



## **SSTEM Scholarship - A Scholarship Program to Enhance Education in Computer Science and Engineering Technology**

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## **Abstract**

University XYZ is the only public, historically black college and university of state XYZ, seeks to recruit and provide scholarships to academically talented students with financial need majoring in Computer Science and Engineering Technology. The scholarship program will target 20 XYZ state residents from underrepresented minority (URM) groups. Technology companies are facing a common challenge: finding a diverse, well-trained workforce. Enrollment of minorities and women in computer and engineering disciplines in the United States is well below other ethnic and gender groups when compared to their percentages in the general population. Enrollment trends that have been tracked by organizations like the National Center for Women and Information Technology, the Anita Borg Institute for Women and Technology and The Association for Computing Machinery (ACM) all report similar stories. There is a steady decline in the number of university students graduating with computer science degrees over of the last ten years. More alarming is that enrollment and graduation rates in Computer Science are much lower for women and URM students. The Computer Science Engineering Technology - STEM (CSET-STEM) Scholars Program seeks to reverse this trend at XYZ STATE by recruiting into the STEM pipeline, academically talented students who will be able to graduate with computer science degrees and degrees in mechanical, civil, and electrical engineering technology. CSET-STEM will target underrepresented STEM students, including women; provide each of them scholarship awards totaling \$27,024 for four years. The CSET-STEM Scholarship will close any financial gap left after applying the LIFE Scholarship and Pell Grant.

## **Project Description**

University XYZ is the only public, historically black college and university of state XYZ, seeks to recruit and provide scholarships to academically talented students with financial need majoring in Computer Science and Engineering Technology. The scholarship program will target 20 XYZ state residents from underrepresented minority (URM) groups. Technology companies are facing a common challenge: finding a diverse, well-trained workforce. Enrollment of minorities and women in computer and engineering disciplines in the United States is well below other ethnic and gender groups when compared to their percentages in the general population. Enrollment trends that have been tracked by organizations like the National Center for Women and Information Technology, the Anita Borg Institute for Women and Technology and The Association for Computing Machinery (ACM) all report similar stories<sup>1,2,3</sup>. There is a steady decline in the number of university students graduating with computer science degrees over of the last ten years. More alarming is that enrollment and graduation rates in Computer Science are much lower for women and URM students. The Computer Science Engineering Technology - STEM (CSET-STEM) Scholars Program seeks to reverse this trend at XYZ STATE by recruiting into the STEM pipeline, academically talented students who will be able to graduate with computer science degrees and degrees in mechanical, civil, and electrical engineering technology. XYZ STATE University has a history and culture of nurturing students and helping them exceed many of their own expectations. Lack of adequate financial support is often cited as a reason for delaying

matriculation or dropping-out at XYZ STATE University, despite receiving Pell Grants and other need-based assistance. This project will recruit students who are eligible for South Carolina's state-wide, merit-based Legislative Incentive for Future Excellence (LIFE) Scholarship and who are also eligible for the Federal Pell Grant. CSET-STEM will target underrepresented STEM students, including women; provide each of them scholarship awards totaling \$27,024 for four years. The CSET-STEM Scholarship will close any financial gap left after applying the LIFE Scholarship and Pell Grant.

### **Project Objectives and Plans**

The objectives of this project are to recruit academically talented and financially disadvantaged minority students, to retain them, and to enhance their educational experiences. Specifically, we will:

- (1) Recruit qualified underrepresented high school seniors, including females, from high schools served by XYZ STATE University's Upward Bound Math and Science Program and other rural high schools in South Carolina with large populations of family income below the poverty level who have demonstrated great potential for success in computer science and engineering technology. The CSET-STEM Advisory Committee - consisting of the Program Manager of the Upward Bound Math and Science Project, Director of the Office of Enrollment Management, Director of the Office of Financial Aid, and the PI/Co-PIs of this project - will develop a CSET-STEM Scholars Program brochure to be distributed to the targeted high schools and during XYZ STATE University student recruitment activities. Faculty and student representatives from National Society for Black Engineers (NSBE) and ACM, as well as first year CSET-STEM Scholars, will visit local schools to motivate students to pursue STEM courses and STEM careers.
- (2) Retain these students through the incorporation of a mandatory pre-college bridge program two weeks prior to the start of the scholar's first enrollment. Students will also interact with staff from various student support offices to include the Office of Student Success and Retention, the Brooks Health Center, the Office of Financial Aid, the Career Center and the Miller F. Whitaker Library. Scholars will be assigned seasoned academic advisers who will provide one-on-one interactions and serve as faculty mentors. The Office of Student Success and Retention will provide early intervention for students struggling in their STEM courses. The CSET-STEM Scholars program will partner with the Honors College to provide tutoring and learning opportunities through study groups.
- (3) Provide students with optional extra computer and research training opportunities – Provide opportunities for students to participate in periodical seminars (once a month) to enhance their presentation, thinking, and research skills; introduce the students to Simulation-Based Engineering and Science (SBE&S) concepts; and time management skills. These activities will enhance students' knowledge and competitiveness in the market place.
- (4) Enhance the educational experience of students through workshops/seminars, K-12 and community outreach opportunities – Encourage the students to participate in STEM student chapter activities (ACM, IEEE, UPE, STARS, NSBE, and others); guest seminars (Medical Physics and Computer Science); travel to local and regional conferences; workshops; graduate schools; and activities in K-12 schools.

(5) Expand proposed program activities to accommodate a student population larger than the Scholarship recipients – Make these activities open to other interested STEM majors and encourage them to participate.

Under the supervision of the PI/Co-PIs, the CSET-STEM Scholars will receive additional optional training on computer technology and research training. A group of faculty from each of the participating disciplines will provide the Scholars the required training. Scholars will be involved in academic enrichment activities such as development of interdisciplinary learning community cohorts of incoming STEM Scholars, optional participation of Scholars in research projects such as NSF/HBCU-UP, LS-AMP and REU programs, internships, travel to research conferences, workshops and graduate schools, and activities in the K-12 schools. While optional, these activities are aimed at maximizing the Scholars' academic and career success.

### **Significance of Project and Rationale**

#### *Summary of Minority Enrollment and Interest in STEM Fields*

Studies show that few underrepresented minority students show interest in STEM majors and many lack adequate preparation in high school needed to succeed in rigorous STEM coursework<sup>5,6</sup>. As a result, even those students who do choose STEM majors have less success as evidenced by lower persistence rates for minority students in STEM disciplines. While the number of women enrolling and graduating in STEM disciplines has grown substantially over the past twenty years, they remain significantly underrepresented in most STEM disciplines and also face a set of unique challenges. Black enrollments in higher education are at an all-time high. But nationwide the black student college graduation rate remains dismally low, at a level of about 45 percent. The black student college graduation rate is about 20 percentage points lower than the rate for whites. There are many reasons for the low college graduation rate of African Americans but, undoubtedly, the most important factor is money. Research has shown that two thirds of all blacks who drop out of college do so for financial reasons<sup>6,7</sup>. Many black students decide that they do not want to build up large debts. Others see financial aid awards reduced after their first year in school and do not want to assume additional expenses. At times, increases in tuition, fees, and the price of textbooks push the cost of education too high for black students. Some black students drop out because they need to enter the work force to help support their families. Others who have tried to work while going to college find that undertaking both tasks simultaneously is too difficult, and, so, many of these students will drop out of college.

#### *Statement of Need*

According to US Census Bureau data, 32.4% of the current US population is comprised of minorities and by 2050, 47.2% of the US population will be minorities. By 2015, undergraduate enrollment is projected to expand by 2.6 million, 80% of these being minority students. As the white, non-Hispanic proportion of the total population decreases from 73.6% in 1995 to a projected 52.8% in 2050, the traditional male white workforce will shrink by an estimated 11% (U.S. Census Bureau) while the minority workforce will expand rapidly. By 2028, it is expected that there will be a shortage of 19 million skilled workers to fill jobs in the U.S. It is therefore essential that the corporate world increase the number of minorities and women with the skills necessary to fulfill their labor demand. Corporate

America must seek to increase diversity in the workplace or face a decline in international competitiveness<sup>6,8</sup>. To help the United States maintain its competitive edge in world markets, support is particularly important in the STEM disciplines. While the number of students enrolled in Computer Science and Engineering Technology disciplines is critically low across the nation, it is especially low in South Carolina. These facts underline the importance of recruiting significantly more students into these disciplines. Retention research<sup>6,8</sup> lists “lack of adequate financing” as a major factor for most students dropping out of college. Lack of financial aid in the form of grants and Scholarships is a major deterrent to minority students’ decision to attend college<sup>6,8</sup>. As financial aid increases, it has a positive effect on minority enrollment in postsecondary education. A large proportion of federal grants to minority students have been replaced by loans. Loans are often a disincentive for many minority students who are reluctant to incur large debts. The reduction in grant and Scholarship-based aid, coupled with rising costs of tuition, room and board and related college costs, makes it extremely difficult for many minorities to attend college. As a result, these students are often times burdened with obtaining loans and/or working long hours. Due to financial constraints, many academically talented students are not able to maintain the level of achievement consistent with their potential. Unfortunately, many minority students need to work fulltime, and they often attempt to do so while carrying a full academic load. The ever-present financial burden and need to work leads many students to cut back to part-time status or interrupt their studies at some point in their educational experience. This is true for many students at XYZ STATE University. XYZ STATE University is located in one of the lowest per capita income Congressional districts in South Carolina. According to the 2008 Census<sup>9</sup>, over 23.8% of the population of Orangeburg County is below the poverty level, compared to 15.7% in South Carolina and 13.2% in the United States as a whole. Most students rely on Federal Pell Grants and loans as their primary sources of financial support for their education. Approximately, 99% of the XYZ State students are eligible to receive federal aid (either U.S. Department of Education Pell Grant or Subsidized Stafford Loan).

### **Project Activities**

The Student Success and Retention Program (SSRP) is a university-wide initiative designed to curb student attrition while increasing the percentage of students who graduate from the University. The CSET-STEM Scholars project will reply of best practices emanating from this program. Scholars will be assigned experienced faculty (including the PI and Co-PIs of this project) in their respective majors to serve as mentors and academic advisors. The project will consist of one required and two optional activities: (1) Required pre-college bridge program, (2) An optional computer technology related training, (3) Optional professional development activities.

#### *Pre-College Bridge Program*

The Pre-college bridge program will incorporate various aspects of the highly successful Louis Stokes-South Carolina Alliance for Minority Participation Summer Bridge Program that has operated here at XYZ STATE for over 20 years. Students will participate in Mathematics and Computer Science seminars and workshops designed to transition them from high school to the rigors of college coursework. The two-week bridge program will occur prior to initial enrollment.

### *Computer Technology Related Training (Simulation-Based Engineering and Science (SBE&S))*

Computer technology training represents an important and especially rewarding component of undergraduate STEM training. Industry and government have become interested in increasing the awareness of research and career opportunities for undergraduate students in the application of computers, especially Simulation-Based Engineering and Science (SBE&S) to solve technological problems. Simulation-Based Engineering and Science (SBE&S)<sup>11</sup> fuses the knowledge and techniques of the traditional engineering fields—electrical, mechanical, civil, chemical, aerospace, nuclear, biomedical, and materials science—with the knowledge and techniques of fields like computer science, mathematics, and the physical and social sciences. As a result, engineers and scientists are better able to predict and optimize systems affecting almost all aspects of our lives and work, including our environment, our security and safety, and the products we use and export. Other benefits include, but are not limited to:

(a) having one-on-one contact with the instructor, (b) improving qualifications, whether for graduate school or for industry, and (c) increasing self-esteem. The CSET-STEM Scholars will use the training modules used in the computer technology course and in the NSF/HBCU-UP program at XYZ State. Some of these courses and modules are (a) Web programming (b) Game Programming and Graphical Programming, and (c) Application software (Mathematica, MATLAB, Maple, and LabVIEW). This will provide an opportunity for all CSET-STEM participants to learn technical skills improve their performance in their classes, in their jobs, and in their future careers. These activities are estimated to require an average of about 1 hour per week.

### *Professional Development Activities*

In order to enhance the educational performance and retention of CSET-STEM Scholars, the following activities are planned. These activities are estimated to require an average of about 2 hours per month:

(a) *Monthly Seminars* -- All Scholars will be encouraged to attend a monthly seminar. Talks will be given by faculty and industry guest speakers. In addition, students will share their experiences. This interaction will aid the integration of students and development of student-faculty bonds. It is expected that eight seminars will be held per academic year. Potential seminar topics are: (1) The CSET-STEM Program, (2) Applying for Graduate School and Financial Aid, (3) Finding a Mentor, (4) Ethics, (5) Public Speaking, (6) Understanding Group Dynamics, (7) Managing Intellectual Property, (8) Time Management, and (9) Technical Writing.

(b) *Graduate School and/or Employment Preparation* -- Scholars will be urged to register with the SC State Career Center. This will ensure that they are prepared to connect with graduate school representatives and employers.

(c) *Academic Mentors* – Each scholar will choose an academic mentor from a list of available mentors. This list will include faculty familiar with the project, PI/Co-PIs, and other faculty members. The students will meet with their mentors monthly on an informal basis. The mentors will assist the students with specific problems and advise the students relating to opportunities and departmental activities suitable for undergraduate participation. The mentors will evaluate the student Scholars within five

broad categories: self-management, planning skills, academic performance, communication skills, and consistency. They will work with the student Scholars to develop their maturity.

*(d) Student Professional Organizations* -- Students will be encouraged to become involved in student professional organizations such as ACM, IEEE, and NSBE. Participation in these student organizations will develop leadership and communication skills.

*(e) Research Opportunities* -- The Scholars are encouraged to be involved in optional research opportunities. The PI/Co-PIs will assist Scholars to select a research advisor. Scholars may work under the guidance of a faculty member. A list of potential research projects, with brief descriptions from faculty participants, will be added to the on-line application. Applicants may indicate their general areas of interest and the investigators will match students with topics and faculty mentors. Every effort will be made to accommodate each student's background and interests. During the first month, the interested Scholars will submit a written proposal for their research projects. By the end of one semester, the interested Scholars are expected to develop a comprehensive research outline and present a progress report, both written and oral. During the last month of the second semester, the Scholars are expected to present written final reports and oral presentations, as well as to present their results at professional conferences and seminars.

#### *Prior Activities on Which the Current Project Builds [10]*

This project will build on the experiences of the project personnel in prior and current projects. These projects have been used to primarily support number of CSMET students. With this new NSF/S-STEM project, more CSMET students will have the opportunity to receive support and training. This CSET-STEM project will build on the success of many projects initiated by CSMET at SC State. The Vision of CSMET is to support the achievements and recognition of STEM students, faculty, and staff through education and mentoring programs.

The Goals/Missions of CSMET are to:

- (i) Assist in raising SC State's academic standing among its peer institutions through competitive and outstanding achievements by students, staff, and faculty;
- (ii) Assist the Office of Academic Affairs in creating and implementing programs that enhance the diversity of students and faculty;
- (iii) Assist in developing new mentoring activities;
- (iv) Assist in providing funding for potential STEM students;
- (v) Coordinate efforts to generate education/training grants to support undergraduate students;
- (vi) Establish a close alliance with other South Carolina universities (e.g., Clemson University, University of South Carolina, Claflin University, Medical University of South Carolina, to name a few);
- (vii) Support K-12 education, teachers, and students; and (viii) Assist in increasing the number of external awards for students and faculty.

This CSET-STEM Scholars program will interact with these current CSMET projects. Scholars from the other STEM Programs will be invited to participate in proposed CSET-STEM activities, and vice-versa, to foster collaboration and cultural diversity and also to share in the training and mentoring benefits of each program. The CSET-STEM program will assist in providing educational opportunities for all students at SC State, especially those associated with CSMET. Specifically, all program students and

faculty will be encouraged to openly share experiences and challenges in learning the technology, culture, and knowledge of other disciplines.

#### *Support Structure for CSET-STEM Scholars*

The scholars in this program who do not meet the initial eligibility criteria to enter the XYZ STATE Honors College will be given the opportunity to earn admittance as level II students. CSET-STEM Scholars who earn at least a 3.5 grade point average after their first year will be invited to apply for acceptance into the Honors College. This will provide additional academic support activities and enhance access to research and internship opportunities.

### **S-STEM Project Management Plan**

The PI and Co-PIs are responsible for coordinating, planning, implementing, and evaluating the project. The overall management plan will incorporate assessment and evaluation and will rely upon observational feedback for adjustment.

### **Summary and Conclusions**

The CSET-STEM program is in its first year and we have recruited five STEM scholars to our program. The scholars participated in the bridge program and completed various activities as mentioned above. The scholars are progressing well in their studies and we hope to retain all of them for the next year. Planning to recruit fifteen more students during 2014-2015 academic year is in full swing. We are in contact with number of potential students and their parents through school visits, university recruitment fairs, and personal contacts and we are confident of meeting our goals.

### **Acknowledgement**

This work was funded by a grant from the NSF-SSTEM Scholarship grant (DUE – 1259286). We are thankful to the NSF for providing us with this help.

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