Oakton Community College and the National Science Foundation Project:
Center for Promoting STEM (DUE-0622329)

FINDINGS

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Built and expanded upon a previously successful project, the Center for Promoting STEM (CP-STEM) at Oakton Community College was established in 2006 to increase the number of students who pursue studies and receive a degree in Science, Technology, Engineering and Mathematics. The additional goals of CP-STEM are:

- To encourage and enhance student success in STEM courses;
- To develop STEM activities and programs in a supportive, rewarding environment;
- To partner with professional organizations, businesses, and high schools in an effort to promote and sustain STEM activities;
- To study, investigate, and incorporate innovative STEM teaching techniques;
- To contribute to the literature on teaching and learning through program assessment;
- To distribute the successful results of CP-STEM activities.

CP-STEM offers the following programs:

- STEM Enrichment Program (SEP),
- STEM Study Sessions (S^3),
- STEM Mentoring Program (SMP),
- STEM Internship Program including Peer Tutor Training Program (PTTP), STEM Lab Assistant Training Program, and Worksite Internships,
- STEM Success Seminars,
- STEM Faculty Leadership program including Conference for Promoting STEM (CoPS) and Problem-based Learning Seminars (PBL), and
- Student-Industry-Teacher Simulations (SIT-SIMs).

CP-STEM also sponsors student clubs that organize academic, career, and social activities.

In an article titled *For Achievers, a New Destination*: *Two year colleges you may want to attend-and leave*, by Beth Frerking (Education Life Supplement Late Edition - Final, Section 4A, Page

23, April 22, 2007), New York Times featured Oakton Community College a successful two-year college model. Specifically, Frerking stated that "[Oakton Community College] recently received a continuing grant of nearly $800,000 from the National Science Foundation to bolster learning in science, technology, engineering and mathematics, particularly for underachieving students."

This report covers the project activities occurred between August 1, 2007 and July 31, 2008. The "Findings" section briefly summarizes the results of our activities during the 2007-2008 academic year, and the steps we anticipate taking in the coming year. "Findings" section is supplemented by a comprehensive description of the activities undertaken and data collected during this period. In addition, the External Evaluator's report is being sent as Appendix VI in our 2007-2008 Activities Report.

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PART ONE: DIFFERENCES BETWEEN STEM AND NON-STEM STUDENTS

To evaluate the STEM Enrichment Program and STEM Mentoring Program, we conducted an attitude survey in spring 2007, complied and analyzed the data in 2007-2008. Based on the survey, we co-authored with Dr. David H. Smith, our external evaluator and senior lecturer of psychology at Northwestern University, a research paper, "Differences between STEM and Non-STEM Students at Community Colleges."

Non-STEM students in our study are those who are self-identified as STEM majors, but are not participating in any CP-STEM programs or activities. The non-CP-STEM students indicated a lowered level of career interests in STEM and valued STEM less by the end of the semester. If we were to assume that the non-STEM students' lowered rates of STEM career interests and values is linear, within five semesters, their career interests and perceptions of the value of STEM will drop by an entire point from average to below average rating. This decline would imply that they will be less likely to continue studying and pursuing a career in STEM.

The survey also indicated that STEM activities and incentives:

- Increase students' extrinsic motivation;
- Maintain students' interest in STEM and sense of accomplishments; and
- Improve students' study skills;
- Did not increase students' confidence in learning STEM.

During 2007-2008, CP-STEM began to consider problem-based learning (PBL) as a pedagogical strategy to improve students' confidence and intrinsic motivation. We planned and conducted a half-day seminar for community college and high school faculty that focused on problem-based learning as a pedagogical strategy. CP-STEM also instigated and has worked closely with two faculty groups that are developing interdisciplinary STEM problem-based learning modules to incorporate into their curricula, and are training additional faculty in PBL development. Interestingly the NSF STEP Grantees' Meeting also emphasized the importance of student-centered pedagogy in STEM education.

We will continue to investigate the differences between STEM and Non-STEM students, and develop strategies based on the differences we found. Details of the research can found in Appendix One in the Annual Report, Activities.

PART TWO: EVANSTON TOWNSHIP HIGH SCHOOL (ETHS) FACULTY AND STUDENT FOCUS GROUPS

In fall 2007, CP-STEM received an Oakton mini-grant for the project, "Collaborating with Evanston Township High School (ETHS) STEM Teachers and Students through a Focused Conversation." By conducting three focused conversations the project sought to identify the perceptions of ETHS teachers and students on community colleges and Oakton, and to foster new and renewed relationships with the high school's STEM faculty. This study revealed that

there is still much misinformation and confusion on the part of both students and teachers about what community colleges offer, particularly in STEM fields. R. Engeln-Maddox, the independent consultant who conducted the focus groups, found that the high school teachers in this study:

- Believed that for STEM students, community colleges might have only limited programs or internship opportunities.
- Seemed to assume that STEM careers are not an option for students who perform at the average or below-average level in high school, and
- Expressed doubts when asked whether they believed a student who did well at Oakton could transfer to a competitive STEM-related program at a four-year school.

As a result of this study, CP-STEM is developing a promotional campaign to address these misconceptions, providing information and events such as CoPS, SIT-SIMs, and PTTP. CP-STEM also is collaborating with Oakton departments including Admissions, College Advancement and Office of Institutional Research to develop a more comprehensive marketing plan for CP-STEM. CP-STEM will continue this kind of research with other high schools in our district to determine whether this attitude toward STEM and community colleges/Oakton is universal among them. Details can be found in Appendix V attached to the annual report, Complete Activities.

PART THREE: FINDINGS FROM THE EXTERNAL EVALUATOR

A copy of the report from David H. Smith, the External Evaluator, is attached as Appendix VI in the 2007-2008 Project Activities report. The following summarizes Dr. Smith's findings and our plans.

- SIT-SIMs were evaluated by means of a survey with both closed-ended "Likert scale" items and open-ended items that were administered to teacher and student participants. Students said they learned about the featured careers, enjoyed the fun hands-on activities, would recommend SIT-SIMs to other students, and agreed that participating increased their interest and confidence in STEM. These positive results reinforce our commitment to continuing SIT-SIMs as an annual event.
- CP-STEM administered a survey with closed-ended "Likert scale" items and open-ended items to attendees of the two CEO, Scholar and Expert Forums. Participants rated highly the events' relevance to STEM and careers. Participants also felt the event increased their interest in STEM and indicated that they would recommend the event to other students. We will continue to seek out high-profile, relevant speakers to build-on this success.
- Content pre- and post- tests were administered to the Intermediate Algebra (MAT120) course and English Composition II (EGL102) course of SEP and control groups. A significantly greater improvement on the multiple choice questions exists for MAT120 SEP students as compared to non-SEP participants. No statistically significant results were found for EGL102 SEP participants as compared to non-SEP participants. The results for the math pre- and post- tests are promising. We are re-examining the factors contributing to the English results and will act to achieve more statistically significant results the next cycle. Our first step is to

meet with instructors to share results and work with them on specifying the extent and nature of STEM supplementation.

- While frequency of study session attendance appears minimally related to course grade and GPA, a trend is seen toward study session attendees being more likely to succeed in the course (C or better) than non-attendees. Based on this result, we will continue to work with instructors to better integrate and promote study sessions so that we can build on this benefit.

- Participants of STEM Enrichment Program (SEP) and STEM Mentoring Program (SMP) completed a survey about their experience in the program. Among those who planned to return to Oakton, 87.5% indicated interest in participating in the program next semester, and 92% wish to continue with their mentor. SEP and SMP participants agreed that they were satisfied with the experience, would recommend the program to other students, had productive meetings with mentors, and felt mentoring had increased their overall confidence and understanding of career possibilities. It is obvious that these programs are very well received by the students. We plan to continue on with SMP with minor modifications and to expand outreach efforts for the SEP components.

The external evaluator identified some challenges including data collection, coder reliability, sample size, data comparisons across sample years, and identification of appropriate assessment tools. CP-STEM attended both the IUPUI Assessment Institute in November 2007, and the 5th International SI Conference in May 2008 in an effort to learn more about appropriate assessment tools and how they can be adapted and improved for CP-STEM. In addition, Oakton has created a new administrative position, Associate Dean of Student Learning, to oversee all of Oakton's assessment efforts. We expect to work closely with this person and with our external evaluator to refine our assessment program in CP-STEM. We are committed to addressing these issues and are formulating an action plan that includes fine tuning data collection logistics, increasing sample sizes, and using new sources of data.

PART FOUR: CHALLENGES AHEAD FOR CP-STEM

As CP-STEM has become more successful and established, a new set of challenges has emerged. These include SEP student recruitment, study session management, internship development, CoPS planning, transition of project leadership, implementation of assessment activities, and sustainability of the program. This section discusses these challenges and offers some plans to address them.

STEM Enrichment Program (SEP) Recruitment

Previously, CP-STEM personnel had phoned, emailed, and mailed program flyers to eligible students. Even though SMP participants have increased significantly, SEP enrollment in 2007-2008 decreased when compared to enrollment in 2006-2007. New technology allows CP-STEM personnel to identify students who are registered in prerequisite courses to the SEP program and provide customized messages that will describe their eligibility when students log in to the system. Oakton also has implemented a new targeted marking approach to certain population groups, and CP-STEM personnel will continue to devise and carry out recruitment plans that more effectively reach potential STEM students from district high schools, existing Oakton students, and students from other post-secondary schools.

Study Sessions Management

Study Sessions at Oakton are an alternative of the Supplemental Instruction (SI) technique developed by the University of Missouri at Kansas City (UMKC). CP-STEM modified the model so that students who had not previously had the instructor, but had successfully completed a course, could become a facilitator for a course section. During the past year, the sessions were held in various classrooms across campus, making it logistically challenging to utilize the supervisor's time effectively. In addition, the 10-week training sessions delayed the facilitators' abilities to respond to problems that emerged early in the semester. To increase the effectiveness of this academic support strategy in the coming year, CP-STEM will host a longer facilitators' training orientation before the semester begins and later host weekly facilitator group meetings. Beginning summer 2008, CP-STEM began to place a greater emphasis upon the differences between SI and tutoring. This allows CP-STEM to provide a service different from tutoring in the Learning Center, and might allow more success with the program in the future.

Internship Development

Oakton Community College has recently been working to revise its internship program. Starting July 1, 2007, the Office of Academic Affairs took over supervision of the part-time internship coordinator. CP-STEM is collaborating with the new coordinator to create internships for freshmen and sophomore college students. CP-STEM also created an industry liaison position from one of two existing high school liaison positions to build and increase connections between CP-STEM and industries and businesses.

Planning CoPS

The Conference for Promoting STEM (CoPS) in December, 2007 succeeded in attracting nearly twice the anticipated number participants to the event. Nearly all evaluations indicated positive reviews of the event. The negative comments refer to a lack of participant interaction, which resulted from having a larger than expected number of participants. The CoPS planning committee for next year's event intends to solicit both community college and high school faculty groups to present which should provide enough sessions to satisfy multiple interests.

Assessment

CP-STEM will work closely with the external evaluator to continue designing meaningful assessment for SEP, SMP, study sessions, and peer tutoring. CP-STEM will continue to identify what is meaningful, what we want to know, and what we are expecting to know. We will seek more suggestions from the external evaluator, will work with him more closely to determine appropriate assessment tools, and will establish a reasonable project timeline to complete the assessment plan.

Transition

CP-STEM congratulates, but also laments the loss of Dr. Tingxiu Wang who is leaving Oakton to become Chair of the Department of Computer Science, Mathematics and Physics at Missouri Western State University. CP-STEM anticipates challenges to the transition as new individuals take on leadership roles in the project.

CP-STEM recommends that Joe Kotowski replace Dr. Wang as project director. As a new co-director, Dr. Carol Ward, professor of Biology, will help build stronger connections between CP-STEM and biology and chemistry departments. Michael Farquhar, Associate Professor of Mathematics, will continue to support the mathematics components of the project. Dr. Robert Sompolski, Dean of Mathematics and Technology, and Gloria Liu, Coordinator for the CP-STEM will continue in their present capacities to provide support to the initiative.

Sustainability

To sustain and enhance the management and development of CP-STEM, Gloria Liu, a co-project director, was hired as coordinator of CP-STEM starting January 15, 2007. Beginning July 1, 2007, Gloria Liu began working 100% of her time in CP-STEM. Oakton Community College funds 50% of her salary while the remainder comes from the grant. Her 100% involvement in CP-STEM is essential for implementing the project. While no details have been announced, CP-STEM presented to Oakton's Board of Trustees in March, 2008 to begin conversations about institutionalizing various CP-STEM programs.

CP-STEM is seeking support for a dedicated space beyond its current office configuration for long term development and sustainability. Since fall 2007, Oakton has designated classrooms for its various programs. This supports first priority scheduling of STEM sections in such classrooms as well as dedicated STEM laboratories. These rooms have been targeted for the display of new posters marketing CP-STEM and related programs. The CP-STEM leadership will develop an Oakton Strategic Initiative proposal to fund a remodeling request for future dedicated space.

Conclusion

CP-STEM has accomplished many notable feats such has hosting a successful first Conference on Promoting STEM, recruiting students from Evanston Township High School to participate in various CP-STEM programs, and supporting a number of students to transfer successfully to four-year institutions. The challenges we have discussed in this report are consequences of growth and success. While CP-STEM experienced many challenges in 2007-2008, we have begun to establish and implement plans to address them, and look forward to a successful year in 2008-2009.