% CeMaST
- Six undergraduate student workers – 15-20 hours per week

Major Objectives for FY11

The major objectives for CeMaST during FY11 are to:

- Use the data collected in the faculty survey and the informal interviews of key stakeholders to refine the center’s mission and goals.

Not yet done.

- Form an external advisory board and hold a meeting with the priority on developing the center’s research agenda.

We have not done this, although our leadership team of Associate and Assistant Directors has deliberated on the priorities of CeMaST.

- Obtain grant funding to support STEM education activities that aligns with the center’s research agenda.

Grant funding for this has not yet occurred, however, we have started this through the reallocation of resources.

- Reform the center’s organizational structure so as to better align with the center’s mission and goals.

Done.

Program Enhancement Requests: Operating Funds

Personnel Requests: Faculty, Staff, Graduate Assistants Program Growth

We have hired a number of new personnel on soft money, but their existence is dependent upon soft money variance transfers. We now need time for these people to accomplish their tasks and to institutionalize their presence. Any transfer of personnel from soft money/variance to hard money GR would make these positions more sustainable thus increasing our ability to plan for the long-term.

Facilities Requests

We recently moved to the Campus Religious Center where we have five offices and two meeting spaces. We are currently are using all our space and do not foresee needing additional space in the near future. We have used various classrooms and space on campus for our outreach activities. If however, we continue to successfully obtain external grant funding, we may have fluctuating space needs.