

BACKGROUND

Underrepresented populations in STEM

- It is estimated that 1 million additional STEM graduates will be needed in the next decade to fill the growing market demand.^{1,2}
- In 2010, 57% of STEM degrees were conferred to women, but only 10% to blacks and 9% to Hispanics.³ Minority representation in mathematics was only 11.4%.⁴
- Enrollment of minorities in STEM majors (34.1%) is nearly identical to Caucasians and Asian Americans (34.3%).⁵ However, ethnic minorities are less likely to complete STEM degrees (26.8%) compared to Caucasians and Asian Americans (46%).⁵
- Dated pedagogies hinder minorities. The separation between science and education yields pedagogies that are unsupported by data. For example, persistent belief in "learning styles."^{6, 7, 8}
- Minority populations lack of research-like experiences in the classroom. The National Council for Undergraduate Research recognizes that research experiences need to be infused into the curriculum as early as the freshmen year.⁹ For example, despite the NIH/NSF Brain Initiative,¹⁰ there are no programs that provide students with experience in magnetic resonance imaging (MRI).

Institutional Context

- York is located in Queens, the most ethnically diverse urban area in the world.^{11, 15}
- The College has over 500 full/part-time faculty, and enrolls approximately 8,420 students. In the Fall of 2012, student enrollment was composed of 33.6% Black, 17.6% Hispanic, 15.9% Asian or Pacific Islander, 1% Native American, and only 5% Caucasian.¹²
- An overwhelming 95% of students receive support via the New York State Tuition Assistance Program (TAP).¹³ And York College has a very low four-year graduate rate (9.5%).¹⁴

Increasing Participation in STEM

- Our current objective is to infuse undergraduate research into the curriculum. By providing underrepresented populations with opportunities for inquiry-based learning we anticipate improved retention, increased graduate rates, and persistence in all disciplines.
- This program has strong potential to positively affect all students at the college and the rest of the CUNY consortium.

Institutional Readiness

- Finley and McNair¹⁶ have summarized several barriers to STEM including poor student advisement and a lack of student time. Mentor-mentee relationships and communities of social support are also important.
- Creating research-like experiences in the classroom informs students that participation in research is important. Developing mentor relationships is also important for personalized education, timely feedback, and morale.
- To help save students time, we intend to take advantage of federal work-study programs to pay students to work in labs. To provide students with a mechanism for social support, the Office of Undergraduate Research is starting research clubs, using social media to inform and connect students, and involve student government in decisions related to student research communities.
- The York College Fact Book¹² is prepared by the Office of Institutional Research to support strategic planning and assessment. Records are accessible to program administrators and data can be parsed according to discipline, gender, ethnicity, and socio-economic status (Table 1).
- York College supports various institutional programs. The Office of Undergraduate Research was founded in 2010 to organize the already prevalent community of undergraduate researchers. The most recent Undergraduate Research Day featured nearly 300 student posters/presentations. York also supports an Honor's Program, the NYC Louis Stokes Alliance for Minority Participation (NYC-LSAMP), the CUNY Pipeline Program for students pursuing the Ph.D., the York Summer Research Program is funded by the U.S. Department of Education, the York Tensor Scholars Program for women in mathematics, and the Center for Excellence in Teaching and Learning (CETL) started in 2007 with Title III support.
- The administration has recognized that undergraduate research and mentorship should count toward tenure and promotion. And we are negotiating a mechanism to provide faculty with reassigned time for grant writing, awards, and the publication of manuscripts.
- The administration has agreed to provide course release time for the program managers. We aim to provide financial incentives for infusing research experiences into the curriculum.
- The administration has also placed an emphasis on cultural competence by supporting awareness workshops, supporting groups like the Women's Center and the African American Resource Center, and including special programs in the curriculum on Cultural Diversity.

YORK COLLEGE AT A GLANCE

INSTITUTIONAL BACKGROUND

- PUI with 8,420 enrollment. 39 enrolled in Master's programs.
- Student to faculty ratio is 19:1
- Highly diverse 130 countries, 87 languages
- 66% female students
- Largest ethnic group: 33.6% Black, non-Hispanic
- 70% under the age of 24
- 64% full-time students
- 95% receive TAP funding from NY state or NYC
- 8.5 % scored >1000 on the SAT. 34% between 800-999.

PROGRESS AND SUCCESSES

- Development of the Office of Undergraduate Research (OUR)
 - Faculty Director receives reassigned time and reports to Provost
 - Dedicated physical space with paid college assistants
- Active committee of ~20 members from all three schools
- 4th Annual Research Day
 - 296 student posters (4%)
 - 54 faculty mentors from most disciplines (10%)
- Dept. of Education sponsored Summer Research Program
 - Students and faculty receive stipends
 - Roughly 50 students in 20 labs
 - Responsible conduct, IRB, and safety training
- Administrative buy-in with financial support from a corporate sponsor: \$20,000
- Increased faculty awareness via OUR & Center for Excellence in Teaching and Learning
- Centralized communication via web site
- Lecture series for Mathematics, Natural Science, and "Research Conversations"
- Assessment via surveys (e.g., SALG) and external program evaluation
- Coordination with independent Honor's Program

CHALLENGES ENCOUNTERED

- Lacking a strategic plan and plans for marketing and assessment
- No coordination between purchasing, internal advancement, marketing, advisement, etc.
- No plan for a sustainable budget, alumni outreach, or a capital campaign
- Lack of faculty initiative to write grants or alter the curriculum to support UR
- No formal recognition for faculty contribution to UR
- Lack of student awareness. Poor ability to directly communicate with students about special programs and application deadlines
- No professional development for students
- No peer mentoring, student ambassadors, and research club.
- No internal awards for students beyond the Summer Research Program
- No encouragement to publish in UR journals
- No college wide curriculum plan
- No coordination for service learning
- No mentor training
- No grant writing incentives or workshops

IMPLEMENTATION PLAN

General Methods

- Faculty leaders will attend the Association of American Colleges and Universities (AAC&U) Annual STEM Institute.
- Model courses and syllabi will be developed to reflect principles of inquiry-based learning, including learning outcomes described by ABET,¹⁷ the AAC&U,¹⁸ the Council for Undergraduate Research (e.g., COEUR¹⁹), and Cross et al. (1989).²⁰
- Academic units (Advisement, Student Affairs, Marketing) will develop a communication strategy to reach students, faculty and administrators.
- The program will be advertised at the beginning of the fall semester. Program applications will be accepted and vetted during the first semester. The first half of the subaward will be granted at the end of the semester.
- Training sessions will start at the beginning of the spring semester. Course syllabi and materials will be submitted for approval. Course proposals must be submitted to the curriculum committee by the end of spring.
- Self-, Peer- and student evaluations will be administered toward the end of the semester. Faculty will receive the second half of the subaward.
- An external program evaluator will review the program.

Management Plan

- The Office of Undergraduate Research and Center for Teaching and Learning will coordinate training sessions, collect syllabi, and aggregate data. The Dean of School of Arts and Sciences will coordinate other academic units.
- Department chairs will be consulted early to insure that the project complements the long-term goals of the department.
- Inquiry-based learning criteria will be placed into all department syllabi and course evaluations to insure long-term and systemic change to pedagogy.

Evaluation Plan

- Syllabi and evaluations will be used to monitor compliance.
- The Office of Undergraduate Research and the Office of Institutional Research will monitor retention, graduation rates, academic performance, participation in undergraduate research activities, and activities that reflect excellence in undergraduate research (e.g., presenting at national conferences and submitting articles to undergraduate research journals).
- Satisfaction measured with Student Assessment of Learning Gains (SALG).
- Dr. Leo Gafney,²¹ an experienced NSF program evaluator will review the program.

Plan for Institutional Impact

- Exemplary syllabi will be used by departments as models for all courses in the discipline, and these standards will be included in the student- and peer-evaluations at the college.
- While the STEM disciplines will be targeted during the initial year of the funding period, we will rapidly expand non-STEM disciplines, working with department chairs to define relevant learning outcomes.
- To reward faculty for their effort and reinforce participation, we will work with the administration to integrate undergraduate research into the criteria for tenure and promotion.

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