The STARS Leadership Corps: Case Studies in Broadening Participation in Computing

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Abstract - We have formed the STARS Alliance to address alarming declines in computing enrollments and the need to broaden participation in computing. Our innovative STARS Leadership Corps engages college students in a community dedicated to giving back, persevering, and striving for excellence. The successful Corps model incorporates best practices in recruiting and retention in computing, including student experiences in outreach, research, and service. We present case studies of three diverse implementations of the STARS Leadership Corps that demonstrate how the Corps can be tailored to individual institutions and student interests.

Index Terms - Broadening participation, Computer science education, Human Factors, Leadership, Management, Service

INTRODUCTION

The STARS Alliance is a partnership among twenty universities and colleges, organized as a constellation of “stars.” Each star is a regional partnership of research, minority-serving and/or women’s institutions, as well as K-12 schools, industry, and community groups. The regional partnerships focus on supporting computing intervention programs at a local level.

Research has shown that student participation in outreach and service learning [2, 3], and research [4], as well as the existence of a community of “like students” [5,6] are effective practices for retention. Financial support, study groups, a supportive program community, specialized advising, setting high expectations for students, and peer solidarity have also been found to promote strong academic performance [7]. “STARS” stands for Students & Technology in Academia, Research, and Service. This represents our central hypothesis: college students who use their computing skills in outreach, research, or service will be more likely to be retained, and will also recruit younger students.

We have developed the STARS Leadership Corps (the “Corps”) to combine these proven best practices into a single program. The Corps allows for freedom in implementation and transferability among diverse institutions, but its common framework allows us to compare the impact of diverse programs on broadening participation. In this framework, Corps leaders implement those practices that work locally, while the STARS Alliance allows us to measure the impact of local efforts on both Corps students and the larger community. Key findings from the first year of Corps evaluation indicate that participation in the Corps has increased student commitment to computing majors, has enabled students to develop computing knowledge and skills, and has created an environment of like students for women and minorities.

The Corps provides institutions a flexible way to engage students in helping to address the needs at a particular institution, or enhance a strong program by adding outreach both on and off campus. Each Corps can choose from a menu of effective practices, including outreach, service, research, mentoring, and internship, to best leverage and enhance the local computing department. We present case studies of three of our STARS Corps, to demonstrate the diversity of approaches that can be taken in implementing a successful Corps program.

STARS LEADERSHIP CORPS

The STARS Leadership Corps is a multi-year experience providing undergraduate and graduate students with support throughout their academic journey. The Corps fosters an extended student community among academia, industry and the community through civic engagement, mentoring, professional development and research experiences. STARS and the Corps model are also described in [8,9].

At an individual STARS university, the Corps is a group of 5-25 undergraduates and up to five graduate students, directed by a faculty Corps leader. The Corps
operates much like a leadership or service learning course, engaging students in professional development along with training to perform a leadership project. This may be implemented at different universities through credit-bearing courses, a STARS student organization, or a department-level honors-type program. Students in the Corps participate in a program kick-off conference called the STARS Celebration, regular Corps meetings and seminars, and student leadership projects complemented by written reflection, presentation to peers, and K-12 outreach.

The annual Corps cycle begins with the STARS Celebration, a four-day conference to celebrate the achievements of past Corps students and induct a new set of students into a national group of STARS leaders dedicated to using computing in service to society. The Celebration prepares students to conduct leadership projects that help them recruit, retain, and become the next generation of computing professionals. Leadership projects can include: Outreach to pre-college students to inform and excite kids about computing; Peer outreach to other college students to mentor and retain slightly younger students; Community service to solve the computing needs of non-profit organizations; and Research Experiences and Internships to serve by improving one’s own expertise in computing.

During the academic year, students work at their home institutions to carry out their projects. Students work in teams with their Corps leader to examine local resources, needs and opportunities. The Corps leader guides students to propose projects that leverage computing skills for outreach, research, or service while addressing local needs and minimizing resource and administrative overhead.

In practice, most STARS Corps meet two to four times a month for project planning, training, and implementation. Students develop leadership skills through planning, teamwork, partnership building, communication, and responsible implementation of their projects. Each Corps student develops critical thinking skills and internalizes what they’ve learned through writing and presenting their work to both peers and younger students.

Each Corps leader can determine the scope and type of leadership projects that he or she will support at their own institution. Successful Corps projects can be derived within existing synergistic partnerships and programs at each institution. The successful Corps leader demonstrates, by example, how to leverage existing resources and time to focus local efforts in ways to have the highest impact. In the remainder of this paper we present case studies of three Corps implementations in the STARS Alliance: the UNC Charlotte, Auburn University, and Florida State University STARS Leadership Corps.

Corps Project Types

**CHARLOTTE STARS LEADERSHIP CORPS**

The Charlotte Corps consists of 19 undergraduates and 3 graduate students from: UNC Charlotte, Johnson C. Smith University, Winthrop University, and Elon University, including one student from the Colorado State University. Our mission is to encourage interest in computing careers through outreach on campus and to local schools and the community. To achieve this, each leadership team developed targeted outreach to a specific audience. Campus outreach targets Corps peers on our college campuses, while the K-12 outreach groups reach out to local schools and organizations.

The campus outreach teams included Women in Computing, Gamers’ Alliance, and Campus Outreach. All three teams formed student organizations on campus: an ACM-W chapter, the Gamers’ Alliance, and the STARS club. The purpose of these clubs is to showcase computing applications and career opportunities, while providing students social and professional development opportunities. The Campus Outreach Team also engaged in on-campus tours for high school students, discussing computing and campus life with students while demonstrating the cutting edge computing technologies in our research labs.

The K-12 outreach teams included Minorities in Computing, High School Outreach, and Middle School Outreach. The High School and Middle School teams developed and presented road-shows that make computing more accessible to K-12 students, and encourage them to prepare for IT careers through math, science, and computer courses.

The Minorities in Computing team performed outreach through the Black Data Processors of America (BDPA) professional organization. The Corps students assisted with the BDPA’s High School Computer Competition Academy, a 10-week Saturday program designed to influence middle and high school students to pursue careers in Information Technology. At the 2007 Black Family Technology Awareness Fair, Corps students helped by talking with parents and students about the benefits of IT careers.

The High School Outreach team created a modular “road-show” for weekly presentations at local schools. This road-show includes modules on scholarships, applying to college, and fun computing or IT applications, including digital humans, cyber-security and hacking. This modular approach made it easy for other Corps students to participate. This relaxed road-show demonstrates to high school students that kids like them enjoy computing, and has been a success in local schools.

The Middle School Outreach team created a road-show that addresses the stereotypes of IT professionals and careers. This road-show connects with young students...
through their use of technologies like handheld games and game consoles. Through the road-show, Corps students demonstrate how they themselves don’t fit the stereotypes, but yet enjoy IT majors. The road-show provokes interest in IT careers, and encourages students to pursue or stay in higher level math and science courses and to take any available computer classes.

In addition to our outreach teams, several Corps students undertook research in virtual humans and games as their leadership projects. Shakespeare Karaoke is a virtual human project for rehearsing and understanding plays. Officer Ed is a virtual human interface for conducting eyewitness identification that is being studied at a local police station. Charlotte is a virtual human that will autonomously interact with students about computing jobs, research projects, and the computing degrees at UNC Charlotte. The Game2Learn project involves building and researching the use of games in learning computer science.

When surveyed about his experience, one student wrote: “The one thing I enjoyed most about the STARS Leadership Program is having my first real taste of trying to work with and educate, not only the general public, but young teenagers who may or may not be college bound. It was quite an eye opening experience seeing the myriad of reactions and personalities of the students.”

Our Corps projects were chosen because of their fit with our mission, and also because of their match within our existing departmental framework. Student projects coincided with our research labs, student interests, and partnerships with local schools. By combining student interests with our established community and research collaborations, we were able to successfully manage the program by building upon our institutional strengths.

While supporting student interests is beneficial, some Corps students need more support and direction in planning and implementing their Corps projects. For example, in 2006-2007 the High School Outreach team was able to visit a number of schools, while our Middle School Outreach team visited only a handful of schools. To help support Corps students in their projects, we have instituted a STARS Computing Leadership Course at UNC Charlotte in Fall 2007. The course includes time for professional development seminars, project planning, and Corps project presentations. A set syllabus, calendar, and online communications and reporting will encourage students to be more proactive and effective. We are also asking students to articulate the impact they expect to have from their projects, and to evaluate success by measuring outcomes.

**AUBURN’S AU STARS**

The STARS Leadership Corps at Auburn University (AU), called “AU STARS” represents a true regional partnership. Since Summer 2006, we have been able to fund 8 graduate and 12 undergraduate Auburn University students, and seven external students from Spelman College (an HBCU for women), South Carolina State University, and Alabama A&M University. We have established partnerships with the AU campus Office of Outreach, Office of Multicultural Affairs, Woman’s Studies Program, and WISE Institute.

Since the inception of the Corps we have built a strong relationship with Auburn City Schools. The AU STARS have collaborated with three K-12 teachers and local school systems to support computer clubs, after school programs, and summer computing camps. We have leveraged free software, to teach kids about computing in our outreach programs, and have impacted the lives of at least 160 K-12 students.

AU STARS and K-12 students presented at AU’s Engineering Day and were visited by at least 500 high school students and their parents. Corps students have also showcased computing through conducting a Women In Computing (WIC) session and World Usability Day (worldusabilityatauburn.org).

AU STARS students are exposed to research through our seminar series, with over 15 talks by speakers including Diann Jordan, Wanda Dann, and Laurie Williams. All AU STARS are required to include a research component in their projects, through local or conference research presentations. Since summer 2006, three of our undergraduates have graduated, and three of our graduate students have completed their Master’s theses.

Dr. Richard Chapman said of participating with AU STARS outreach, “I can recall the best part of my experience was watching the growth and development that occurred in students as they learned… almost all of the students had developed a sense of independence as they worked, they were also able to check work through their own errors. I can recall only being called over by students when they wanted to show off their work. They were becoming experts in their own domain and no longer needed constant supervision. Being a part of such growth was a fascinating opportunity.”

AU STARS fills a space in the community to provide computer enrichment and improve computer literacy for many students and their teachers. It may be challenging to begin a project in your community schools, as some universities may have previously approached schools with a condescending attitude. Recognizing that many school systems have limited computer facilities and very little training in the use of educational software, our approach to partnering with local schools has been a personal one. In order to form computer clubs, we began our affiliation through a teacher we knew. Without personal contacts, the best point of contact is the principal. Plan a brief meeting with the principal to offer the services of your Corps as a
volunteer organization with the long-term goal of increasing the computer literacy and efficacy of their students. Point out that improving computer skills has a positive effect into other areas such as math, reading, general problem solving skills and greater overall academic motivation that may result [Wil07].

With time constraints and scheduling challenges, finding time and resource to create curricula materials for computing clubs and activities can seem daunting. We began by researching robust software with a supportive text created to facilitate learning with example projects and learning materials. We capitalized on the popularity of video games, and advertised our projects as game design for education. We adopted two sets of resources for our programs: (1) Alice3D software, available at www.alice.org, and the "Learning to Program with Alice" textbook [10], and (2) Squeak software, available at squeakland.org, and "Powerful Ideas in the Classroom: Using Squeak to enhance Math and Science Learning" [11]. With these materials, we were prepared to handle a nine-week period each semester. In order to work with 50 elementary students in one school, we began by recruiting a dozen AU students, two faculty to supervise and lead sessions (mature students could also fulfill supervisory roles), and two K-12 teachers to ensure proper classroom management. We utilized their computer lab facilities (equipped with 25 computers) twice per week. We also coordinated with the school’s technology coordinator to install software, and after-school programs that included transportation to take students home.

FSU STARS LEADERSHIP CORPS

For the Spring 2006-Spring 2007 period, the FSU STARS Leadership Corps (FSU-Corps) Scholars Program involved a total of 15 students, including underrepresented minorities, women, and persons with disabilities. The students have grown in their confidence in leadership skills, in planning and implementation, and in working with a diverse group of individuals.

In Spring and Summer 2006, the FSU-Corps scholars were divided into three teams to identify different activities that represent the three BPC areas of concern: recruiting, retention, and bridging. Both graduate and undergraduate students from the Department of Computer Science and the College of Information teamed up to develop plans for Corps activities for the summer and fall sessions. FSU-Corps Scholars on the recruiting team helped prepare STARS Alliance marketing materials for presentation and dissemination to consortium partners during the kickoff summer workshop in August 2006. FSU-Corps scholars also helped prepare prototypes of the STARS Alliance website.

We were also able to secure permission from the Leon County School system to conduct various outreach activities targeted to school-age children and guidance counselors in the regional high and middle schools. The students prepared marketing materials and coordinated outreach activities with the guidance counselors.

During the August 2006 STARS Alliance Kick-Off Summer Workshop, FSU-Corps students participated in the poster session with papers describing research on broadening participation in computing and projects they planned to implement in Fall 2006.

In November 2006, the Corps hosted a "Computing Careers Night" at FSU. This gave the Corps team the opportunity to plan an event to increase awareness about computing and IT degrees and careers. Various speakers from both FSU (e.g., FSU Admissions Office, College of Business, College of Information, Department of Computer Science, and the Career Center) and industry (e.g., BearingPoint) were invited to participate in the event. The evening was well attended with many presenters who were pleased with the contacts they made, and participants picking up university admissions and specific computing information from the departments. Guests included FAMU Corps scholars, high school students and their parents, undergraduate students, counselors, and local teen group sponsors/leaders. The FSU computer Store and Comp USA Training section provided gifts for the participants.

In Spring 2007, FSU-Corps focused on the continuous recruiting effort for future Corps scholars as the majority of our students were either graduating or moving on to graduate school. We have developed several recruiting tools (e.g., flyers and posters) for this purpose and have been talking to various IT and CS classes about BPC and the STARS Alliance. One group of Corps scholars is developing the FSU STAR website to showcase various Corps activities, student and faculty profiles using accessible design.

Two teams of Corps students are partnering with the Community Neighborhood Renaissance Partnership on two IT projects for the Appalachian Ridge Technology Learning Center – a community center devoted to serving the computing needs of a largely African-American neighborhood. One Corps team is designing a prototype website to showcase digital media products that will be developed by youth during their yearly summer Digital Media Camp. Another Corps team has improved the learning center’s network and developed documents to help their largely volunteer staff maintain the network.

Also, in the works is a plan to provide basic technology skills training or mentoring to students with disabilities through a partnership with High School High Tech that is organized by Ability First. The latter helps prepare students with disabilities to develop high-tech knowledge and skills to equip them for various IT-related positions. A team of Corps students is currently working on
a plan (e.g., program structure, participants and procedures) for a college student mentoring program. This program is supported in part by: the Computer Science Department, the Women in Computing Society, Access, and the Association of Computing Machinery student chapter. Additional student groups are being recruited to represent the minority groups and persons with disabilities on campus.

The Corps is assisting the Student Disability Resource Center at FSU to locate computing tools for the disabled to assist in studying math, science and technology topics. Current tools for reading, such as Kurzweil 3000, do not handle mathematics or computer code. JAWS has spell and read modes but does not shift easily between them as needed for instructional math and computer science texts. This makes the learning of this material costly when human readers must assist students. The Corps plans to test MathGenie as a tool for teaching math to students with visual impairments.

The Corps is in the planning stages of a service learning program, by developing a “Microsoft Certified Refurbisher” shop, with Lutheran Social Services of North Florida. It is intended to give students the opportunity to develop policy and procedures pursuant to an organization, and to provide IT assistance, training, and technology to non-profit organizations and for disadvantaged populations. Corps students participating in this program will be evaluated and receive service learning credits on their transcripts.

The FSU Corps program has enabled students to develop considerable leadership skills by enabling students to research and develop their own leadership project ideas. The success of these students is reflected in their selection for a number of FSU’s leadership, service, and scholarly achievement awards including the Student Seminole Award, Who’s Who (3 recipients), FSU Humanitarian Award, and FSU Outstanding Senior Scholar. One student received the Sean A. Pittman Award for outstanding leadership and dedication, with significant contributions to the welfare and support of African-American students.

In Fall 2006, several FSU-Corps scholars led a semester-long program to mentor 16 gifted middle school students. This involved Corps members working in teams, each leading a small group of middle school students weekly in one of four projects: web authoring; programming in Alice; NetLogo; and Lego Mindstorms. Each group was to produce at least one product by the end of the semester. Some mentees worked collaboratively on one product, while others had unique products but worked together in the learning process. The middle school students came to campus on Friday mornings where their mentors took charge of them in a lab setting. This project included resources from the College of Information, Department of Computer Science, the School of Computational Science, and the National High Magnetic Field Laboratory, and both graduate and undergraduate students. At the end of the semester, each middle school student gave a Powerpoint presentation to family, Corps members, faculty and interested administrators. A reception followed. Overall, middle school participants demonstrated more interest in computing and IT degrees and increased confidence in computing at the end of the program.

Our Corps is such that members select their own project from one aspect of a large project, or a whole project of smaller scope that the PIs have collected. The middle school project was divided into three parts. Overall, each part was very time-consuming as the audience consisted of gifted students, able to absorb a large amount of material at each meeting. One of the PIs was familiar with this outreach program and had hesitated in making the commitment but the request had come in and been agreed to in advance, so we went forward with as much pre-planning as possible. The Corps students were outstanding in their leadership and what they gained from the experience was very rewarding. Without question, these students are better leaders as a result of this project. However, for most of the Corps students, their academics suffered. We’ve since learned the importance of assessing the level of commitment required for a project in advance, so we can plan ahead to balance the load.

MEASURES OF SUCCESS

In our first year of implementation, 107 college students from 20 universities and colleges participated in the Corps. Slightly more than half of these participants were female, and 43% were African American. In the three aforementioned examples of STARS, 49 students created three student organizations, and conducted outreach activities with more than 500 K-12 students, 500 parents, and 100 teachers and guidance counselors. Five major community events were hosted. Overall, these STARS leveraged 19 partnerships within their respective campus, school and industry communities to implement outreach, mentoring, and service learning projects.

Key findings from the Corps surveys and program evaluation have demonstrated that our goals of retention, recruiting, technical excellence, and computing identity are being met. Post survey results indicated that all Corps students would recommend participation to their peers, and 99% of those not graduating planned to stay in the Corps more than one year. A key finding from the first Corps participant survey is that participation in the Corps increased student commitment to computing majors for 88% of students. Eighty-three percent of students reported that Corps participation allowed them to develop computing skills and knowledge. Eighty-eight percent of students felt that participating in the Corps gave them opportunities to work with people like themselves, supporting the goal of creating a community for both majority and under-represented computing students. The mean responses to
survey statements that they are committed to applying computing to benefit society, and to promoting computing to others was a 4.5 on a 5 point scale. In response to open survey items regarding computing identity, student responses reflect common values of leadership, creativity, and social impact in the community.

CONCLUSION

Although our STARS Leadership Corps implementations have each faced challenges, our results have been overwhelmingly positive. Corps students are reporting higher levels of commitment to computing, and overwhelmingly positive attitudes about their Corps experiences: Our STARS are providing leadership and socially relevant experiences to our Corps students, while raising public awareness of computing, and building meaningful partnerships in our communities.

The STARS Alliance and Corps are also having a positive impact on both departments and faculty. Corps students are being leveraged at many campuses for college recruiting events, and are bringing recognition to their departments for their excellence, both academically and through leadership. STARS faculty are reporting enhanced collaboration and research opportunities within their schools and with other institutions. We believe the positive results for students, faculty, and departments will encourage computing departments to institutionalize the partnerships and experiences built through STARS into permanent, sustainable Corps programs.

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REFERENCES


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