Institutionalization of Undergraduate Research: the CSI Experience

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Abstract

The benefits of an undergraduate research experience have long been recognized by American Universities. Undergraduate research programs allow students to explore their own long-term career goals in the context of an actual academic research environment. The College of Staten Island has actively promoted undergraduate research, with the support of external grants awarded to faculty and its own long-standing program of summer research fellowships. In the past 6 years, the outcomes of these programs have been showcased in an annual Undergraduate Research Conference. This paper discusses the details of this program, its impact on engineering and technology undergraduates and the outlook for the future.

Introduction

Wenzel (as cited by Merkel[1]) states in "Undergraduate Research: A Capstone Learning Experience" that CUR(the Council on Undergraduate Research) faculty and administrators have defined undergraduate research as "an inquiry or investigation conducted by an undergraduate student that makes an original, intellectual, or creative contribution to the discipline."

The involvement of undergraduates in research, particularly, at the predominantly undergraduate institutions (PUI) is on the rise because undergraduate research (UR) enriches students' academic experiences leading to success. It has also been documented that UR enhances learning and leads to better retention[2]. There is equally compelling evidence that UR experience facilitates entry in many graduate and professional programs[3]. Undergraduate Research at CSI continues to be promoted for many of the same reasons but more importantly it is an effort to transform the undergraduate education and creating a culture of scholarship and research as broadly as possible. While the benefits of UR to students, faculty and the institutions may vary with different settings, Jill Singer succinctly lists some of the benefits of UR as follows[4]:

- Challenging students to pose and answer meaningful question;
- Increasing the number of high quality interactions between students and faculty outside of the traditional classroom;
- Enlivening the intellectual climate on campus and stimulating discussions and collaborations within and across disciplines; and
- Helping students develop quantitative, problem solving, and presentation skills.

While CSI promotes UR across all disciplines, the tradition of UR in STEM (science, technology, engineering and mathematics) disciplines has existed much longer than social sciences and humanities. It is not surprising given the fact that faculty in STEM areas have been discussing ways to integrate UR as a capstone experience longer and found that UR enhanced student learning, increase critical thinking skills and steered students into successful STEM related careers. It has also been relatively easier to provide UR experiences in sciences and engineering because faculty typically have their research laboratories to fit in one or more aspiring undergraduates. In the current global competitive environment and United States facing a critical shortage of students majoring in STEM areas, it is more critical than ever before that institutions like CSI motivate more and more students to undertake UR projects and through faculty mentoring steer students in STEM disciplines.

At CSI, the academic administration has been and continues to be proactive to institutionalize the benefits of support for and encouragement of undergraduate research efforts. The College has always recognized that students who engage in research learn through inquiry and experience with an intensity and depth not likely encountered in the classroom. With that in mind, the College has supported and encouraged UR with faculty mentors. The College of Staten Island has promoted undergraduate research under three specific initiatives in the last ten years: Summer Research Fellowships, NSF-REU Grant support and the Undergraduate Research Conferences each of which is described below.

Summer Research Fellowships

The College of Staten Island began offering financial support for students conducting undergraduate research in the Summer almost thirty years ago. Initially, funds were set aside to support two students from the Division of Science and Technology each summer; from the beginning, financial support has been split between grant funds from individual faculty and funds provided by the Office of Academic Affairs.

Summer support for undergraduate research has always been competitive. The decision to allocate support has always been made by a committee of the Faculty. In the last three years, support has been extended to students enrolled full-time at CSI, in any of the 25 undergraduate majors currently offered.

Current stipends amount to $2,000 for the Summer. The College of Staten Island continues to pursue the 50/50 policy, which requires an existing external grant allowing undergraduate student stipends. However, this is sometimes not possible in the case of specific majors; in order to maintain support in all the academic disciplines, the policy is rather flexibly implemented.

Figure 1 shows the growth of Summer Research awards since 2000. Because of the requirement of a 50% match from external Faculty grants, the actual number of stipends is not entirely under the control of Academic Administration. The dotted line represents an exponential least squares regression (the "trend line"), illustrating the growth of this form of support over recent years.

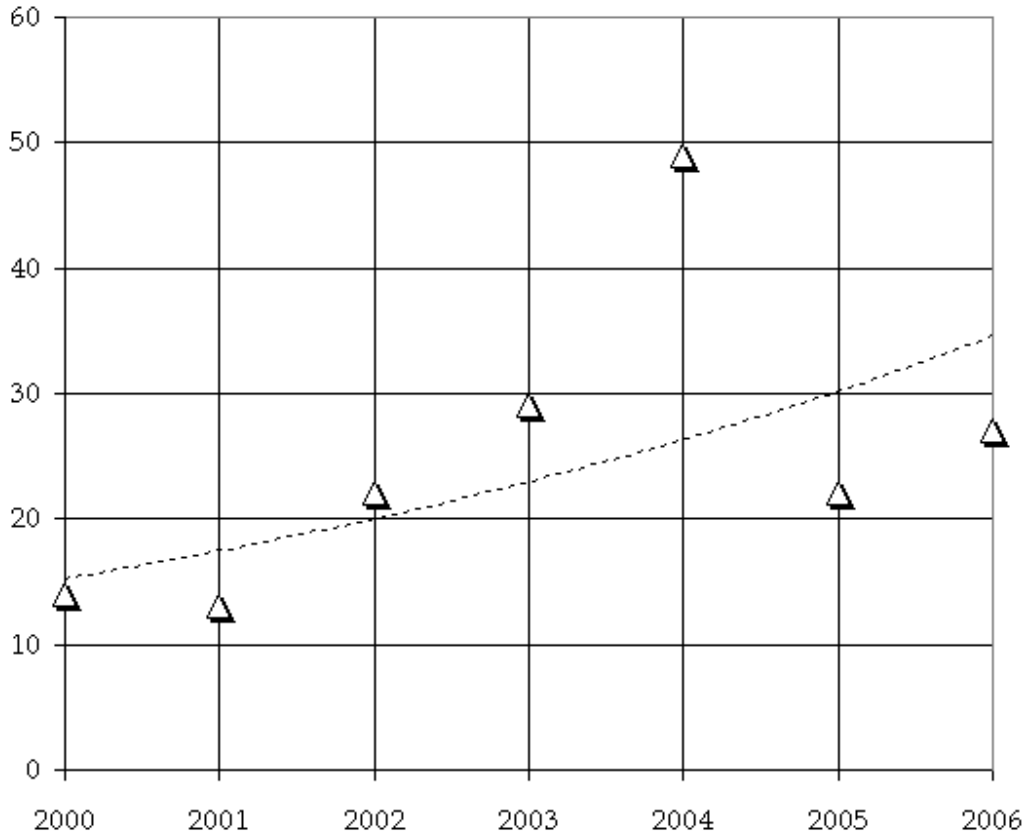

Fig. 1. Undergraduate Summer Research Awards since 2000, with trend line

NSF-REU Grants

The NSF Research Experience for Undergraduates grants constitute a more traditional form of undergraduate research support. The College of Staten Island has applied for an increasing number of such grants over the years. Because these grants follow standard NSF guidelines, support has been available for a much smaller subset of academic majors, chiefly Chemistry[6], Biology and Engineering Science. Again, the number and type of REU grants is a reflection of the academic strengths of the CSI Faculty and the available NSF funds.

Figure 2 shows the point data and trend for NSF-REU support over the last 12 years. Again, an exponential least squares regression model shows a modest growth trend line in this type of support.

The Undergraduate Research Conference

The College of Staten Island has been holding its annual Undergraduate Research Conference since the Spring of 2002. From inception, its theme has been, “Passport to Knowledge” which underscores the importance of pursuit and creation of knowledge through research. Students majoring in all disciplines CSI offers are given the opportunity to present projects, both scholarly and creative, that have been mentored by a CSI faculty member.

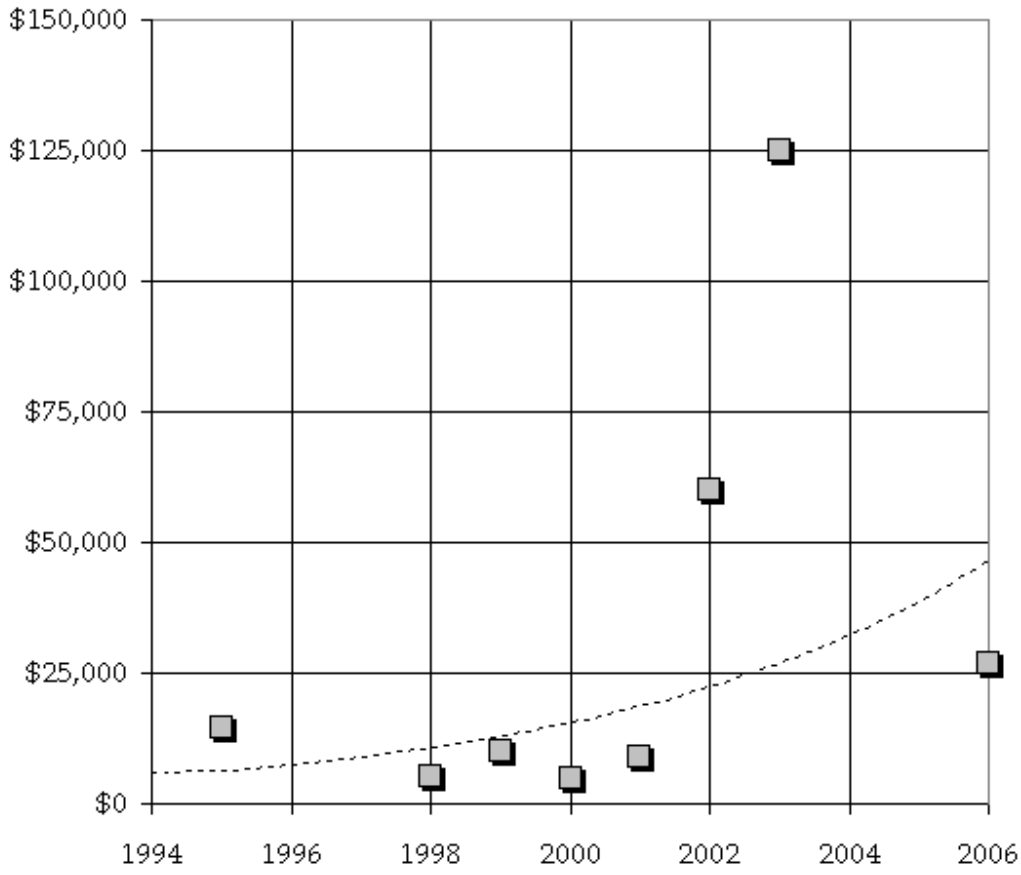

Figure 2. NSF-REU grants over the last 12 years and trend line

The three major goals of the conference are:
(a) Recognition of undergraduate research and creative work as highly valued teaching and learning experiences at the College.
(b) Celebration of academic excellence.
(c) Promotion of student-faculty collaboration and interaction in all aspects of teaching/learning.

The Conference is open to the entire campus community and friends of the College. Students are especially encouraged to attend the conference, which carries general elective academic credit (under CSI's CLUE credits program.) Students attending the conference are exposed to the research and creative work of undergraduates like themselves, and it has been our hope that they will be encouraged to undertake their own projects.

All CSI undergraduate students whose research/scholarly and/or creative/artistic projects (or works in progress) have been mentored and sponsored for presentation by a CSI faculty mentor qualify for conference participation. Students are welcome to submit abstracts for individual or group projects; they may submit more than one abstract. The conference is meant to showcase and exemplify the accomplishments of undergraduates and the contribution their faculty

mentors make toward their learning. The Conference also promotes a healthy competition among students by having faculty members judge the quality of students' research presentation. While the selection criteria and judging practices are still evolving, the conference has typically recognized 4-5 students each year as Research Award Winners with a cash award funded by the CSI Foundation.

Since inception, the conference is kicked off with a celebratory luncheon for student scholars and their faculty mentors- CSI's way to express gratitude for their effort and dedication to scholarship/research. It is also worth noting that thus far the financial support for the conference has been provided by the CSI Student Government, Academic and Curricular Affairs Commission and the CSI Foundation.

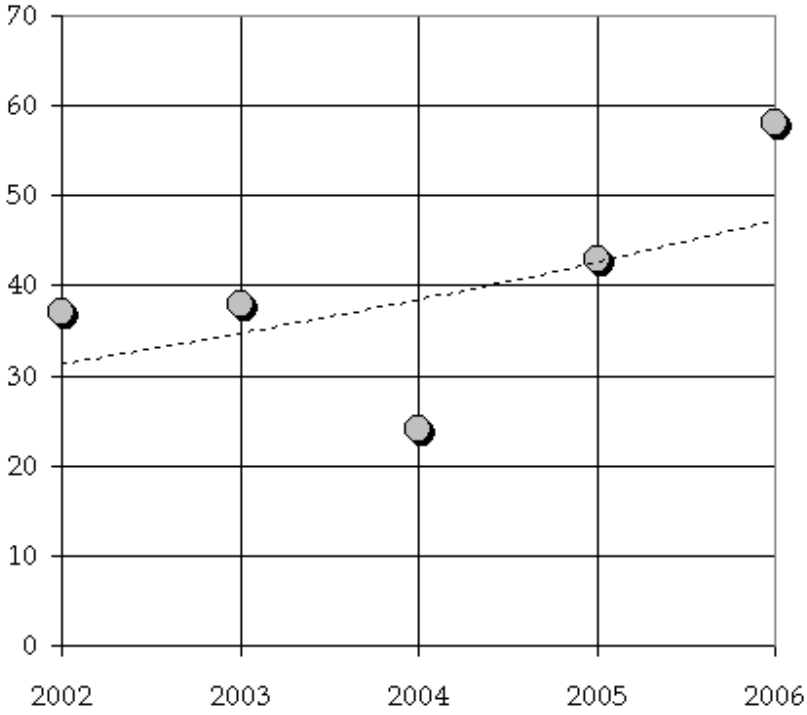

Figure 3. Student participation in the CSI Undergraduate Research Conference since its inception, including growth trend line

Participation in the CSI Undergraduate Research Conference has grown over five years, as shown in Figure 3. The growth trend line shown in the figure is also an exponential least squares regression of the data points.

Figure 4 shows the distribution of academic disciplines in the Undergraduate Research Conference over the years. The distribution of disciplines may be a reflection of the research culture within each discipline, as well as the specific nature of scholarly work within the departments.

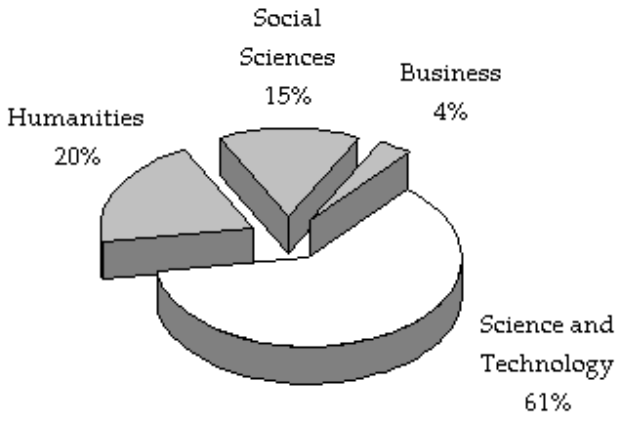

Figure 4. Participation in the Undergraduate Research by major

Conclusions and Recommendations

There is no question that UR continues to gain momentum nationwide both at PUIs as well as research universities because of many tangible benefits, especially enhanced learning through research. The College of Staten Island has taken small but steady steps in providing UR opportunities to motivated students by providing incentives through summer research fellowships. However, lot more remains to be done toward fully realizing UR potential and engaging larger number of students in such activities. While CSI has shown a fairly steady growth, we are far from realizing participation of students from every academic department. It is our belief that the most critical need in institutionalizing UR at any institution is to proactively engage faculty in the discussion on how to integrate research into the curriculum.

A number of fine examples of integrating research in the curriculum can be found in March 2006 CUR Quarterly. Equally critical factor for us to recognize what Peter Burns[5] stated very succinctly and eloquently: "We need to dispel the notion that excellent teaching is incompatible with first-rate research." It is also important that the institutions, particularly PUIs, must review its reward and faculty tenure/promotion structures to incorporate due recognition for faculty efforts in mentoring undergraduate students[7].

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