



STEM Scholars Bridge Program for Increased Student Retentions, Internship and Career Exploration at University of Southern Maine

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Abstract

In the summer of 2012, the National Science Foundation (NSF) awarded the University of Southern Maine (USM) with a scholarship grant for “STEM Opportunities for Academically Capable and Financially Needy Students: University of Southern Maine STEM Scholars Program” (S-STEM- NSF#1153281). This paper provides information on the progress of USM’s Summer Bridge Program that was developed as our model for blending the elements of recruitment, retention, and placement into an integrated, comprehensive but non-intrusive program that promotes student success in transitioning from high schools and community colleges to University of Southern Maine. In the terms of broader Impacts: The project provides increased opportunities for a larger, more diverse population of students, non-traditional, underrepresented and first generation, to obtain a STEM degree and to be placed in an awarding STEM job upon graduation. This pilot study provides educational opportunities from entry to degree completion for 41 academically talented and financially needy incoming freshmen and community college transfer students who are interested in careers in Computer Science, Engineering, Environmental Science, and Technology Management. It is the goal of this report to disseminate information on creating USM STEM-Scholars learning community.

Rational and Significance

Academically Capable and Financially Needy Students (ACFNS) and the Non-traditional student subgroup.

A crucial goal of this project is to provide bridge programming as a framework for scholastic success in targeted areas of academic limitation for non-traditional (NT) students enrolled in STEM degrees. For NT students, factors external to the university have a greater impact on their perception of the university experience [6]. Studies that compared traditional to non-traditional found that among NT students, managing competing priorities, for example, work, children, family, voluntary work, and travelling time to and from campuses ranked the highest and when compared to traditional students [10]. For instance, NT students reported that multiple obligations in their lives lead to difficulties with attendance, including family obligations concerning childcare [9]. Older part-time, and commuter undergraduate student are increasingly a larger portion of the student bodies, yet these students have a higher rate of attrition from college than their traditional counterparts. The reasons why they drop out is not well understood unless we review some of the potential causes [5]. According to the National Survey of Student Engagement from 2006, external obstacles for NT students have made it more difficult for them to develop peer relationships (study groups) at the university [10]. Professional barriers are typically found in the workplace and relate to lack of tuition reimbursement, time management, and/or lack of release time from work. Institutional barriers include lack of access to higher education, the high cost of tuition, and diminished affordability [2]. Furthermore, because adult learners also face the barriers previously mentioned, they may be coping with life situations that can add additional stress and/or anxiety, and this life stress may compound the academic stress they are experiencing [2]. Adult learners appear to be subject to age-related stereotype threat regarding their math performance suggesting that their perceptions of their own ability are negatively influenced by the stereotype that

adults are not as cognitively competent as younger students [2]. Literature on math attitudes in adult learners is limited, though several estimates can be made based on general math attitude documentation that despite the importance of mathematical understanding, many adults dislike and avoid math, even those who are competent in math. The reason for this dislike and avoidance is likely a combination of math anxiety and low confidence [2]. However, NT students may face specific barriers, they also have particular strengths, specifically, they tend to ask more questions and contribute more in class, they prepare more drafts of their coursework, and they are more likely to complete their coursework [10]. Recent research with adult learners has examined these concepts outside mathematics and consistently finds that adult learners with higher levels of self-efficacy and self-concept are more satisfied with their postsecondary experience, more persistent when faced with educational roadblocks, and more likely to enroll in future courses [2].

When reviewing institutional reactions to NT student retention. All students who are experiencing academic difficulties should be encouraged to seek tutoring assistance from learning centers. When possible, faculty should play an active role in continually identifying and recommending qualified students to work as tutors [4]. These learning centers must provide adequate and appropriate facilities to help students with rooms located at convenient locations for students, especially those who commute or live off-campus, to create study group or complete homework [4]. Within these learning centers, retention initiatives should support student diversity that requires different approaches to college teaching, even in math and science [7]. Preliminary evaluations of students found that while most students prefer the new approaches to learning, women and some minority students demonstrated differences in preferred learning styles as assessed by the Myers-Briggs Inventory [3]. Additionally, when considering the external obstacles and characteristics of NT students, it cannot be assumed that students are largely isolated from worldly concerns. Students may have learned to recognize "A" level mastery of the subject matter, and have a good idea of how long it will take to achieve it, but still have their plans interrupted by externally imposed changes in work schedules, by sick children (especially in single parent households) or other non-academic factors. These constraints are less severe with traditional students however divergent constraints are greater for the non-traditional students who now form the new majority in higher education [4].

At the University of Southern Maine (USM), NT students comprise of a large proportion of the undergraduate population [1]. The National Center for Education Statistics (NCES) acknowledges there is no precise definition for non-traditional student, but suggests that part-time status and age are common elements [8]. Other common characteristics of the NT student include: full-time employment, single parent, and eligibility for financial aid. Any and all of these variables can accumulate into external obstacles toward the NT's degree completion. Internally, the NT's academic hurdles are similar to the traditional student; time management, course loads, technology access, and financial obligations [8]. The problem that this projects proposes to address in this pilot program is to provide a in-house (department) learning center that provides math tutors to address an instructional hurdle on accommodations, focuses on the adult learners in regards toward math anxiety, diversity of learning styles, and ultimately provides resources that proactively addresses course and program retention. These internal and external impediments of the NT student profile coupled with the view that few select degree-granting colleges are oriented entirely towards non-traditional students are the motivation for this pilot project.

Project Summary

Presently completing year three of the S-STEM scholars program, year one began in the summer of 2012, when NSF awarded the USM with a scholarship grant for STEM Opportunities for Academically Capable and Financially Needy Students (ACFNS): “University of Southern Maine STEM Scholars Program” (S-STEM). Summer of 2013, the S-STEM program finished its second Bridge Program with seven additional freshman students. The Bridge program was developed as our model for blending the elements of recruitment, retention, and placement into an integrated, comprehensive but non-intrusive program that promotes student success in transitioning from high schools and community colleges to University of Southern Maine.

Broader Impacts:

The project has provided increased opportunities for a larger, more diverse population of students, non-traditional, underrepresented and first generation, to obtain a STEM degree and to be placed in an awarding STEM job upon graduation. The program provides educational opportunities from entry to degree completion for 41 academically talented and financially needy incoming freshmen and community college transfer students (NTS) who are interested in careers in Computer Science, Engineering, Environmental Science, and Technology Management.

Students who met the academic and financial selection criteria were awarded scholarship up to \$5,000 in scholarship funds. Students were recruited from four feeder high schools and three local Community Colleges. In order to maintain their scholarship funding, students are required to maintain fulltime status and an acceptable academic GPA, as well as demonstrate a continued financial need to continue the scholarships. USM’s objectives in this program include a focus on improving and strengthening retention rates with assistance in placement in STEM jobs, as well as establishing articulation agreements with the participating community colleges. Programming includes a Summer Bridge Program, the assignment of Mentor/Advisors, establishment of a S-STEM Learning Community, and assigning peer mentors within the separate STEM academic areas, and tutors upon request or advised. Each month during the academic semester, seminars have been scheduled that include programming on STEM careers, career planning, and site visits. Students explore opportunities; optional summer internships /Co-Ops, and consider undergraduate research fellowships.

Major Points

Overview of Summer Bridge Programs

In the first year, the Summer Bridge program was scheduled for three days in August. All students were required to participate; and notices and agendas for the Bridge program were sent out in mid-July, 2012. The purpose of the program was to introduce them to the S-STEM program; its requirements, available support services, meet with their academic mentors, and learn and get to know the other participants in the S-STEM program. Students were also provided courses in academic survival skills like time management and mathematics, introductions to STEM industries, and participated in team building exercises. Originally it was planned that students would live in a common USM dorm for the three-day program. In the case

of the first cohort, all participants lived within commuting distance of the campus, so this option was waived. The students also toured local facilities and talked with industry professionals on location. It was felt that students would gain insight on possible internship opportunities by engaging industry professionals on location versus in the classroom.

Day-One Program consisted of presenting all students with binders of information regarding their individual program areas, S-STEM Scholarship participation agreements, and schedule of upcoming events and materials associated toward the arranged programming. Day-one activities included a tour of the Portland campus and orientation to various students' assistance and library resources. Part of the programming scheduled on day one included a series of exercises for developing new relationships amongst the peer groups and teambuilding exercises. Students participated in a tour of the Computer Sciences program and in a facilitated competition to create their own STEM Scholars brand logos. This competition concluded with a single design adopted by the students to be their logo and would eventually be printed onto t-shirts they would print and produce, as well as used on future program materials.

Day one ended with prearranged afternoon tours of possible internship sites in the Portland community. Two locations were chosen for their broad appeal to a variety of possible internships; Eco-Maine, a non-profit waste management company owned and operated by 21 municipalities in Southern Maine, and LANCO assembly systems that specializes in the design and manufacture of turnkey automated assembly and test systems, serving customers from a wide variety of industries such as automotive, consumer products, cosmetic, electronics, medical, military, and telecommunications.

Day –Two Program consisted of reconvening on the USM's Gorham campus. Activities included a campus tour and orientation to various students' assistance and library resources. Part of the planned programming included a tour of the Environmental Sciences program and a field study of a local stream to conduct an environmental assessment with peer students in the program. In the Technology labs, the students participating in learning the applications of digital image transfer to artifact by screen-printing their own t-shirts with their S-STEM Scholar logos. This was a team building exercise that began on day one.

Day two ended with prearranged afternoon tours of possible internship sites in the Portland community; Fairchild Semiconductor, who delivers energy-efficient power semiconductor, analog, discrete and optoelectronic devices for power management and mobile applications, and the Portland Water District - a quasi-municipality providing water, wastewater, and environmental services to 11 Greater Portland communities.

Day –Three Program consisted of reconvening on the USM's Gorham campus. Programming commenced with a tour and facilitated exercises within the Mechanical Engineering lab within the Engineering Department. These exercises included programming for developing best practices for applied mathematics. The afternoon on day three consisted of academic mentors working with their S-STEM Scholar peers on developing academic strategies for the coming academic year. These included developing and planning an academic program of study of their course loads for the duration of their programs of study. Day three ended with an event where the entire participating STEM program faculty was invited to meet the S-STEM scholars.

Implementation Strategies

Living/Learning Community Objectives: the learning community has been centered on monthly program activities and peer activities within the academic program areas and collectively as STEM students. Much of this programming consisted of USM alumni guest speakers from each of the target STEM majors (Environmental Science, Engineering, Computer Science and Technology) Representation included three Computer scientists, and two Engineers. These graduates working in the STEM fields provided a forum in which the S-STEM Scholars to hear about their specific careers experiences, ask the speakers questions, and gain insights on preferred practices and trends in their STEM career areas. In addition to speakers' forums, programming was developed for STEM career exploration, resume and references resource development, cover letters, and mock interviews with panelists from USM faculty and academic professionals. Sessions were also provided with program area and peer mentors as well as presentation on available tutoring resources available to all members in the learning community upon request or advice. Additional programming included opportunities for the Mentor/Advisors to monitor and update personalized academic support plans that were generated as part of the S-STEM Summer Bridge Programs.

Accomplishments

We successfully recruited a full cohort, and our summer bridge program introduced the S-STEM Scholars to both S-STEM program resources and their academic mentors. In addition, much of the summer bridge program introduced the scholars to university academic resources, career and internship opportunities, and provided the facilitation of developing a learning community for the participants in their STEM academic areas.

A secondary key outcome in year 1 was the monthly Learning Community seminars which provided the Scholars with opportunities to have dialog with recent graduates in their STEM fields and to acquire strategies for best practices in both their academic objectives and their selection of career and internship opportunities. In addition, formative evaluations were gathered on these seminars and additional programming was developed to address their observations. It was considered important the Learning Community has input into their programming. One of those requests included doing mock interviews. This event was later scheduled with STEM content specialist panels to interview each of the Scholars for specified career or internship positions each student had researched and investigated. Cover letter and resume development and submission to the panel was a component of the seminar.

First year S-STEM Scholars (Cohort 1) were also encouraged to participate in optional Summer Undergraduate Research Fellowships, as well as seek internships in STEM career-related positions. At present, several students have been retained for Summer 2013 research fellowships, and/or working in the internships within their STEM academic areas.

Reflection

Each cohort of students was selected from a qualified list of students that had also been accepted to the University of Southern Maine. To date all freshman and transfer students are on track to

complete their specified criteria. The goal of the grant is retention; each cohort of students are on track in regards to retention expectations, and are on track in regards to placement into STEM careers. Much of the programming developed for both the Summer Bridge program and the monthly Learning Community seminars has been devoted to career development. During each of the Summer Bridge programs, field trips to area businesses and government institutions that hire USM interns and graduates were arranged. During our monthly Learning Community seminars, USM graduates in STEM program areas provided question and answer sessions for the STEM Scholars regarding career opportunities in each of their fields. Programming was delivered addressing resume and cover letter development, career and internship searches, and practicums of enhancing their interviewing skills with mock interviews with panelists. At present USM is committed to developing college level articulation agreements with the community colleges. A number of articulation initiatives have been implemented at the department levels within the STEM academic areas. Each of the monthly Learning Community seminars has been centered on components of training and professional development of the S-STEM Scholars. As previously discussed, during the summer bridge program, students had the opportunity to visit business and industry sites in the area where many USM STEM alumni have had successful internships and/or careers. During the Learning Community seminars, students participated in programming for professional development and training that included, team building, career and internship research and exploration, cover letter and resume development, mock interviews, undergraduate research opportunities, and tutoring.

Closing

One of the project's first forms of dissemination of information has been the development of our S-STEM website as well as fliers and news releases that were distributed to the project's advisory boards members, high school, and feeder institutions for public distribution. For internal dissemination a Blackboard site was developed to share and communicate information within the S-STEM learning community. In addition to the website for publicity, the USM Office of Public Affairs distributed press releases to each scholarship student's hometown/ local newspapers.

The recruitment of students for Cohort 2 for year two is on track with a final seminar scheduled to introduce the students in Cohort 1 to the students from Cohort 2. The experienced students will act as a peer-to-peer relationship within the learning community between the cohorts, as well as assist in the programming and goals of retention.

The Year Two S-STEM Summer Bridge was successful with 7 new freshmen to join members of upperclassmen in Cohort 2. These freshmen met with their mentor/Advisors in order to begin the process of acclimating into the S-STEM scholars programs as well as develop their four-year programming. In regards to dissemination on the project, the USM Office of Public Affairs plans to continue to distribute press releases for the new cohort. Videos of the S-STEM Scholars' Cohort 1 and 2 are available on YouTube for review regarding a image diary of some of the programming developed by the leadership at University of Southern Maine.

Student research projects and internships:

To date, students from Year One and Year Two have participated in several research projects and sponsored academic research. This information is in more detail within the student profile section. Here are some of the highlights.

- STEM-Scholar (Env Sci) has been an active member and officer of their Environmental Science Club, participated in research on the feeding habits of juvenile river herring in the Penobscot River Estuary with Dr. Karen Wilson. This student has also presented her research at the Northeast Fish and Wildlife Conference, and University of Southern Maine's Thinking Matters Student Exhibition.
- STEM-Scholar (Env Sci) presented his research on Smelt Diets in the Penobscot River Estuary with Dr. Karen Wilson at the Northeast Fish and Wildlife Conference, and University of Southern Maine's Thinking Matters Student Exhibition. He also volunteered time with local high schools and clubs on environmental projects.
- STEM-Scholar (Env Sci) has been member and officer of DES student group and University of Southern Maine's Thinking Matters Student Exhibition, and coordinated events in the Portland area for environmental activities.
- STEM-Scholar (Eng) participate in the University of Southern Maine's Thinking Matters Student Exhibition and has been tutoring Statistics and Thermodynamics courses, volunteering for the Engineering Expo student competition, and an officer in the Engineering Students club.
- STEM-scholar (Tec) participated in an internship in the summer of 2013, as well as has been employed in his field of study part-time since his internship. He has been a volunteer for the Maine Appalachian Trail Club maintaining hiking trails.
- STEM-Scholar (Tec) has been teaching Basic Electricity at a local community college in her field of study, and a member and officer of her Student Manufacturing Society.
- STEM-Scholar (Comp Sci) has been coaching middle school Ultimate team, and designed a digital logic course for seventh graders.
- STEM-Scholar (Tec) has been involved in another scholar's team as a representative of Creative Writing Collective Magazine Team.
- STEM-Scholar (Env Sci) was accepted for the Kappa alpha omicron international honors society for environmental science. He was in the founding class at USM. He has also been involved with a research project, Titled - "Why is the River Brown?" Sponsor - DES and EPA, and Dr. Karen Wilson Funded – DES. He has also been a member and officer of a social fraternity leading community service activities for his chapter.
- STEM-Scholar (Tec) has been doing an internship (12-15 hours a week) with the USM IT and developing training modules and developing interactive maps.
- STEM-Scholar (Tec) has been doing work-study within the Information & Innovation/Maine Cyber Security Cluster for the University of Southern Maine in Portland.
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- STEM-Scholar (Eng) participated in University of Southern Maine's Thinking Matters Student Exhibition.

- STEM-Scholar (Eng) participated in University of Southern Maine's Thinking Matters Student Exhibition.
- STEM- Scholar (Com Sci) participating in an internship within his field of study and is working part-time 10-15 hours a week.

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