

UNDERGRADUATE RESEARCH PROGRAM AT A COMMUNITY COLLEGE

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ABSTRACT

An initiative by the National Research Council [USA] has charged Community Colleges to consider instituting a foundation program to introduce students to science research. A team of four women has begun formalization of this process. They include a reference librarian, a Teaching in Community Specialist, a civil engineer, and a physics faculty member. Initial focus will be a community of faculty "Research in Community" to promote test-bed implementation and assessment as well as foster faculty buy-in across the campus. The plan will be coordinated with the existing Honors Program and current independent faculty / student research projects. The major goals are to enhance overall student experience, improving student performance and preparation, supporting student transfer opportunities, and outreach to academic and community partners. This format is modeled on "Teaching in Community" specifically to provide better access for women in science to all aspects of the undergraduate experience.

INTRODUCTION

Springfield Technical Community College, a leader in technology and instructional innovation, transforms lives through educational opportunities that promote personal and professional success. To this end, the College is committed to fostering inquiry; embracing diversity; respecting an open exchange of ideas; encouraging leadership; and inspiring creativity and serving the future with a caring faculty and staff.

STCC Mission Statement

In November 2010, a team of four faculty and administrators (the workshop team) from Springfield Technical Community College (STCC) attended a workshop conducted by The Council on Undergraduate Research in conjunction with the National Council of Institutional Administrators (CUR/NCIA). Funded by the National Science Foundation (NSF), CUR/NCIA is a "program to build a foundation of knowledge and the resources upon which a vision of undergraduate research at community colleges can be constructed" (Council on Undergraduate Research & National Council of Institutional

Administrators, 2010). To that end, the workshop was designed to “assist community colleges to develop effective and sustainable undergraduate research programs” (Council of Undergraduate Research & National Council on Institutional Administrators, 2010) given the unique academic environment of those institutions. The workshop team attended with the overall objective of envisaging an ideal undergraduate research environment and arriving at a realistic conclusion about the possibility of such a program at STCC, consistent with the College’s vision of “being the leading-edge educational solution for workforce, community, and innovation” (Springfield Technical Community College, 2011) and advancing student engagement, success, retention, internship and transfer opportunities, and job placement. Critical to this determination was clarification of the definition of undergraduate research and the identification of highly important issues relevant to the College’s mission, i.e., the impetus for the initiative, and of current activities on campus that could be considered undergraduate research. In addition, the STCC team hoped to identify existing institutional practices or policies exist that would encourage or support both faculty and student participation in undergraduate research along with obstacles and challenges to the same.

This paper presents an overview of STCC as an urban, diverse institution; a summary of the workshop team’s preliminary analysis and self-study; an analysis of goals, objectives, and strategies in light of institutional strengths and challenges, preliminary faculty input on the feasibility and direction of the program, and the groundwork for future implementation and design of the program.

BACKGROUND

Since the publication of *How People Learn* in 2000, the fundamental underlying goal of research and development in education has been having students develop deep understanding of what they are learning.

Learning research suggests that there are new ways to introduce students to traditional subjects, such as mathematics, science, history, and literature, and that these new approaches make it possible for a majority of individuals to develop a deep understanding of important subject matter.

(Bransford, 2000, pg. 6)

How People Learn places great emphasis on deep understanding because all the evidence points to the central role of understanding in determining whether knowledge is usable, transferable, can be employed to advance one’s knowledge, and can be used in the creation of new knowledge.

The Council on Undergraduate Research defines undergraduate research as “[a]n inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline.” (Council on Undergraduate Research & National Council of Institutional Administrators, 2010) “Authentic research represents a significant departure from typical undergraduate laboratory courses in which students complete predetermined activities in a rigid three- to four-hour block of time each week throughout a semester. In contrast, students engaged in authentic research work as a part of a larger team of investigators...” Sadler and Troy (2010) suggest. Sadler and Troy also note that “[a]dvocates for undergraduate research in the

sciences have suggested that these experiences produce a variety of benefits including more sophisticated understandings of science and the nature of science, improved attitudes toward science, promotion of careers in science, enhanced critical thinking, and improved self-efficacy.” (Sadler and Troy, 2010) According to Nagda, Gregerman, Jonides, von Hippel, and Learner, the goal of a program established at the University of Michigan was to “broker intellectual relationships between faculty and first-year and sophomore undergraduates through research partnership.” (1998, p. 58). The project elements were similar to what is being proposed here. The program went through two standard semesters, rather than the summer. Faculty came from all departments and programs on the campus, and it was not an honors program. In fact, underrepresented minority students, women and even ‘marginal’ students were recruited. (Nagda, Gregerman, Jonides, van Hippel and Learner, 1998) They reported on retention statistics, and looked for evidence of persistence.

Dolan (2010) notes that national movements are under way to reform introductory biology education and integrate research experiences into undergraduate courses for majors and non-majors alike. This reform effort faces institutional and cultural barriers that prevent widespread employment of effective instructional practices. A goal of this project is to overcome those barriers that Dolan discusses, especially for traditionally underrepresented student populations. From Karukstis’ (2010) article, it is evident that there is existing or available NSF funding that supports this process. This is not community college focused. In 2007, she posits the importance of this kind of activity for a successful United States in the twenty-first century. Examples of previous work include that in 2008 reported by Mojock, Keefer and Summer. Their project was designed to provide a community college undergraduate an authentic research opportunity in a science discipline. They recruited students who had completed a two-semester sequence in chemistry or physics to explore the technical aspects of producing economically viable bio-diesel fuel from donated discarded restaurant cooking oils.

Springfield Technical Community College

Located in the Knowledge Corridor^{®1} of Western Massachusetts and Northern Connecticut, STCC (www.stcc.edu) in Springfield, Massachusetts, arose 40 years ago from the looming threat of a devastating economic blow to the region – the closing of the United States Armory. Today the institution – the only technical college in the Commonwealth of Massachusetts – is a powerful economic engine in its own right, providing businesses throughout Western Massachusetts with trained employees and encouraging business to grow and thrive. The only community college in the nation with a Technology Park², STCC offers 86 programs for approximately 7,000 (~ 4100 FTE) students (57% female, 43% male) and has given the community over 29,000

¹ So named because of its “dense population of elite colleges and universities (29 total) and over 100,000 college students”; colleges/universities include Amherst, Williams, Smith, University of Massachusetts Amherst. (The Economic Development Council of Western Massachusetts, 2011).

² In 2001, STCC was selected by the U.S. Department of Commerce, Economic Development Administration as the sole national winner of the Award for Excellence in Urban Economic Development. In 2002, the International Economic Development Council recognized the Technology Park with its Economic Development Award for a Revitalization Program. (STCC, 2011)

alumni. By race, current enrollment is 50% White, 19% Hispanic, 14% African American, and 4% Other Minorities.

Community colleges are generally two-year colleges, though students often take more than two-years to complete their programs. While many states do offer housing, Massachusetts' community colleges are not residential. STCC serves multiple missions. One is to prepare students for the workforce, often in response to local employer demands. Another is to prepare students to transfer to four-year colleges to continue studies in the sciences, liberal arts or pre-professional programs. The last is remedial, primarily in mathematics and English. This mission supports both native speakers of English and English language learners. Both a degree- and certificate-granting institution, STCC awarded 794 Associate Degrees and 204 Certificates in 2009-2010. Areas of study included Liberal Arts/General Studies Transfer (54%), Business & Information Technologies (14%), Engineering Technologies (14%), Arts, Humanities & Social Sciences (7%), Health Sciences (5%), Nursing (3%), and Mathematics, Science & Engineering Transfer (3%). By enrollment, the top five majors were Pre-Health Sciences, Liberal Arts/General Studies/Liberal Arts Transfer, Law Enforcement, Bilingual Core, and Nursing. There are currently 827 students in STCC's Engineering Technology programs and 60 in the Engineering Transfer program. STCC is an Achieving the Dream College, a major national initiative for student success and retention.

The College currently holds articulation agreements with twenty institutions, including Boston University College of Engineering, Rensselaer Polytechnic Institute, Rochester Institute of Technology, and the University of Massachusetts Amherst. In addition to its highly-regarded transfer programs, STCC offers a variety of high-demand career programs, such as Biotechnology, IT Security, Laser Electro-Optics, Nursing, and Sonography. The College offers academic remediation for entering students, Adult/Continuing Education programs, Advanced Placement credit, cooperative education, distance learning, English as a Second Language, Honors Program, independent study, internships, and services for learning-disabled students. Many STCC programs, degree or certificate, require a rigid application process.

Since 1990, the College's Commonwealth Honors Program has been a selective program offering a challenging academic experience for qualified students who desire unique study and research contact in their field of study. Honors students are required to enroll in two colloquia and a Library Research Methods course. Additionally, students may work independently with faculty to design an honors add-on component in an approved course, equivalent to an extra twenty percent of class work, subject to oversight and approval by the Honors Program committee.

Faculty – 425 total, including adjuncts – are required to hold a Masters Degree in their respective field. The College is supportive of faculty conference travel and encourages off-campus professional development events. Major professional development initiatives on-campus include the New Faculty Seminar, Emerging Technologies, and Writing across the Curriculum programs. In addition, a strengths-based sharing of best practices called Teaching in Community (TIC) encourages and supports faculty in creative exploration of experimentation with and reflection on teaching and learning as

it relates to the diverse STCC community. TIC is designed to provide faculty with a new or renewed sense of vision and connection to teaching and learning.

Pre-Analysis and Self-Study

The workshop team performed a self-study prior to the CUR/NCIA workshop. Fundamental to the process was the discussion and exploration of definitions of undergraduate research at the community college level, in general and in specific disciplines; the benefits and limitations of undergraduate research in a community college environment; the identification of institutional resources and support mechanisms; an overall methodology of development; student, faculty, and institutional expectations and responsibilities; and characteristics of successful programs.

The program as initially envisioned by the workshop team consisted of a dedicated core of students and faculty. Faculty directed student-centered projects as (1) individualized projects, (2) ongoing long-term projects through which students could “cycle”, (3) service learning projects designed to meet needs on campus or in the local community, or (4) student internships or practicum occurring in outside institutions – academic or business – which provided students with employment while satisfying academic requirements. Laboratory space, equipment, library services, and other resources were available. Faculty working with students received commensurate reduced workloads or other incentives. A central researchers’ space existed so that students, faculty, and guests could meet informally for discussion and networking. Annual presentations of activities occurred and a site hosting presentation materials was maintained. Student writing improved as thoughtful documentation and presentations of work ensued. Overall, participating students were better prepared for the four-year institution, more competitive in the scholarship and transfer application process, and better positioned for gaining employment. Further, students typically underrepresented in STEM fields – especially women and minorities – were attracted, engaged, and retained in these areas of study as research opportunities provided meaningful contextual and relevant methodologies for learning.

Students

A small number of STCC students currently conduct independent research projects under the guidance of faculty in varying degrees. Such projects are typically initiated when students approach faculty with an idea or topic they desire to pursue. These motivated students, however, face the same typical competing outside obligations of most community college students. Student schedules are restricted by job and family responsibilities, and many students are without access to computers or broadband Internet off campus. The workshop team agreed that those obligations must be acknowledged and validated. In addition, the lack of awareness about the definition and role of research, as well as a deficiency in research and pre-requisite skills, must be addressed. Demonstrating the value of student-centered research to students themselves is fundamental to the success of the program. Critical are strategies to ensure widespread opportunities for all interested students while maintaining satisfactory pre-requisite qualifications and skills. Further, determining effective recruitment and enrolment incentives as well as adequate support mechanisms to encourage, track, and document student progress is paramount to a sustainable model.

Faculty

Community colleges are teaching institutions and community college faculty are, first and foremost, teachers. Faculty endeavor to prepare students for selective program acceptance, transfer to four-year institutions, or entrance into the workplace. In general, faculty hope to foster lifelong learners with the skills to succeed in today's knowledge-based society. To that end, undergraduate research, in and of itself a powerful form of professional development for faculty, broadens knowledge in all teaching disciplines, strengthens collegiality between faculty, and enhances faculty/student relationships – all while elevating faculty professionally. It leads to potential grant opportunities and to the establishment of learning communities – proven pedagogy for increasing retention and student success – as well as drives outreach efforts to academic, business, and civic organizations. Service learning projects are an organic result of such outreach.

A perception exists on the part of faculty that undergraduate research is not valued or highly recognized in institutional culture. Involvement in undergraduate research is not a consideration for tenure, and, outside of a minimal amount within the Honors Program, scant resources exist to showcase research or support travel for students or faculty to present research. Contractual workloads, academic advising duties, and college service requirements present obstacles to faculty participation. Lack of incentives for faculty to undertake the commitment – additional compensation, release time, or tenure/promotion considerations – is at issue. Also critical is a lack of physical space and meeting time for students and faculty to collaborate. Strategies to effectively support and incentivize faculty in such a program are critical to the successful implementation of the program.

Institution

This program presents an opportunity for STCC to build upon its many strengths, including strong collegiality among faculty and staff, strong administrative support for faculty-initiated projects and programs, and a highly effective grants office. The institution must exhibit a willingness to meaningfully recognize the efforts of both students and faculty in an undergraduate research program and provide the necessary support for the program. In return, benefits to the institution would include increased grant funding, strengthened outreach to the academic, business, and civic communities, and an overall elevation of the College in the community. A heightened sense of faculty accomplishment and collegiately along with development of prestigious partnerships would further the mission of the College. Further, given the institution's challenge of an underprepared student body and consistent with its focus on student retention, an undergraduate research program promoting retention would place the College on the cutting edge of pedagogies for community college student success. These efforts would be especially significant if impactful on reaching traditionally underrepresented students in STEM fields.

ACTION PLAN

The workshop team formulated an action plan as the major outcome of the CUR/NCIA workshop. Pursuant to the overarching goals of the project, this plan outlines specific goals, strategies, objectives, and outcomes over a three year period in three phases with an ultimate outcome of full implementation of a successful and sustainable

undergraduate research program at STCC. Fundamental to the action plan is the clear articulation of the definition of undergraduate research, specific to the needs of the community college population at STCC, to the agreement of all disciplines and across all curricula, and to promote the participation of underrepresented and non-traditional students, especially women and minorities. Per CUR/NCIA, the term undergraduate research at the community college level does not imply publishable material but rather an experience to direct the student toward more formalized research. Therefore, the philosophy underlying this plan is that correctly applied student-centered research experiences enhance student engagement and understanding, thereby improving student success, preparation, retention, and inclusion. This experience will carry through to the four-year institution. In addition, meaningful student research experiences will enhance faculty teaching of all undergraduates while allowing faculty to pursue fields of interest and constructively reinforce student and professional relationships.

A faculty group modeled on the highly effective Teaching in Community program will be established and will serve as the faculty information and development “arm” of the project. Called “Research in Community for Excellence” (RICE), this group will serve as the faculty forum to facilitate enlargement of the knowledge base as input is drawn from the entire campus community. The formation of a support structure – a baseline system of accountability between faculty, students, and administration – will be designed. The current Honors Program, meeting teaching, learning, contractual, and institutional policy, will be the delivery mechanism for undergraduate research, extending research opportunities to all qualified students. The existing supervisory committee of the Honors Program, which makes academic decisions on what constitutes honors level work, will adjudicate the program parallel to a four-year institution. Current Honors faculty will guide and inform decisions until a working definition and program design are well-established.

Current research activities and independent projects will be inventoried and coalesced campus wide, allowing a balanced approach to designing student research experiences in all areas of study. Outreach to various STCC departments, such as Grants and Development, as well as to academic, business, and community organizations, will be a priority as the project nurtures research opportunities in the form of internships and community service projects.

Phase I: 2010 – 2011 Academic Year

Phase I begins the formalization of the program with informational sessions for faculty and initial reporting to administration.

Goal: To introduce and infuse a culture of undergraduate research at STCC

➤ Objectives

- Determine characteristics of successful undergraduate research program at STCC
- Determine how undergraduate research is compatible with a teaching institution and consistent with the teaching mission of the College
- Promote “buy-in” of faculty
- Identify methods to elevate participating faculty and students in the culture of the institution
- Assess existing and required resources and support

➤ Strategies

- Formulation of RICE group
- RICE meetings with STCC faculty
- Compilation of faculty feedback from RICE sessions
- Report to College President and Dean of Academic Affairs
- Research funding sources and begin funding process
- Outcomes
 - Preliminary working definition of undergraduate research at STCC
 - Preliminary formal articulation of program's philosophy
 - Preliminary draft of overall program characteristics and structure
 - RICE approved by College President and Academic Dean
 - Formalization of first full RICE faculty cohort

Phase II: 2011 – 2012 Academic Year

Phase II represents the specific formalization of the program. The program will eventually fit within the Shared Governance structure as a standing committee, which also serves as a free standing authority for future funding requests.

Goal: To design a sustainable undergraduate research program

- Objectives
 - Compile and analyze faculty feedback from RICE meetings
 - Evaluate existing library services and identify gaps
 - Inventory existing Honors projects and independent faculty research projects
 - Identify “test-bed” faculty and courses for pilot projects and faculty mentors
 - Set thresholds, pre-requisites, and criteria for participation
 - Identify realistic, sustainable incentives for faculty
 - Develop effective support structure for program
 - Determine satisfactory faculty incentives and adequate support
- Strategies
 - Exploration of existing and planned learning communities to further program
 - Present definition of undergraduate research to Shared Governance
 - Outreach to Grants/Development and other sources for funding; initialization of contacts in academic/business/civic communities
 - Review, compilation, and presentation to College President and Dean of Academic Affairs
- Outcomes
 - Formal definition of undergraduate research as approved by Shared Governance
 - Clarification of connection between undergraduate research and Honors Program
 - RICE becomes standing committee under Shared Governance
 - Fully-designed undergraduate research program at STCC approved by College President and Dean of Academic Affairs
 - Approval by Academic Curriculum Committee

Phase III: 2012 – 2013 Academic Year

The STCC definition for undergraduate research will be finalized and a working program design will be fully implemented.

Goal: To implement fully-designed undergraduate research program

- Objectives
 - Recruit and enroll qualified students
 - Pursue funding sources and outside resources
 - Comply with union contractual obligations and limitations
- Strategies
 - Establish faculty mentors
 - Develop assessment and evaluation instruments to align with academic/industry standards (examples: ABET, Essential of Medical Technologies, Nursing)
 - Conduct outreach to other community colleges via reciprocal site visits
 - Conduct outreach to other campus and national organizations
 - Conduct outreach to local/state/national civic and business communities
- Outcomes
 - Sufficient numbers of qualified and interested students and faculty; satisfactory projected enrollment
 - Formal assessment and evaluation underway
 - Collaboration with other academic, business, and community organizations with appropriate facilities, research programs, and opportunities for students
 - Recognition by STCC Board of Trustees

First RICE Meeting – Preliminary Faculty Feedback

The workshop team introduced the concept of the undergraduate research program to approximately thirty attending faculty at the first RICE meeting. Underlying faculty issues and concerns were probed from a strengths-based perspective. Faculty related best experiences in terms of “high points” doing research at STCC or in another setting and were asked “what wishes, hopes, and ideas do you have for this initiative of RICE?” A cursory compilation of feedback on the benefits of such a program indicated recurring themes of teamwork, student empowerment, non-traditional student inclusion, students seeing the “big picture”, collaboration between courses and disciplines, ongoing service projects, creativity in terms of research outcomes, and a sense of community at a “commuter school”. Consistent with the workshop team’s pre-workshop self-study, faculty consistently identified obstacles to the success of the program as students’ fear of research and lack of research skills, contractual workload and time constraints on faculty, and lack of funding and overall institutional support. A follow-up Phase I RICE meeting will further identify and clarify issues related to the implementation and sustainability of the project.

ASSESSMENT

The program will evaluate its impact both quantitatively and qualitatively consistent with, but not limited to, the following indicators and outcomes. A formal assessment plan is under development.

Tab.1: Evaluative Indicators and Outcomes

Students	Faculty	Institution
# participants	# participants	Increased collaboration with local and peer institutions

Diversity of participants	Diversity of programs offered	Increased visibility in community
Retention	Retention	Increased appeal to potential students
Increased scores on faculty-designed content/skill rubrics	Increased grant activity	Increased grant funding
Number and quality of presentations and publications	Increased collaboration with faculty	Enhanced collegiality among faculty and administration
Scholarship and transfer success	New faculty researchers and increased research publication	
Better preparedness for four-year institutions	Faculty feedback	
Job and internship placement		
Increased interest in STEM		
Student feedback		

CONCLUSION

A team from Springfield Technical Community College (STCC) attended a workshop conducted by The Council on Undergraduate Research in conjunction with the National Council of Institutional Administrators (CUR/NCIA). The team's attendance precipitated the development of an undergraduate research program at STCC consistent with the unique student population and teaching mission of the institution. Guided by a preliminary self-study to define undergraduate research at the community college level and explore the feasibility of such a program, an action plan was developed to begin formalization and implementation of the program. Fundamental to the process is the identification of both highly important issues relevant to the College's mission and of current activities on campus that could be considered undergraduate research. In addition, the STCC team hopes to identify existing institutional practices or policies exist that would encourage or support both faculty and student participation in undergraduate research along with obstacles and challenges to the same.

The major goals of this initiative are to enhance the overall student experience; improve student engagement, performance, and preparation; support student transfer opportunities; recruit and retain traditionally underrepresented groups in areas of study such as STEM; and foster outreach to academic, community, and industry partners. In a clearly outlined three-year, three-phase process, the major goals of the initiative will be directed by the STCC definition of undergraduate research and characteristics of the successful program will be identified and tailored by input across the campus and the curriculum. The initial template will be an existing Honors Program in conjunction with a faculty cohort called "Research in Community for Excellence (RICE)". Effective support structures will be formulated and approved and a meaningful assessment process of outcomes and results will be developed. The overarching goal of a successful and sustainable student-centered undergraduate research program will be reached in the 2012-2013 academic year.

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