The Computer Science Academic, Retention, and Enrichment Program (CARE)

Results from Prior NSF Support
The PIs do not have prior NSF support; however, the Kutztown University Department of Biological Sciences is beginning the third year of an S-STEM award for students enrolled in Environmental or Marine Science programs. NSF Award 1154006, Enrollment, Retention, and Success of High Ability Students in Two Field-based Interdisciplinary Science Programs, has provided us with experience that we can build upon for this proposal. Two academic years have been completed. Ten scholarship awards were made for the Fall 2012 semester, and 11 were made for Spring 2013. Fifteen scholarships were awarded for both the Fall 2013 and Spring 2013 semesters. Sixteen scholarships will be given for the upcoming semester, Fall 2014.

The project team, including staff from Admissions, Financial Aid, Career Development Center, and others, in place for the current project is committed to support of the CARE proposal as well (see support letters). Procedures are in place with the university bookstore for the student book allowance. In addition, the current project includes the processes of recruiting underrepresented students, scheduling activities, and preparing students for success. Information will be shared with the CARE project team and adapted as appropriate for this project.

The proposed Teaching, Research, And Careers at Kutztown in Science (TRACKS) program has been established, including a learning community for freshmen that provides information about careers, student clubs in the sciences, research and internship opportunities available to undergraduate students, seminars by outside speakers, and trips to the Smithsonian Institution Museum of Natural Science and the Marine Science Consortium in Virginia. Other STEM students are invited to participate in TRACKS activities when space allows, broadening the impact of the program beyond the scholarship recipients and furthering the goal of increasing STEM majors.

More than half of scholarship recipients have achieved our stated 3.0 GPA every semester, with over 60% of scholars achieving this goal in three of four semesters. The goal is to increase the percentage of scholars earning the goal GPA each semester to 75%. Students earning a GPA less than a 3.0 in a given semester have been informed that their future funding will be dependent upon demonstration of academic progress and that the PIs are available to advise and assist them. Additional monitoring of student progress during the semester is being added to identify students needing support earlier. Students will be encouraged to utilize academic support services provided through the University’s Academic Enrichment office and tutoring services provided by KU-STEM grant award. Additionally, the supplemental instructors were not well utilized, but the Science floor (residence hall) tutor was, so the supplementary instructors will be eliminated and a second floor tutor will be added.

Additional emphasis will be placed on the importance of full participation in the project and its impact on student success. The PIs have learned that communication about the activities and goals must be done more frequently. The PIs also plan to communicate further with the two students who decided not to pursue STEM majors, to see if there is anything that can be changed to prevent such losses in the future. In an effort to encourage future STEM majors, the PIs have reached out to ninth through eleventh grade students in under-represented populations to encourage them to consider the STEM disciplines, and to inform them about the S-STEM scholarships and activities available to help them.

INTRODUCTION
Overview: Historical Background and the Need for More Computer Science Graduates
Individuals and organizations have been tracking the enrollment and graduation rates of computer science and its allied fields. Organizations like the Computer Research Association (CRA) and the National Center for Women and Information Technology (NCWIT) have been involved in this effort since 1974.
CRA and NCWIT hope to influence policy that affects computer science and are premier sources of data about “how we are doing” with regard to the various constituent populations who may enter and continue in the field of computing. The NCWIT web site depicts a longitudinal view of the number of students intending to major in computer science according to their gender. The upturn that occurred during the years 1993 through 2001 corresponds to the growth in the use of the Internet for a multitude of applications. Students were seeing that it might be possible to “strike it rich” by going into computer science. In 2001, the Internet bubble burst and many individuals did not consider the field as opportunity-rich as before. This is clearly shown by a study conducted by the NSF and described in Panko (2008) about the opinion that students had about computer science. From Panko (2008, 183), “… there is a deep belief among both IS majors and non-IS students that the career outlook for IS professionals is poor. Students were frightened by poor employment opportunities right after the dotcom bust, and they were also concerned with the longer-term issue of job offshoring to less-developed countries.” Although the downturn in the number of women intending to enter computer science is less than that for the men, its impact is higher due to the smaller number of women in the discipline.

The National Science Board’s Science and Engineering Indicators show that after a rise in 2011 of all students intending to major in Math and Statistics, there was a slight decrease in the number of students that intend to go into these disciplines in 2012. More telling are the national trends of the various ethnic groups and gender groups planning to study in these disciplines. Overall the trend for the last five years has been flat, with some groups rising slightly in 2012 and others falling.

According to the CRA report for 2013, the average Computer Science bachelor’s enrollment per department rose 37% to just over 410 (300 in 2012) majors. The Computer Science bachelor’s enrollment at Kutztown for the Fall 2014 was 96. This is approximately 77% below the national average. Overall, we aim to increase enrollment in our programs, and specifically, we would like to increase the number of qualified students in the underrepresented populations. Using females as an example, females account for 10% of our newly enrolled students, significantly under the national average of 14%.

Overview: The Need for Underrepresented Populations in Computing
In 2013-2014, 10% of the new admissions to the Kutztown’s computer science program are females and 90% are males. Categorizing admits in terms of ethnicity we have the following distribution in 2014: 71% of the new admissions were white; 3% were not specified or blank; Hispanic make up for 5%; 11% of the new admits are African American; Asians account for 8% of new admits; American Indians account for 1% of the admissions.

The Taulbee reports for 2011-2012 and 2012-2013, the results of a survey carried out by the Computer Research Association (CRA), show that for 2011-2013 the average number of students per department enrolled in computer science and information technology (CS&IT) programs was 584.9 in 2012-2013 and 496.8 in 2011-2012. Our enrollment for 2013 was 227 students, a difference of 357.9 students or about 61%. The report indicates that of those schools that responded to the survey, 11.8% were African American and 15.4% Hispanic. Looking at the results of our own department, 7 students out of 227 (3%) were African American and 13 students out of 227 (6%) were Hispanic. The remaining 12% of students were categorized as “other.” Looking over the past several years between 2006 and 2013, a total of 208 students were enrolled. A categorization by ethnic groups was 142 (68%) were Caucasian, 9 (4%) were African American, and 16 (8%) were Hispanic. Looking at gender among total students, 22 (11%) were female, and 186 (89%) were male. Compared to national averages, Kutztown’s Computer Science department has a significant amount of work to do to improve this situation.

There has been significant research for example as to why women don’t enter the computer science field (Ramsey and McCorduck 2005). From this and other research came a list of best practices (Barker and Cohoon 2009), as applied to systems of undergraduate computing education. They include 1) a strategic
plan for recruiting, 2) curriculum, 3) student support, 4) institutional policies & support, 5) evaluation & tracking system, and 6) pedagogy.

Minorities such as African American (4.5%) and Hispanic (6.3%) are also underrepresented in computer science (CRA 2011). Varma (2006) listed some best practices that can be implemented to encourage minority recruitment and retention in computer science. These include 1) making courses relevant, 2) caring for students, 3) training for teaching assistants, including graduate assistants, 3) advisors recognizing diversity, and 5) connecting with fellow students. Insights into why minorities select computer science as their post-secondary educational and career choices are well documented in Varma (2007).

CARE program activities will be founded on research-based methods for recruitment and retention. As we describe the various aspects of the CARE program, the connection to reform initiatives as recommended by Barker and Cohoon (2009) are a key foundation of activities selected. Barker and Cohoon’s recommendations are summarized below (extracted from Barker and Cohoon, 2009, pg. 1)

- Integrate teaching methods that create inclusive, collaborative environments early in the curriculum.
- Provide early feedback on assignments and the meaning of grades so that students can self-judge whether they are on par with their peers.
- Help students understand how their classes and other experiences (internships, REUs, etc.) contribute to their future identities as computing professionals.
- Align assignments and coursework with student interests and career goals.
- Foster routine, positive student-student and student-faculty interactions that contribute to a sense of belonging in the departmental community.
- Avoid stereotypes and stereotypical threats both in and out of class.
- Include visible, high-level administrative support and resources for sustained implementation and evaluation.
- Ensure that efforts to diversify are positively reinforced within the faculty reward structure for promotion and tenure.
- Evaluate efforts to identify what works and what doesn’t work; make mid-course corrections to increase success; and communicate findings for increased support and replication by others.

Overview: The Computer Science Program at Kutztown University
The undergraduate computer science and information technology program at Kutztown University is housed in the College of Liberal Arts and Sciences, and consists of two tracks: Software Development and Information Technology. Both tracks provide students with the background to pursue opportunities in careers or post-graduate study associated with technology. The tracks were developed and faculty in the computer science department oversees the curriculum. Both tracks introduce students to the discipline with fundamental computer science courses. The tracks then diverge to provide students with track-specific computer science courses and concomitant courses in areas such as writing, mathematics and science. The program is completed by general education courses, which gives students a liberal arts education.

Over the last several years, Kutztown University has demonstrated ongoing support for the computer science program by providing funds that have allowed the department to work toward achievement of ABET (ABET 2014) accreditation. In 2008, the university added a classroom with 27 PCs. During that same year, an open lab was established adjacent to the departmental and faculty offices. This lab allows students to work more closely with professors and in student groups as they develop programs. In 2009,
university support allowed the creation of a new tenure-track faculty position. In 2014, Kutztown added another classroom with 29 PCs, as well as two additional labs.

PROJECT OBJECTIVES
The CARE program is aimed at academically talented students with an interest in computer science and information technology. Both nationally and locally, the percentage of female and minority computer science majors is traditionally very low, and the numbers are not improving. For this reason, the CARE program is aimed at the recruitment and retention of all eligible academically talented majors, with additional effort focused on underrepresented groups. The proposed project has three primary objectives, aligned with the goals of the NSF S-STEM program description. The objectives are:

1. **Recruitment/Retention/Graduation** – We will actively recruit academically talented students with financial need and provide activities and resources to aid in their retention and graduation. In terms of best practices, this objective consists of creating a strategic plan, providing student support, creating appropriate curriculum, addressing pedagogy, and modifying institutional practices such as recruitment to target and support academically talented students in computing.

2. **Skill Development and Confidence** – We will implement activities to help academically talented students develop the skills needed for success in computer science, as well as to gain confidence in their abilities to use those skills. This objective aligns with the best practice for Systemic Change on supporting students in computer science programs through pedagogy and curriculum.

3. **Culture** – We will develop and encourage a culture more welcoming to academically talented students in an effort to provide a better experience for them, implementing the best practices of student support.

Our program proposal also includes assessment of our project, which incorporates the best practices of evaluation and tracking.

Project Motivation
There is considerable concern within the discipline about the difficulties in recruiting, retaining and graduating academically talented students in computer science. Both the CRA Taulbee reports and the National Science Board’s Indicators shows that there is a need across institutions for programs that address these difficulties. Kutztown is no different with regard to these concerns. Many of our students are first-generation college students who do not have the critical family support and financial resources to attain their degrees. Students work multiple jobs to help finance their own educations, leaving them with less time to devote to studies and extracurricular activities that will enhance their preparation for the workforce or graduate school. The goal is for these academically talented students to graduate with a degree in computer science and enter the STEM workforce or continue on in a STEM graduate program. The CARE program will include High Impact Educational Activities (Kuh 2008) to address the shortage of academically talented students in computer science.

PROJECT PLAN
Project Overview
To achieve the objectives outlined above, we will build upon existing capabilities and implement new practices. In this section, we expand on our objectives and identify strategies and tactics to achieve them.

As stated above, the CARE program is aimed at all academically talented students with financial need who have an interest in computer science. As part of the program, CARE will also target underrepresented groups. This is the first coordinated effort on the part of the Computer Science Department at Kutztown University to actively address the issue of the underrepresentation of minorities and women in the program. We look to follow the approach and successes of other institutions that have dealt with the same problem to obtain desired results. A clear leader in this effort, based on their success
with recruiting women into their computer science program, is Carnegie Mellon University. Since 1995 they have been pursuing the goal of making the Computer Science program at Carnegie Mellon an institution that is as friendly to women as it is to men. Lenore Blum (2001) documents the results of the Carnegie Mellon program and identifies four important areas to consider for women in a computer science program. These are the experience gap, confidence doubts, curriculum and pedagogy, and peer culture.

Objective 1. Recruitment/Retention/Graduation – graduate more academically talented students in computer science

Our approach to recruitment will be a coordinated activity among the CARE program team, the Office of Admissions, and Financial Aid Services. Since the Office of Admissions usually has the most contact with potential students, we must work closely with them to achieve our enrollment goals for the CARE program. The CARE program recruitment will be tied to the yearly admissions cycle that begins in May and continues to the end of April in the following year. During the admissions cycle, the Office of Admissions hosts many activities for prospective students. These activities include off-campus recruiting, STEM Open House, and visitation days. The Director of Admissions has expressed a desire for a closer working relationship between Admissions and academic departments. In light of this, the Admissions Office will identify interested and qualified candidates for CARE and make the appropriate connections with the PIs. This will allow us to have early direct contact with potential students.

A Concerted and Orchestrated Effort to Recruit Academically Qualified Students for the CARE program. Computer Science has consistently been proactive in the recruitment and support of students to the computer science program. The advent of the CARE program will create a new level of effort to attract academically talented and qualified students to our program. By increasing the pool of applicants in the underrepresented constituencies, we will identify a greater number of potential students, including underserved populations. We will monitor the success of these activities to ensure that the applicant pool becomes more diverse. The following summarizes the newly focused effort.

1. Admissions and the Computer Science and Information Technology Department will work together to identify qualified students for the CARE program. These students will be targeted by the department and actively recruited.
2. New and special activities will be created to increase the pool of potential students for CARE. As part of our active recruitment of qualified students, a special Computer Science Day will be created where students, counselors, and teachers will be invited to campus to learn about computer science at Kutztown and the CARE program. One-on-one interviews will take place. Giving the student an opportunity to ask questions about CARE and the computer sciences program.
3. A high school outreach program will be created in which CARE program team members and other faculty and current computer science students will visit high schools and junior high schools to identify and garner interest in CARE and computer science. We will identify schools whose demographics are more in line with the desired demographic objectives for our program. The PI has direct experience in creating outreach programs like this and was successful in recruiting students to his previous university.
4. Literature will be created and distributed to feeder schools and non-feeder schools to garner interest in our computer science program and CARE. This literature will be distributed to potential CARE constituent groups. Our department website will be updated to incorporate information about CARE.
5. In addition to identifying students interested in computer science, students interested in other STEM disciplines will also be contacted regarding CARE and the program in computer science.
6. We intend to launch special evening programs for potential CARE students similar to those activities taking place at Carnegie Mellon University (Ritchie, 2014), culminating in a year-end competition.
7. Invitations will be sent to interested students to participate in computer programming competitions and Hack-a-thons sponsored by our student technology association.
8. Hack-a-thons and programming competitions are not always attractive to all students, so we will also sponsor collaborative activities. For example, developing software for organizations having needs but not having the means to pay a group of programmers to create the software.

9. To better understand why students do not select KU computer science as their post-secondary educational choice, we will seek input from students who did not select KU. We expect that these contacts will aid us in refining the recruiting process.

As mentioned previously these CARE activities are based upon historically successful models for attracting students in computer science, including the underrepresented populations.

**Retaining Computer Science Program Students**

As is well cited in the literature today, students tend to change their major frequently during post-secondary education. Computer science is no different in this regard and has its own additional retention problems. Kutztown University has many student services to support and retain students. The computer science department has also put into place activities that will be built upon for the CARE program.

Retention of students in any university program is dependent upon several factors. A student’s sense of match between his or her field of study and his or her career desires is one important factor. A student’s sense of belonging is also a key factor in his or her decision to remain or leave a particular university. San Diego State University cited the top 10 reasons for students deciding to leave a university program which included lack of a sense of belonging; limited financial support; lack of advising and guidance; attention spread over academic and employment duties; and academic fit. CARE will address these aspects.

Student retention will be encouraged and supported by the following activities (also using Barker and Cohoon’s list of reform initiatives listed earlier), some of which are already in place:

1. Students admitted through the CARE program will become part of the computer science learning community. The learning community program has existed for the past 10 years and supports highly qualified students during his or her first year at the university. The learning community is meant to support the social and peripheral aspects of the computer science program. Students in the learning community participate in special programs during the course of the year in order to maximize their chances for success in the computer science program.

2. Each student will be assigned a faculty advisor who will help track his or her progress and help with course decisions. These assignments will be based on the demographic information of the CARE student. For instance, female students will be assigned to a female advisor.

3. Each student will be assigned a faculty mentor for the duration of his or her post-secondary education at Kutztown University.

4. Each student will be assigned a student mentor to provide support for the duration of his or her post-secondary education. (Student and faculty mentors are meant to provide the students with various kinds of support – both academic and non-academic). CARE students will be encouraged to become involved with faculty research, internship activities, and externship activities. Through these activities, career opportunities for people in the computer science field will be reinforced again and again.

5. The CARE program will be assessed on a regular basis to determine its effectiveness and to ascertain what is working and what is not working. This will in turn result in adjustments to the program as it progresses over its duration.

6. A curriculum review will take place as part of the initiation of the CARE program to better understand courses that need revision for underrepresented constituencies. Changes will be made to the curriculum as a regular departmental activity.

Of course this list of activities is by no means comprehensive and we will be evaluating our activities for their effectiveness.

**Objective 2. Skill Development and Confidence** – encourage career skills in students
All participants will be encouraged to identify and develop not only career-relevant skills, but also leadership potential (Hill, Corbett et al. 2010). Skills specific to computer science that are part of the computer science program include subjects like mathematics and problem solving skills. Communication skills, leadership skills, and business acumen represent key skills desired by employers of practicing computer scientists or information technologists. Some of the courses in the computer science curriculum include subject matter along these lines, but we also will make use of the workshop format to augment a student’s coursework. These workshops will be open to all students.

The KU Career Development Center (CDC) has agreed to help inform students about potential careers in computer science and strategies to secure employment. Topics covered by the CDC include identifying career goals, training in use of CDC resources, identifying internship opportunities, mock interviews, guidance in resume preparation, and issues for professionals in the workplace. (See support letter.)

As part of CARE, students will create a resume at the start of their education. During their four years at KU in the CARE program, they will update and create new versions of their resumes based on any new job experience, significant coursework, work on a research project, papers and presentations completed, and individual and team projects. The resume is something that many students commence in their final year, but resume building should begin at the start of the college education to ensure that all relevant experience is captured and to provide the greatest opportunity for feedback.

**Objective 3. Culture – develop a culture that is more welcoming**

The development of the culture of the CARE program will involve introducing the students to a diverse group of computer scientists from a variety of fields. Many of these computer scientists will be professionals who can share their experiences and serve as role models (Hill, Corbett et al. 2010). The activities planned include monthly bag lunches, professional presentations, organized field trips and attendance at professional conferences. These activities not only build upon the students’ skills but also provide a sense of belonging, a demonstrated tool for retention.

The monthly bag lunches will provide students with a forum to discuss issues experienced by professionals in computer science. Local academic researchers or representatives of companies who work in one of the computer science areas will deliver professional presentations. Many of these presenters will be members of underrepresented groups so students can see individuals like themselves successfully pursuing a career in computer science. The presenters will discuss their own career paths. Presentations will be recorded and available on the CS website. The scholarship recipients will be expected to attend these lunches and presentations, and to participate in reflective responses, which will include keeping a journal. Each student will be required to keep a journal during the academic year, not only as a reflective experience for the participant, but also to aid in resume development and program assessment. As we gain more experience with journal keeping, we envision the extension of this activity for all computer science students.

One annual off-campus field trip per year will provide scholarship recipients with an opportunity to observe computer scientists on the job. Field trips will be arranged so that students can interact with individuals similar to themselves. Students will also attend two professional conferences in their four years in the program. Possible conferences include the Grace Hopper Celebration of Women in Computing, the Black Data Processing Associates (BDPA) yearly technology conference and the ACM Richard Tapia Celebration of Diversity in Computing.

. By attending conferences, scholarship recipients will become more aware of the benefits of a career in computer science and will meet peers and role models who are actively involved in computer science-related fields. We will also encourage students to write and submit research papers to conferences.
The CARE program is designed to achieve NSF-defined goals in general and S-STEM goals specifically, while addressing the need for a more diverse student body in the computer science program. The CARE program is a full educational and social experiences created to attract academically talented students with financial need and retain them until they graduate and find employment or go on to graduate school. By providing financial assistance in the form of scholarships, students can focus on the program activities as opposed to financial concerns. By building on known successful programs, we believe we can attract students and help them achieve success in the CARE program.

**SIGNIFICANCE OF PROJECT AND RATIONALE**

The CARE project is significant because it represents an important cultural change in the Kutztown University Computer Science program that will, in turn, increase the number of academically talented students who enroll in and matriculate from the Kutztown Computer Science program. In 2006, only 0.4% of first-year college students intended to major in computer science (AACU 2008). Only 8.7% of the students in KU’s Computer Science program are female, although females comprise 58.03% of our student body. The CARE Project not only seeks to increase the overall number of academically talented students, but also seeks to increase the ratio of underrepresented populations in the Computer Science program.

In examining our data regarding freshman during the past several years, there are a number of significant characteristics that are highlighted. The number of female freshmen computer science majors ranges from 1 to 5 while the number of men ranges from 24 to 29. Both totals have remained fairly consistent and the percentage of women is very low. The average 1-year retention rate for majors over the past five years is 75%, which is slightly below the university average of 76%. The 1-year retention rate for female majors over the same period is 53%. The retention of the freshmen women from year one to year two ranges from 0% to 80%; however, once students stay for year two, the retention and graduation percentages improve. The CARE program will address issues related to the recruitment and retention of academically talented students, including underrepresented groups in the Computer Science program for the duration of their study. Within the context of the best practices of tracking and evaluation, we plan to gain a better understanding of the issues that students face in computer science programs. We will actively work to resolve issues that arise to remove barriers to success in our computer science program.

Total cost of attendance at Kutztown University for the 2014-2015 academic years is projected to be $23,836 for in-state students and $34,594 for out-of-state students. 80% of entering freshman in Fall 2014 were determined eligible for financial aid. Projected 2014 financial need for entering freshmen is $18,580. The proposed scholarships are based on this figure; however, we have determined that we could impact the greatest number of students during challenging economic times by offering a maximum tuition/fee scholarship of $7,800 plus an $800 book scholarship per student annually. A minimum of 24 S-STEM scholarships will be awarded over the course of the project, with the possibility of a higher number depending on the demonstrated financial need of the most academically qualified students. The scholarship awards will permit these students to focus on academic and career success by dramatically reducing the financial burden of college attendance.

**ACTIVITIES ON WHICH THE CURRENT PROJECT BUILDS**

The proposed project builds on a variety of activities at Kutztown University and within the Computer Science program that have been established to promote student success and enhance the quality of the academic program.

Dr. Lisa Frye and Dr. Linda Day, project co-PIs, have contributed to the faculty-supported learning community. Learning communities offer academic support, help students to plan for course scheduling, and provide thoughtful approaches to issues related to student life, and are considered a High Impact Educational Practice (Kuh 2008). Time management, study skills, Career Development Center (CDC)
overview, and course scheduling are some of the workshops conducted each year. The voluntary nature of existing programs leads to inconsistent participation by students. We plan to restructure this for scholarship recipients in the CARE program, by setting expectations for student participation to a minimum of 75% attendance throughout the semester and also expanding the topics covered to be of value to not only freshman but also to upper level students. Presentations would vary on a weekly basis, with formal presentations on study skills and information literacy, augmented by student-led discussions and reflections on seminars, field trip experiences, and first-hand reports on research and internships. Students will be expected to keep a journal that will document their experience in the program and provide subject matter for discussions. With a social network for scholarship recipients, and with the relationships students build with computer science faculty and advisors, we expect to improve retention and academic success.

Career development activities in computer science have traditionally been treated informally and through the learning community, but will be elevated in the CARE program. Career information presentations and activities provided by Career Development Center (CDC) staff will build greater career awareness among students, beginning in the freshman year and continuing to graduation.

One of the PIs, Dr. Randy Kaplan, has experience in attracting students in computer science through the creation of special programs. The PI’s effort occurred in 2006 and 2007 and was called G.I.R.L.S (Games in Real Live Situations) (Kaplan 2006). The purpose of G.I.R.L.S was to have middle school and high school students come to a weeklong program where they would learn how to create computer games. The cohort was kept small due to limited funds – about 10 students in 2006 and 2007. The G.I.R.L.S program resulted in additional applicants to the degree program at the institution hosting G.I.R.L.S. This experience is extremely relevant to CARE and lessons learned from this experience will be employed in CARE.

We encourage students to become involved in faculty research projects, and our department supports many students in this regard. Dr. Dale Parson, one of the CARE team members is very experienced in his work with students and encourages students to carry out research. During summer 2014, Dr. Parson and Alison Seidel presented a paper at the International Conference of Frontiers in Education entitled “Mining Student Time Management Patterns in Programming Projects.”

S-STEM seminars will be developed and integrated as part of the CARE program. These will substantially enhance an existing seminar series offered by the computer science department. Special attention will be given to selecting presenters who represent appropriate role models for CARE students. Presenters will include members of the underrepresented constituencies. Upper-class scholarship recipients will also be encouraged to present seminars.

In the past, the Kutztown Technology Association, a student group administered by computer science students, sponsored presentations by students, faculty and external experts. We have incorporated these presentations into the project to build computer science awareness, to provide career enrichment, and to allow students to socialize. Planned meetings with working computer scientists will further enhance the value of these presentations for our students. We will also incorporate an off-campus field trip to a local company to afford the students an opportunity to see applications of computer science.

Finally, the project will also utilize the services of the newly established (Fall 2013) Center for Academic Success and Achievement (CASA). CASA will focuses on the academic success of students through tutoring, supplemental instruction and mentoring, as well as coordinating with other offices and providing personal contact and monitoring for students.

**PROJECT MANAGEMENT PLAN**
The CARE team has been organized according to the major activities required for the success of the proposed project, including: 1) Recruitment and Retention, 2) Academic Support, and 3) Career Planning and Development. The CARE team includes members from the Computer Science and Academic Enrichment Faculty, the Dean, the Assessment Office, Admissions, the Career Development Center, and Center for Academic Success and Achievement. The project responsibilities and activities are delineated in Table 1 below.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsibility</th>
<th>Schedule</th>
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</thead>
<tbody>
<tr>
<td>Project Oversight and Management</td>
<td>Kaplan, Frye, and Day (PI’s)</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Recruitment</td>
<td>Kaplan, Frye, and Day (PI’s), Admissions and Enrollment and Financial Aid</td>
<td>Yearly admissions cycle</td>
</tr>
<tr>
<td>Selection and Awards</td>
<td>Parson, Fox, Zayaitz, PIs</td>
<td>Yearly, awarded in Spring term according to admissions cycle</td>
</tr>
<tr>
<td>Student Eligibility Review</td>
<td>Kaplan, Frye, and Day (PI’s), Parson, Fox, Zayaitz, Admissions and Enrollment</td>
<td>Each semester</td>
</tr>
<tr>
<td>CARE Program Activities Planning, Development, and Implementation</td>
<td>Kaplan, Frye, and Day (PI’s) Computer Science and Information Technology Faculty, Career Development Center, Center for Academic Success and Achievement, Identified Outside Organizations</td>
<td>Ongoing (including regular seminars, field trips, invited talks, KTA activities, etc.)</td>
</tr>
<tr>
<td>Learning Community</td>
<td>Frye and Day</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Supplemental Instruction</td>
<td>Center for Academic Success and Achievement</td>
<td>Twice weekly, optional</td>
</tr>
<tr>
<td>Peer Mentor Training</td>
<td>Center for Academic Success and Achievement, Kaplan, Frye, and Day (PI’s)</td>
<td>Annually, fall semester</td>
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<tr>
<td>Peer Mentoring</td>
<td>Computer Science and Information Technology Faculty Upper Classmen</td>
<td>Ongoing, on-demand</td>
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<tr>
<td>Internships/Externships</td>
<td>Career Development Center &amp; Computer Science and Information Technology Faculty</td>
<td>Ongoing</td>
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<tr>
<td>Research Opportunities</td>
<td>Computer Science and Information Technology Faculty</td>
<td>Ongoing, to be formalized</td>
</tr>
<tr>
<td>Student Evaluation</td>
<td>Clary (evaluator) Kaplan, Frye, Day (PI’s) and all other CARE program team members</td>
<td>Each semester</td>
</tr>
<tr>
<td>Project Evaluation</td>
<td>Clary (evaluator) Kaplan, Frye, Day (PI’s) and all other CARE program team members</td>
<td>Ongoing, annual evaluation, project conclusion</td>
</tr>
<tr>
<td>Reporting and Dissemination, and maintain S-STEM records</td>
<td>Kaplan, Frye, and Day (PI’s)</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

Table 1: Project Management Plan

DISSEMINATION PLAN
The dissemination of the activities and results of this program will be an ongoing effort for the CARE PIs. Dissemination to internal, external, and NSF organizations will be part of the information sharing process. As we collect data from the program and assess its success or lack thereof, it is important that we regularly and frequently discuss what we have done and what we will be doing. To that end, we envision a series of activities that will result in widespread dissemination of our lessons learned and results. The plan for dissemination of information from CARE consists of the following activities.

<table>
<thead>
<tr>
<th>Dissemination Activity</th>
<th>Of Interest To:</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progress reports</td>
<td>NSF, CARE Team, PI’s</td>
<td>Semi-Annually</td>
</tr>
<tr>
<td>Internal Research Notes and Reports</td>
<td>University at large, posted on departmental web site</td>
<td>Periodically, when appropriate</td>
</tr>
<tr>
<td>Conference Papers</td>
<td>Conference Attendees, University at large</td>
<td>Semi-Annually (at least 2 papers per year)</td>
</tr>
<tr>
<td>Journal Papers</td>
<td>NSF, CARE Team, PI’s, University at large, posted on departmental web site</td>
<td>Ongoing as appropriate</td>
</tr>
<tr>
<td>CARE Scholars Survey</td>
<td>NSF, CARE Team, PI’s, CARE Scholars</td>
<td>Yearly</td>
</tr>
<tr>
<td>CARE Program Assessment</td>
<td>NSF, CARE Team, PI’s</td>
<td>Yearly</td>
</tr>
<tr>
<td>Final Program report</td>
<td>NSF, CARE Team, PI’s, University at large</td>
<td>Final project year</td>
</tr>
</tbody>
</table>

Table 2: Results Dissemination Plan

STUDENT SELECTION PROCESS AND CRITERIA

Students will be identified by a Selection Committee consisting of the PIs, Dr. Dale Parson (Associate Professor of Computer Science), Ms. Holly Fox (Application Support Manager in IT), and Dr. Anne Zayaitz (Dean of the College of Arts and Science).

A minimum of 6 S-STEM scholarships will be distributed in year one, given to freshmen and sophomores. In each subsequent year, six additional freshmen will be added to the original core group of six students, providing a minimum of 24 S-STEM scholarships over the four years of the project. An attempt will be made to award scholarships to students in both the software development and information technology tracks. From the prior experience of the PI’s and drawing from other successful programs, obtaining 6 additional students per year is an attainable goal. These additional students will not affect faculty-teaching load as most courses offered have available seats.

The selection criteria for the S-STEM scholarships will be 1) financial need, 2) predicted GPA, 3) math SAT scores, 4) other qualifications (i.e. involvement, leadership), and 5) contribution to the diversity of the computer science student population. Predicted GPA and math SAT scores are being used as selection criteria due to the lack of additional data for incoming freshmen students. Also, these criteria are often used by college admissions offices to predict college success.

Our target entry GPA for students is 2.5. Historically we know that students who have a GPA of 2.5 are more likely to complete the program. In reality, some of the students in the pool of applicants may not have achieved this GPA. Each potential applicant will be evaluated on a case-by-case basis.

Special scaffolding support will be given to students who show potential but do not have the necessary GPA. We will look for improvement in student performance as a result of these special support efforts. Such an approach gives us the potential to select from a wider group of academically talented students. A
qualified student would have this GPA. What if we encountered a student with a 2.25 GPA but also an acceptable SAT score? An endorsement from a teacher may indicate that the student is a hard and dedicated worker and has achieved steadily. Our entrance requirements will be formulated in such a way as to permit some “wiggle room” in student selection. A pre-college session may be enough to remediate a student’s weakness(es) or he or she may need ongoing support in the form of tutors and supplemental instruction.

The target for SAT math score will be 560, with some flexibility as described above.

When a student is identified as meeting the CARE program criteria as determined by the selection committee, they will be invited to apply for a CARE scholarship. They will be asked to submit a short essay describing experiences that have led them to select computer science as a major, as well as their prospective career goals. Applicants will also be asked to submit a letter of recommendation from a teacher familiar with their academic potential. This essay will be submitted to the selection committee.

Each year, the scholarship recipients will be evaluated. Students who transfer to a non-STEM major at Kutztown University will resign their scholarship. The resigned scholarship will be given to a qualified student candidate in the following year. Students who transfer to another S-STEM major will be given the option to continue to participate in our program as scholarship recipients since the CARE also requires students to specialize in a basic science discipline, and the students are continuing in a STEM field. As the CARE program progresses, we will be monitoring student performance. If a student does not achieve the defined performance criteria, the student will be placed on probation in the CARE program for one semester. If no improvement is seen during the probation semester and/or performance further deteriorates, the student will be asked to leave the CARE program. Under these circumstances, the scholarship will be granted to another qualified student in the coming year. It is our intention to provide every reasonable form of academic and co-curricular support for each student who enters the program, and it is our expressed goal to make considerable effort to retain students and to promote their success.

CARE STUDENT SUPPORT SERVICES AND PROGRAMS

Through the scholarship offered by CARE, some of the financial requirements will be eliminated from student concern. This leaves academic concerns and issues to be addressed. The CARE program is important to our efforts in addressing the issues that discourage academically talented students from becoming computer science majors. Participants will be actively recruited and provided with academic support through the advising, tutoring and supplemental instruction needed to be successful in the program. Community support will be provided through mentoring and meetings where concerns can be expressed and addressed. Skill development and confidence building will occur through presentations and study will expose the participants to successful professionals in the field. Faculty members will regularly meet with CARE program students.

With the idea that the CARE program will be ongoing, current CARE students upon graduation will be encouraged to assume the role of mentors, speakers, and role models for existing students in the CARE program.

QUALITY EDUCATIONAL PROGRAMS

Computer science programs offer students a high quality educational foundation upon which they can build a successful career in science. Alumni from both specializations in computer science have success in career pursuits following graduation. One of the ways in which this success is reflected is that companies that hire KU graduates in computer science continue to do so. An outstanding feature of both specializations is the shear breadth of the courses offered to students. Our purpose is to provide students with a true sense of the many aspects of the field of computer science, thereby allowing them to make informed decisions concerning their careers. Students must take a total of 60 credit hours in computer
science. At least four of these courses must be senior level courses. Students who find employment in computer-related fields feel well prepared for their careers, as learned from anecdotal reports of student activity following graduation.

The program is in the process of assessing its programs in preparation for accreditation. This process has produced many positive changes benefiting students. In addition to the ongoing accreditation activities, we meet regularly with our Industrial Advisory Board (IAB) to solicit feedback about our programs and courses, in an effort to meet the needs of current and projected industry trends. We have refined the two tracks to ensure that the courses offered meet industry trends, allowing the students to meet employment needs. We have added courses in database, networking, and security to more thoroughly cover these increasingly important industry requirements.

ASSESSMENT AND EVALUATION

Three sets of assessments are planned for the project, with each set corresponding to one of the three project objectives. The Assistant Vice-Provost for Assessment at Kutztown University will be the project’s Assessment Coordinator.

Assessment Objective 1: Project Outputs. The first assessment focuses on the success of the project to increase the pool of computer scientists. Specifically, we will track the number of students who are (1) recruited into the program, (2) their retention in computer science or other STEM discipline, (3) their graduation rate in computer science or other STEM discipline, and (4) their employment (or graduate school) in a computer science or other STEM field. The project target is to increase graduation rates to 80% over the course of the project.

Assessment Objective 2: Project Outcomes. The second assessment concerns the learning outcomes for the project, which involves both skills and abilities, and self-confidence and self-efficacy related to those skills. With respect to skills and abilities, current assessments routinely conducted by the computer science project will be utilized, although samples of work products by female and male students will also be assessed for the outcomes of written communication, problem solving, and spatial abilities; assessment of the first two outcomes will use the appropriate AAC&U VALUE rubrics (Rhodes 2010), and spatial ability. Spatial ability can be measured in many different ways as documented by Eliot and Smith (Eliot and Smith 1983) and we will select the most appropriate as we implement this project. Self-efficacy/confidence will be assessed with the Longitudinal Assessment of Engineering Self-Efficacy or LAESE (Marra, Rodgers et al. 2009). A final assessment of these outcomes will utilize the resume that will result from the project’s career development experiences, which will be updated annually. The advisors will review each student’s resume; for purposes of project assessment, we will be looking for growth in the categories of education, work experience, internships/externships, and technical skills.

Assessment Objective 3: Computer Science Community. Assessment of the culture experienced by students will include both process and product, and one measure will utilize the journal portion of the project. The journals will be reviewed to determine the quality of the experiences students are having as members of the program, with particular attention to the degree of connection with students, faculty, and mentors. Moreover, the journals are expected to include the number and types of co-curricular experiences in which students participate, and the level of participation in the monthly bag lunches, professional presentations, field trips, and other events will be measured. In addition, one of the six subscales of the LAESE is “feelings of inclusion,” which provides another look at involvement in and impact of the culture. Finally, Project Objectives 2 and 3 will be assessed with annual interviews conducted by a Graduate Assistant in computer science. The interviews will be designed to gain a qualitative understanding of students’ feelings about their fit within the field of computer science, and their feelings about their confidence in their abilities as computer scientists; the interviews will also be used to explore specific entries from students’ journals.
Historical institutional data and consultation with experts in Admissions, Academic Enrichment, and STEM disciplines has led to the development of explicit outcome targets expressly for scholarship recipients for each of our objectives (Table 3). Summative program assessment and formative assessment used to refine the experiences of scholarship recipients will be accomplished through use of locally developed and commercially available surveys, focus group discussions, and examination of institutional data. We plan to evaluate S-STEM scholar academic achievement, the effectiveness of peer mentors, computer science faculty, team members, and the PIs. These results will be shared with STEM faculty at Kutztown University and with the wider audience of professionals teaching STEM students at other schools.

The following table represents an estimate of the desirable results to be achieved from the CARE program. We set these goals as attainable ones for the CARE program. Understanding that they are estimates allows us to learn how to achieve them and improve them over time.

<table>
<thead>
<tr>
<th>Program Objective 1: Recruit/Retain/Graduate</th>
<th>Activities</th>
<th>Source of data</th>
<th>Target measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruitment</td>
<td>Data from recruitment events</td>
<td>Increase number of academically talented applicants; a minimum of 6 qualified students are recruited per year</td>
<td></td>
</tr>
<tr>
<td>Yr. 1 learning community</td>
<td>End of semester assessment</td>
<td>An evaluation of the usefulness of the learning community program in the first year. We are looking to achieve a target of 80% usefulness as determined by the students</td>
<td></td>
</tr>
<tr>
<td>Peer Mentors for Freshmen</td>
<td>End of semester assessment</td>
<td>&gt;75% of Freshmen scholars and mentors will report a positive mentoring experience</td>
<td></td>
</tr>
<tr>
<td>Tutoring and Supplemental Instruction</td>
<td>Records of participation in tutoring/SI &amp; final grades</td>
<td>&gt;75% of scholars who use Tutoring and/or Supplemental Instruction report that it helped in test or assignment preparation</td>
<td></td>
</tr>
<tr>
<td>Retention to Year 2</td>
<td>Historical data</td>
<td>&gt;90% of scholars will be retained to year 2 in</td>
<td></td>
</tr>
<tr>
<td>Retention to graduation</td>
<td>Graduation data</td>
<td>&gt;80% of scholars will graduate in Computer Science</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Objective 2: Skill Development and Confidence</th>
<th>Relevant Skills</th>
<th>Departmental assessment</th>
<th>&gt;80% meets or exceeds the standard based on the AAC&amp;U VALUE rubrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>--------------------------------------------------------</td>
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<tr>
<td>Spatial Skills</td>
<td>Yearly spatial skills test</td>
<td>&gt;80% meets or exceeds the standard determined by the PIs</td>
<td></td>
</tr>
<tr>
<td>Skills and confidence</td>
<td>Yearly resume update</td>
<td>100% of scholars will update resume 75% will have increased their skills, experiences and/or activities based on LAESE</td>
<td></td>
</tr>
<tr>
<td>S-STEM Seminars</td>
<td>Reflective essays/discussions Participation records End of semester assessment Seminar Evaluations</td>
<td>Written reflective seminar review &gt;50% scholars participate in the seminars &gt;75% Seminars are judged as valuable by seminar participants</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Objective 3: Culture</th>
<th>Confidence and inclusion</th>
<th>Yearly Women in Engineering survey (adopted for minorities)</th>
<th>&gt;80% say they feel they are in the right place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidence and</td>
<td>Journal</td>
<td>Journals will be reviewed using a rubric developed</td>
<td></td>
</tr>
</tbody>
</table>
We will ask students about their accomplishments and frustrations. Our target is that 75% of the accomplishments are positive 75% of the time (or better).

Confidence and inclusion

End of year interview with graduating student

Interview will reflect a majority (>80%) positive evaluation of the CARE program

<table>
<thead>
<tr>
<th>Table 3: Program objectives and assessment targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTELLECTUAL MERIT OF PROJECT</td>
</tr>
<tr>
<td>The intellectual merit of CARE will be the lessons we learn that allow us to change and evolve our institution to provide all students with the opportunity to succeed in Computer Science and other STEM disciplines, and to improve our diversity in a program that has significant underrepresentation. The PIs believe that to some extent there are institutional environmental roadblocks to improving the diversity of the student body. Our discovery of these roadblocks and determination for how to remove them will be valuable to our department, our institution, our sister institutions in the state system, and other rural colleges.</td>
</tr>
<tr>
<td>The proposed activities will advance knowledge in the field by helping to increase the number of qualified graduates for the nation’s computer science needs. Our experience with the activities identified in this proposal and others that are utilized as the program progresses represent a significant contribution to the educational field. Further, the lessons learned from the curricular and co-curricular activities will likely be of value to other STEM disciplines, especially those with little diversity. Some of the proposed activities build upon successes achieved at other institutions; our challenge will be in implementing similar activities at a rural, public, predominantly undergraduate institution. Although we use some aspects of Carnegie Mellon’s program as a model, they will be modified for our student population and other institutional opportunities and challenges. It is extremely important to understand what works and what does not work in our environment to enhance the success of all of our students.</td>
</tr>
<tr>
<td>BROADER IMPACTS</td>
</tr>
<tr>
<td>Broadly speaking, we are constructing a model to enhance the success for all students attending the University. The program, activities, and lessons learned would be valuable to all disciplines and our administration as we move forward into a time when education is going through tremendous reconfiguration. The lessons that we are able to learn about what currently works and what does not with regard to diversifying the student body and improving the success of all of our students at Kutztown will be tremendously impactful. This initial phase of CARE represents an exercise in laying a strong foundation for the University in attracting students who will be able meet the needs of the coming decades. Subsequent phases of CARE will continue our exploration and strengthening of our foundations.</td>
</tr>
<tr>
<td>Our ability to provide the region and world with capable and well-equipped students represents a huge impact going forward. We aim to be a leader within the region. Of course the dissemination of our lessons learned is extremely important in this regard, and the collection and understanding of our successes and failures will definitely be of value on a wider basis to society. To this end, we will make our results available to others through publications in journals such as Computers and Education (Elsevier) and the Journal of Educational Computing Research. We will also present our findings at conferences such the Association for Advancement of Computing in Education World Conference and the IEEE International Conference on Computer Science &amp; Education.</td>
</tr>
</tbody>
</table>