The STARS Alliance:

A Southeastern Partnership for Diverse Participation in Computing

FSU, FAMU, USF, Georgia Tech, Auburn, NC State, Meredith, Spelman, Landmark UNC Charlotte…and growing!

www.itstars.org

Research Universities

Women's Institutions

Minority Serving Institutions

Industry Partners

STUDENTS

K-12 Partners

Community Colleges

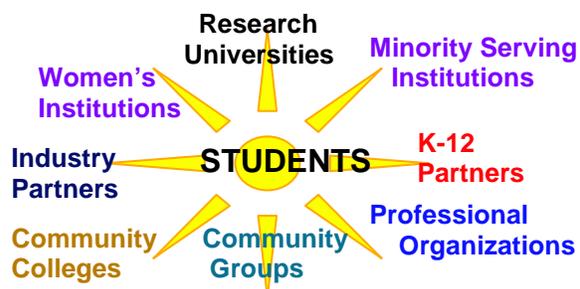**Community Groups**

Professional Organizations

Fig. 1.1: Students & Technology in Academia, Research and Service (STARS)

1. Project Goals and Outcomes

We propose to form an alliance of ten academic institutions with education, corporate, and community partners to broaden participation in computing (BPC). The alliance will implement, disseminate, and institutionalize effective practices for recruiting, bridging, and graduating women, under-represented minorities and persons with disabilities in computing disciplines.

Our **goals and expected outcomes** are focused on under-represented student populations from middle school through graduate school and on information technology (IT), computer science, and computing-related programs ("computing disciplines").

Goal 1 is **Recruiting** of under-represented populations, with the outcomes of a) increasing student enrollment in post-secondary computing programs, and b) increasing student awareness about computing disciplines and careers. Goal 2 is **Bridging** for under-represented populations, with the outcomes of a) Increasing student readiness to enter computing programs, and b) Increasing the number of undergraduates (in computing or non-computing disciplines) who enter computing graduate school or workforce. Goal 3 is **Retention** of under-represented populations, with the outcomes of a) Increasing the graduation rates in computing disciplines, b) increasing the year-to-year persistence and the declaration of majors in computing disciplines, and c) Increasing college adjustment and GPA. Goal 4 is **Sustainability**, with the outcomes of a) Sustaining effective BPC practices at alliance institutions, and b) Institutionalizing alliance partnerships. Goal 5 is **Dissemination**, with the outcomes of a) Increasing national awareness of effective practices, b) Serving as a model and repository for effective practices for BPC, and c) Promoting alliance implementation and evaluation methodology.

To **motivate the need for an alliance**, consider that substantial results have been published to inform effective practices for recruiting, bridging, and graduating under-represented persons into computing disciplines. However, since many BPC interventions are implemented as tangential to the core research, teaching and service mission of academia, even successful programs can end when the faculty champion leaves or funding ends. Evaluating BPC implementations at an inter-institutional level provides a pool of resources and expertise, while offering stronger evidence and incentive for institutionalizing effective practices. Further consider that research shows that higher student retention rates and satisfaction, particularly among minority students, result from the existence of a community of "like" students to support the development of a student's identity [Coh05,Blu05,Tho05,Sel98]. However, the representation of some minority student populations is so small within their institutions that it is difficult to foster communities of "like" students. Community-building efforts must extend beyond a single academic institution and beyond academia, as well.

From 1992-2002, UNC Charlotte, NC State, Georgia Tech, Florida State University (FSU), and Florida A&M University (FAMU) participated in the NSF-funded Southeastern University and College Coalition for Engineering Education [SUCCEED]. Designed to make a

dramatic change in the quality of engineering education, SUCCEED resulted in the development, implementation and institutionalization of a fundamentally new and experimental undergraduate engineering curriculum model. These schools, along with the University of South Florida (USF)-Lakeland, Auburn University, Spelman College, Meredith College and Landmark College propose to form the **S**tudents and **T**echnology in **A**cademia, **R**esearch and **S**ervice (**STARS**) Alliance to make a dramatic impact in the culture and practice in computing disciplines.

The alliance has a hierarchical structure best described as a constellation of "*stars.*" Each star (Table 1.1) includes research, minority-serving and/or women's institutions (with enrollments in computing programs shown in Table 1.2), as well as K-12 schools, industry, and community groups. Stars continue to grow with the addition of new partners.

Table 1.1: The STARS Alliance: A constellation of five "stars"

Stars	Universities & Colleges	K-12, Industry, Community Partners
North Carolina-Piedmont	**UNC Charlotte (Research University)** • College of IT (Software & Information Systems, Computer Science, Bioinformatics); College of Engineering (Computer Engineering) SLC Students will be drawn also from **J.C. Smith University (private HBCU)**	Charlotte-Mecklenburg School System; TIAA-CREF, IBM, Girl Scouts Hornets Nest Council, the Latino Network, the Council for Race Relations, NCEITA-WISE (NC IT Association, women in science & engineering), MCNC (micro-electronics computing center of N.C.)
North Carolina-Triangle	**N.C. State University (Research University)** • Department of Computer Science **Meredith College (Women's College)** • Department of Mathematics & Computer Science	Wake County School System; SAS, IBM, ACM NCSU Chapter, SWE, WISE, Friday Institute, WICS, WMM, MCNC
Alabama/ Georgia	**Auburn University (Research University)** • College of Computer Science & Software Engineering (Computer Science, Software Engineering, Wireless Engineering) **Spelman College (private Women's HBCU)** • Computer Science SLC Students also from **Morehouse (private HBCU).**	Edward Bell High School (Tallapoosa County); Lochapoka High School (Lee County); Alabama Cooperative Extension (Family & Community Programs)
Georgia	**Georgia Institute of Technology (Research University)** • College of Computing **HBCU alliance(s)** announced in year two	Georgia Department of Education; Girl Scouts; Intel; Cisco; ACM Student Chapter; Computer Science Teachers Association; Women@CC; MiCS, GT Institute for Computing Education
Florida	**Florida State University (Research University)** • College of Information; College of Arts & Sciences (Computer Science); Career Center; Center for Academic Retention and Enhancement **Florida A & M University (HBCU)** • Computer Information Sciences **University of South Florida-Lakeland (Undergrad)** • Information Technology; Diversity Center **Landmark College** (community college in Vermont for students with **learning disabilities and AD/HD**) • Computer Science	FAMU High (a minority High School); Leon County School System; Boys & Girls Club of the Big Bend; Miccosukee Youth Center; Tallahassee Neighborhood Network Centers (HUD); Tallahassee Boys Choirs; Oracle; Cisco; *All stars are continuing to grow by adding partners.*

Stars implement BPC initiatives that involve particular schools, companies and community groups. Initiatives include a Student Leadership Corps (SLC) and collaborative learning and problem solving through instruments such as pair programming and socially-relevant assignments. The alliance as a whole will strive to provide a comprehensive set of high-quality opportunities to students and a consistent evaluation of the success and failure of programs implemented. The alliance will further provide SLC Training, a Web portal, a

"Marketing and Careers" campaign, research experiences for undergraduates, an alliance exchange, and an annual student research conference ("ITSTARS Celebration") that will be hosted by TIAA CREF the first year, with a $10,000 gift. The alliance will actively disseminate their practices and findings and will study the long-term sustainability of the programs it implements. Continuous, and as automated as possible, assessment of the progress and value of the different practices will be an integral part of the alliance operational model.

We expect the alliance to bring about a dramatic breakthrough in effective recruiting, bridging and retention practices that could then become standard practice at alliance institutions as well as at institutions nation-wide.

<u>**Intellectual merit**</u>: The STARS Alliance will identify effective practices and demonstrate their applicability for BPC across a variety of southeastern institutions. We will collect and contribute to the knowledge and assessment base for BPC efforts at institutional, regional, and national levels. We will determine the most important factors in building lasting relationships and infrastructures that support and sustain BPC practices, and we will provide opportunities to evaluate and disseminate recommendations that affect BPC.

<u>**Broader impact**</u>: The principal outcome of this project is expected to be an increase in the enrollment in, and retention and graduation of, under-represented populations from post secondary information technology, computer science, and computing-related programs. The effort is expected to also have a long-term impact through the establishment of a sustainable inter-institutional infrastructure to implement effective practices for BPC.

The alliance steering committee of 17 researchers is a diverse mix, including nine female and six African-American faculty, ranging from assistant to full professors, in computing, education, social sciences, and educational psychology. This alliance will foster a rich dialogue on creative and effective practices for broadening participation in computing, as well as about computing and education research. Each academic institution has tremendous institutional support for BPC.

Table 1.2: Estimated current enrollment in computing at stars academic partners by gender and number of underrepresented minority students (non-white/non-Asian)

School	PhD Students			MS Students			Undergraduate students		
	Total	Female	Minority	Total	Female	Minority	Total	Female	Minority
Ga. Tech.	260	49 (19%)	12 (5%)	193	37 (19%)	20 (10%)	1,065	102(10%)	96 (9%)
NCSU	121	23 (19%)	4 (3%)	241	51(21%)	6 (2%)	689	75 (11%)	105 (15%)
UNCC	56	9 (16%)	2 (3%)	227	78 (34%)	30 (13%)	530	78 (15%)	91 (17%)
Auburn	45	19 (42%)	7 (16%)	140	26 (18%)	9 (6%)	459	33 (7%)	21 (5%)
FSU	37	9 (24%)	4 (11%)	93	24 (26%)	10 (8%)	523	101 (19%)	110 (21%)
FAMU	0	0	0	16	5 (31%)	8 (50%)	450	151 (34%)	440 (98%)
USF-L	0	0	0	0	0	0	62	10 (16%)	21 (33%)
Spelman	0	0	0	0	0	0	210*	100%	100%
Meredith	0	0	0	0	0	0	20	18 (90%)	2(10%)
Landmark	Community College, 100% Learning Disabled or AD/HD						389*	108 (28%)	35 (9%)

*Includes non-computing students

2. Implementation Plan

In this section, we discuss how our proposed activities align with our existing programs. We outline the specific creative and strategic actions that we will undertake to implement and institutionalize effective BPC practices, through the formation of a sustainable alliance infrastructure. Lastly, we provide an overview of the literature that informs our work.

2.1 Aligning with Similar Programs

Table 2.1 lists examples of our ongoing programs that have goals similar to this project. These programs have demonstrated successful strategies for BPC.

Table 2.1: Example Programs at STARS Partners

Outreach and K-12 Programs	
Girls are IT!: 11-14 year old girls	UNC Charlotte developed an engaging mobile robotics activity for the NSF funded "IT bus" that is touring girl scout troops in N.C., http://www.girlsareit.org
Girls on Track: Middle school girls; formerly middle school teachers & guidance counselors	NCSU and Meredith College in collaboration with Wake County NC Schools developed and held NSF funded summer math camps to engage middle school girls through exploring urban and social problems using mathematics and technology, http://www.ontrack.ncsu.edu
DITI Teachers & Counselors Workshop: Middle school teachers & guidance counselors	UNC Charlotte interweaves diversity, technology and careers training in a 1-week workshop. Equips teachers and guidance counselors to guide all student populations towards computing careers, http://www.coit.uncc.edu/diti. Modeled after Carnegie Mellon's Summer Institute for HS AP Computer Science [Blu01].
CoolComputing@Tech: High school students, parents, counselors	Georgia Tech: On-campus conference for invited students and their parents in target groups. Program design includes student presentations and panels, demos of cutting edge research projects; employer panels; reception with the Dean, etc.
IMC@T, Women@CC Roadshows High school outreach	Increasing Minorities in Computing at (Georgia) Tech sends members of MiCS (Minorities in Computer Science) to visit high school classrooms with a slide show; in addition to visiting high schools, Women@CC outreach to middle schoolers.
Post-Secondary Programs	
GK-12 Fellows: STEM grad students; minority, low income high schools	UNC Charlotte and Georgia Tech each have NSF-funded programs that deploy STEM graduate students to serve as resources to minority high schools.
WiCS club: Computing undergraduate and graduate students	NCSU and FSU have each founded a Women in Computer Science student organization that provides networking, peer support, and career development opportunities for women and men in Computer Science. http://wics.csc.ncsu.edu/.
Peer Mentors: engineering undergrads	UNC Charlotte trains peer mentors for group mentoring of first-year students. Provides camaraderie, advice, tutoring, peer support.
Big/Little Sisters Program women	Each woman entering the College of Computing at GT is offered a Big Sister to aid in the transition.
GEAR UP: Computing undergraduate students	USF Lakeland developed a tiered peer mentoring to support underrepresented students in computing [Tho05; Sey98].
Louis Stokes Alliances for Minority Participation; Florida/Georgia and North Carolina	FAMU, with NSF funding, participates in a Florida/Georgia alliance and UNC Charlotte participates in an N.C. alliance of Universities and colleges for recruitment, progression and graduation of STEM minority scholars. Student mentoring, research and other academic, professional and community activities.
Scholars of the Future:	Auburn, funded by NSF ITWF, pairs faculty mentors with minority undergrads for ongoing year round research program. http://dm1.cse.eng.auburn.edu/~itwf/
McNair Scholars: Minority STEM undergraduate students	UNC Charlotte introduces STEM undergrad students to research through semester long course on research methodologies, summer research experience in a lab, and student research conference presentations.
Research Experiences: minority engineering	UNC Charlotte and HBCU Johnson C. Smith University undergraduates work in research labs during the summer. Student research conference presentations.
REU Site: computing undergraduates	Auburn, funded by NSF REU, pairs faculty mentors with Auburn and Spelman undergraduates for intense 10 week summer research experiences.
Intel Opportunity Scholars Program: freshman & graduate	Georgia Tech groups one grad student to guide 3 undergrads through a year-long research project. Includes mentor training, professional development, and banquet with poster session. After 2-3 years, students move to doing research with faculty.
Curricular Programs	
Pair Programming and Agile Software Development: Undergrad Computing students	NCSU, universities nationwide, developed NSF funded pair learning educational materials that have had a positive impact on the success, attitudes, and persistence for female and minority undergraduate students. http://agile.csc.ncsu.edu/education/ Auburn University and Meredith College conduct informal pair programming.
Learning Disabilities (LD) Curricula	Landmark College, funded by the NSF, created an online introductory biology curriculum for teaching high school and college students with learning disabilities.

However, each activity in Table 1.2 remains, to large extent, an island of activity with little interaction among participants from different programs or among evaluation teams for each program. The STARS Alliance will dramatically broaden the impact of these programs by pooling expertise and resources to consolidate, scale, replicate and sustain programs and program evaluation among multiple institutions and populationsThe STARS model for developing the Student Leadership Corps (described later) is a composite of the post-secondary programs listed in Table 2.1. A central tenant of the STARS philosophy is civic engagement, and SLC students will become involved as volunteers for outreach programs, such as those in Table 2.1. Alliance partners will implement and extend curricular changes such as NC State's pair programming model and Landmark College's work with students with learning disabilities and AD/HD.

2.2 Creative & Strategic Actions

In this section, we detail the specific activities we will undertake, including: Alliance-supporting and dissemination activities (STARS Advisory Boards, and Alliance Exchange, Web portal, and Marketing and Careers Campaign), student interventions (SLC, REUs), and curricular changes (pair programming, and supporting students with disabilities). Our common theme of Students and Technology in Academia, Research, and Service emphasizes that we believe that investing in these students and charging them with becoming leaders through community building, research, and service will not only mobilize an incredible human capital resource, but will result in dramatic changes throughout the computing pipeline.

2.2.1 STARS Advisory Boards

An advisory board will be formed for each of the stars to bring together representatives from the academic institutions, school districts, industrial corporations and community groups who are partnering to implement interventions within particular schools or communities. The advisory boards will provide input and support from the community and industry for reaching target populations (e.g., immigrant families not familiar with academia), providing internship opportunities for students, and assisting with dissemination of initiative opportunities and results.

2.2.2 Alliance Exchange

We refer to Alliance-wide interaction as the Alliance Exchange. It includes an Alliance Steering Committee (ASC), an Evaluation Team (section 4) and multiple Task Force Dialogues.

- The ASC is made up of 17 senior personnel: the project director, web portal manager, five evaluators, and the 10 lead academic liaisons (see Table 3.1). They will monitor institutional demographic data and guide development and implementation of programs and evaluation.
- The Evaluation Team is comprised of five of the senior personnel (Table 3.1). They will design, refine, guide, and evaluate the effectiveness of the Alliance and its activities.
- Each Task Force Dialogue (TFD) brings together a smaller group of alliance partners for a multi-institutional dialogue on important issues, such as:
  - **Bridging**: admissions criteria and building bridges between K-12 and undergraduate computing programs and between non-computing undergrad programs to graduate computing programs;
  - **First Generation Students**: preparing our institutions for the Hispanic immigrant population whose children will reach college age in about five years;
  - **Combining Research & Outreach**: strategies for leveraging the Alliance infrastructure to engage computing researchers in broadening the impact of their research;
  - **Institutional Change**: incorporating successful interventions into the core academic mission.

2.2.3 Alliance Web Portal

An alliance web portal at www.ITstars.org will support Alliance-wide efforts to brand our Southeastern partnership. The portal will serve to: engage visitors to learn more about IT careers

and how to pursue an IT degree; provide an overview of the Alliance; serve as a central repository and communication tool for Alliance members and people interested in BPC issues; and inform our current students how to participate in the SLC. The portal will also include a **"**Socially Relevant Projects Repository**"** of programming assignments with social value (similar to the "Nifty Assignments" repository http://nifty.stanford.edu/). Women [Far02,Cha02] and minority [NSF96] students often value work that has social value. This repository would serve as a resource for instructors to create material that will be more appealing to a diverse audience. Several content area experts (named in Table 3.1) will inform the information in the web portal.

2.2.4 Marketing & Careers Campaign

A targeted print and web marketing campaign will emphasize a "Reach for the Stars" theme emphasizing the tremendous diversity and opportunities in computing and IT related degrees and careers. The campaign will highlight existing role models and address many of the computing myths typically attributed with turning away potential students. Our print and Web campaign will clearly articulate market trends and career opportunities in computing and IT and the explicit degree path that a student will need to follow. In addition, a "dynamic skills to career matching application" will be developed and adopted by alliance academic partners to inform those with the appropriate interests and aptitude that a career path in computing exists.

2.2.5   The Student Leadership Corps (SLC)

The SLC is a multi-year experience providing students with multiple touch-points to find information and support throughout their academic journey [Pin99,Cle92]. The SLC will foster an extended student community among academia, industry and the community through *civic engagement, mentoring, professional development and research experiences*. Our program is informed by best practices such as those disseminated by the Learning through Evaluation, Adaptation, and Dissemination [LEAD] Center, including Richard Tapia's Spend a Summer with a Scientist program at Rice University [Ale98], the National Center for Women in Technology [NCWIT], the alliance partner programs highlighted in Table 2.1, Johnson C. Smith University's Service Learning and Lyceum Programs, and includes the ethnic-based mentoring model developed by USF-Lakeland's Nathan Thomas [Tho05]. In particular, Dr. Thomas developed a tiered peer mentoring program to support underrepresented students in computing. Utilizing principles from his Ethnic-based Mentoring Model, upper-class students mentor first year students. To promote recruitment, leadership development through service learning, and retention, first year mentees mentor high school students. An ecological approach is used to support mentors and mentees college adjustment, GPA, retention, graduation and Career preparation [Tho05,Sey98,Cha00]. The SLC will be implemented as follows.

o   **"Reach for the STARS" SLC Workshop**
    All SLC students will attend an alliance-wide one-week summer workshop, conducted by the alliance steering committee, to promote community building and prepare students for their upcoming SLC assignments. New SLC students will be introduced to mentoring, leadership skills, research experiences, preparing for graduate school, professional development and civic engagement. Civic engagement will emphasize how computing and IT professionals can use their skills to improve our collective quality of life. Training will cover the statistics on the disparity in the representation of women and minorities in computing careers as well as the national need to reverse the trend. Returning SLC students will assist with training, share prior year experiences and receiving additional training for assignments. Working in teams, the students will choose their academic year assignment by the end of the week.

- **SLC Monthly Seminar Series**
  During the academic year, SLC students will attend monthly seminars, held at institutions within regional stars, to cover SLC Workshop topics in greater depth.
- **Electronic Journals**
  SLC students will maintain an electronic journal to document SLC activities and reflect on their impact and meaning. Students will be given questions to guide their journal entries to collect data for evaluation (e.g., perceptions of, and intentions to continue in computing).
- **SLC Assignments**
  Each SLC assignments will generally fall within the following categories, and will include three components: written reflection, presentation to peers, and outreach to community.
  - **Outreach Ambassadors**
    A small group of Student ambassadors will be enlisted at each star and charged with designing their own creative way to spread the word about computing to 7th-12th graders in their areas. Ambassadors will be challenged to dispel common misconceptions about computing (study, careers, myths) that abound among parents, counselors, teachers and students and will participate in established outreach programs (Table 2.1). Ambassadors will write about and present their experiences.
  - **Service Learning**
    Students will be enlisted to use their computing skills for community good, e.g., to setup networking and web sites for non-profits or for tutoring "gate-keeper" courses such as 7th grade algebra. Students will write and present their experiences, as above.
  - **Research Experiences for Undergraduates**
    Undergraduates will be guided through a research experience by graduate student mentors, as per Georgia Tech's Intel Opportunities Scholars program, or by a faculty mentor, as per Auburn's Scholars of the Future and UNC Charlotte's McNair Scholars program (Table 2.1). Students will write a research paper in a publishable format, present their work to peers and share their experiences with 7th-12th graders.
  - **Internship Experiences**
    Students will work in industrial settings to gain work experience. Students will write about their experience, present their experience to peers and give a career-role presentation to middle or high school students or educators.
  - **SLC Peer Coordinators, Peer Ambassadors, Peer Mentors**
    Students will assist faculty with SLC assignments. Typically Peer Coordinators (PC) will lead students in activities that the PC has previously carried out. Peer Ambassadors may develop a chapter of a professional society for women or minority students. Peer Mentors will provide mentoring to "junior" peers, e.g., juniors/seniors mentor freshman/sophomores and grads mentor juniors/seniors, [Tho05].
- **Peer Mentoring**
  All SLC students who are undergraduates will have a peer mentor (as described above). Grad students will have a faculty mentor. This tiered approach will incorporate Nathan Thomas' strategies for student development of: Identity, Social Support, Psychological Support, Academic Support, Sense of Belonging, and Leadership Development. These strategies are related to college adjustment, GPA, and retention [Tho05].
- **ITSTARS Celebration**
  Each year will culminate in the ITSTARS Celebration, a conference and poster session for students to present and share their SLC experiences. Competitive Best Paper, Best Mentor,

Best Ambassador, etc., awards will be presented to the students. TIAA CREF will host the first Celebration at their facility in Charlotte, NC, with a $10,000 gift (see letter of support).

All ten academic partners will participate in the SLC, along with Johnson C. Smith University, Morehouse College, and other HBCU partners to be named by Georgia Tech (Table 1.2). About 130-180 SLC students will be selected annually from incoming freshman, transfer students, newly-declared computing majors, and new graduate students, as well as returning students. Students will be eligible to receive SLC stipends for two years ($500/semester for undergrads and $1,000/semester for grads). Some students will receive SLC stipends for summer participation (e.g., to assist with outreach, summer camps and SLC program coordination). Students will be encouraged to continue their SLC participation beyond 2 years without additional stipends. Our aim is to engage the students to want to share their SLC experiences by serving an advanced leadership role (e.g., peer mentor or coordinator). Attempts will be made to support ALL SLC students to attend the SLC Workshop and the ITSTARS Celebration.

2.2.6 Summer Research Experiences for Undergraduates (SREU)

A smaller number of $5,000 stipends will be awarded to SLC students engaging in research for a more in-depth research experience during the summer. Students will be required to write a research proposal and SREUs will be awarded competitively by the Alliance Steering Committee. To foster inter-institutional collaboration, students will be encouraged to work with research faculty at any Alliance partner (including non-academic partners such as the Microelectronics Center of N.C. and TIAA CREF). The SREU is meant to complement existing NSF-funded REU sites and individual REU summer supplements by providing REU students with the benefits of the SLC community.

2.2.7 Pair Programming

As a first step towards realizing systemic curriculum change to broaden participation in computing, NC State will lead the Alliance efforts to replicate pair programming. Extensive studies of student pair programmers have been conducted at [Nag03,Wil02a,Wil02b] and the University of California – Santa Cruz (UCSC) [Bev02,McD02]. Those studies consistently report, to varying degrees, the following observations relative to the use of pair programming in introductory computer science classes. An equal or higher percentage of pair programming students completed an introductory programming class with a grade of C or better when compared with solo programmers. Student participation in pair programming leads to at least similar exam performance on average when compared with solo programming students. Students that use pair programming on programming projects produce better projects than solo programming students. If pair programming is required only for a closed lab, there is no discernable impact on programming projects produced outside of the closed lab. Students in paired labs have a positive attitude toward collaborative programming settings. Students who use pair programming in an introductory computer science course are not hampered in future solo programming courses. Students who use pair programming in an introductory programming course are significantly more likely than solo-programming students to pursue Computer Science related majors one year later. During Year 1, Pair Programming will be implemented at least at NC State, UNC Charlotte, Meredith, Auburn, Georgia Tech and FSU.

2.2.8 Teaching Math to the Visually Impaired

USF-Lakeland will lead an effort for teaching math to visually impaired students. The mathgenie is a computer program developed over the last three years with a goal of providing a personal math reader to blind students trying to learn math at all levels in K-12. Work generated by a teacher for sighted students is automatically converted for use by the mathgenie, requiring no

special knowledge from the teacher concerning such issues as a Braille code and preparation of equations for the blind student [MathGenie].

In year 1, USF-Lakeland will setup a lab to 1) teach visually-impaired college students how to use the MathGenie equation browser; 2) prepare university teaching faculty to use the mathgenie in their classrooms and labs; and 3) train K-12 teachers from the Polk County public school system to utilize the mathgenie in their classrooms. The alliance evaluation team will develop an evaluation to determine if such a tool is useful to college students and the ease with which teachers are able to integrate the use of the mathgenie into mainstream classrooms.

By the time most visually impaired students reach the university, their math skills are well below expectations for incoming freshmen. The mathgenie should be very useful for these students in their remedial math classes and beyond. Though $7,000 is needed to initially setup the USF-Lakeland lab, replication of the mathgenie requires only software loaded on a standard Windows operating system.

2.2.9 Computing Education for Students with Learning Disabilities

The Southeast Alliance includes Landmark College, located outside of the southeastern geographic area. Landmark College was brought into the Alliance for their unique experience exclusively teaching college students with diagnosed LD. Landmark's population is unique, with all students having a diagnosed LD and/or AD/HD. While all Alliance members have students with LD, in most cases, we don't know who they are. Landmark College brings to the Alliance: a unique population—they are one of the few colleges in the nation exclusively serving students with LD and decades of expertise, best practices, and techniques for teaching students with LD, which will be disseminated among Alliance members and to the broader IHE community via the web portal. One of the points of replication of the SLC at all these institutions is to determine if it is equally successful with diverse student populations. Landmark's participation in the SLC enables all of us to see whether SLC works well for LD students. If the SLC needs to be modified for Landmark students, then the other Alliance members will be able to modify their own programs to better meet the needs of all students, whether or not diagnosed with LD.

2.2.10 AARCS: African Americans in Research in Computer Science

Juan Gilbert of Auburn University is serving on the alliance evaluation team, and is also proposing a BPC-Demonstration Project entitled "The African-American Researchers in Computing Sciences (AARCS)". The AARCS Demonstration Project is well suited for integration into The STARS Alliance. AARCS will broaden participation of African-Americans in computing using three components, Targeted Presentations, Future Faculty Mentoring and an annual mini-conference at Auburn University.

2.3 Motivation and Research Base

Information technology (IT) is one of the fastest-growing areas of job growth. However, the Department of Labor projects that IT degree production will not keep up with demand for IT jobs in the current decade [Zwe05]. To meet the need for IT jobs and remain competitive, we must increase the number of students, and particularly those from historically underrepresented groups, receiving undergraduate and graduate degrees in the computing disciplines. The inclusion of these groups in computing can provide increased opportunities for individuals and an infusion of talent, creativity, and diverse perspectives that can shape the future of technology. Researchers and newspapers alike tout the need for broader participation in technology, and address some of the reasons for unequal representation [Rip05, Jas05, Mul05, Lew05, Lew03, Pos91, Pow90].

The formation of the STARS Alliance is inspired and informed by existing collaborative efforts between multiple organizations to support underrepresented minorities (see Table 2.1, [SUCCEED, LEAD, NCWIT, MNSCU, GEAR UP, NACME, NSF-PI, CDC, Asp00, TAP, Gan05]). Many of these programs incorporate the efforts of educational institutions with industry, K-12 schools, and community and professional organizations, and engage the interests and efforts of undergraduate and graduate students in mentoring, research, and/or service. The SLC program is built as a framework to "wrap" successful programs such as these with community building and development opportunities for students, in a way that is flexible enough to implement diverse but united programs at multiple institutions.

Research evidence is central to the choice and design of STARS activities. Here we review literature that reports success and retention factors for undergraduate and graduate students in Science, Technology, Engineering, and Math (STEM) programs. Most of these studies report general findings for all students, while some focus on a particular underrepresented group. However, we believe that while some populations may need a specialized approach, particularly when building a community of like students, most of the factors are applicable to all students.

Persistence and Retention: Factors that contribute to persistence in STEM disciplines for all students include ensuring adequate preparation, lab participation, hands-on research opportunities with faculty, and positive peer interactions and influences [Ast92]. Nathan Thomas defines strategies for retention, including: Identity, Social Support, Psychological Support, Academic Support, Sense of Belonging, and Leadership Development [Tho05]. High academic achievement prior to college and interest in SME majors upon college entrance are also positively associated with SME retention [Bon00]. For example, Post, Stewart, and Smith [Pos91] found that confidence regarding educational requirements was a significant predictor of math and science careers. Financial support, study groups, a supportive program community, specialized advising, setting high expectations for students, and peer solidarity have also been found to provide an environment highly supportive of strong academic performance [Hra95]. Relationships between peers offer the best support to underrepresented students [Coh05]. Retention of underrepresented groups will have the effect of increasing the overall number of students in a group that are in a major, that has a effect in making the major attractive to and survivable for students in that group. [Coho05,Blu05].

The persistence of doctoral students in mathematics, and the quality of experience in graduate school, has been linked to how well integrated students are in the academic communities of their department and discipline [Tin93,Rog95,Her04]. In addition, doctoral students who persist in mathematics are more likely to have family members who are involved in mathematics, to have participated in research experiences as undergraduates, and have been committed to mathematics from a very young age [Her02].

Civic Engagement, Recruiting and Bridging: Numerous programs have introduced students to service learning and outreach as ambassadors or recruiters with great success [TAP,Hor04,Fla04], Civic engagement projects, such as Girls are IT! [Dah03] and ChicTech [Kam04] provide students with opportunities to be leaders and role models for younger students, providing both recruitment and retention benefits.

Participation of students in real projects that have impacts on other people and offer experience that will be useful in future careers will have a positive effect on student retention. Educational research shows that grounding teaching in familiar, concrete, and relevant examples improves learning [Bra99]. The participation in BPC efforts by industry and professional organizations will help computing programs stay connected to the job market. This connection

has been shown to have a positive effect on gendered attrition [Coh05]. Connecting computing to real applications that help others may also encourage retention of women and minorities [Coh05,Far02,Cha02,NSF96].

Research experiences: Similarly to the benefits of civic engagement, the participation of students in actual research has tremendous benefits for retention, as evidenced by the GA Tech/Intel Opportunity program, the Tapia Spend a Summer with a Scientist program [Ale98], and reported in [Asp00].

Collaborative learning: Research has shown that African-American success rates in science courses can be dramatically improved by shifting the learning paradigm from individual study to one that capitalizes on group processes, such as student work groups and student-student tutoring [Nel96,Tre92] while others suggest such collaborative learning would improve retention of women in computing [Coh05].

These findings and our experiences in intervention programs inform the design of the Alliance programs. The SLC program incorporates the development of community and peer interactions with hands-on research and service that are so important for persistence and strong academic performance. Pair programming brings some of these advantages to the classroom, with the result of improved student aptitudes and attitudes in computing [Nag03]. MathGenie brings math education to the visually impaired [MathGenie], while Landmark's learning disabilities work informs us all about teaching diverse students. The Alliance Exchange and continued examination of other best practice resources will ensure the continued applicability of STARS programs.

2.4 Plans for Dissemination

Anthony Chow of FSU will coordinate alliance dissemination. The alliance web portal will be a key point for dissemination with the marketing & careers campaign, the advisory board meetings, the industry panel, and the SLC Student Ambassadors and Service Learning used as mechanisms to draw a larger audience to the web portal. After year 1, we will open the ITSTARS Celebration to competitive submissions from non-SLC students nationwide. The alliance as a whole and individual stars will seek Public Service Announcements, Presentations at education conferences (e.g., SIGCSE, ASEE, FIE) and related events (e.g., Grace Hopper, Anita Borg Women in Technology Institute), and journal publications (Computer Science Education, IEEE Transactions on Education, the Journal of Engineering Education).

Ms. Stephanie Counts will be engaged as a Community Consultant for alliance dissemination (see letter of support from ITS LLC, a minority-owned management consulting firm certified as a Historically Underutilized Business and UNC Charlotte consulting budget). As President and CEO of Counts & Co. and co-President of the Women's Inter-Cultural Exchange, Ms. Counts brings much experience with "building and bridging social capital beginning with Women of Color and merging to the broader community. Ms. Counts will use her extensive network to connect UNC Charlotte with the targeted community groups, and will use her national network to do the same for other stars.

We have also budgeted for the production of a DVD and an annual alliance magazine that will feature our SLC students, their experiences, and evaluation results. These will be distributed nationally. College websites will describe and link to www.ITstars.org

3. Partnership Plan

The partnership for the STARS Alliance will be guided by the Alliance Steering Committee. A hierarchical operational mode will be used. Each star (Table 1.2) will form its own advisory board of academic and non-academic partners to coordinate implementation of the SLC, pair programming and other initiatives within star institutions. The SLC activities (e.g., outreach ambassadors, peer mentors) will take place among star partners (e.g., Auburn and Spelman students together). The SLC Workshop and ITSTARS Celebration will be organized by the alliance as a whole. Task Force Dialogues will guide focused topics of interest alliance-wide. The Web portal and Marketing & Careers campaign will take place alliance-wide. Alliance-wide evaluation will be conducted by the evaluation team, with local students helping collect data. Section 2.2 gives details. Roles of the key personnel within the Alliance are listed in Table 3.1.

Table 3.1 Alliance Partner Roles

Role(s)	Description
Alliance evaluation team	Juan Gilbert, Auburn; Sarah Berenson & Laurie Williams, NC State; Stephen Rollins, EPPC consulting; Nathan Thomas, USF-Lakeland; Several student assistants; This team will handle evaluation (tools development, data collection and analysis) for evaluating the Alliance infrastructure, the SLC program, Pair Programming, and Teaching Visually Impaired students.
Project Managemnt	Teresa Dahlberg, Director of the Diversity in Information Technology Institute and Associate professor of Computer Science, UNC Charlotte, will Chair the Alliance Steering Committee, coordinate Alliance Exchange and report to the NSF.
Web Portal, Marketing & Careers	Anthony Chow, FSU, along with the FSU Career Center, will lead the development of the web portal and the collateral materials to be used for the marketing & careers campaign.
Content Area Experts for Web Portal & Program Models	Nathan Thomas, USF Lakeland: the ecological model of retention incorporated into the SLC. Laurie Williams, NC State: Pair Programming implementation. Art Karshmer, USF Lakeland: teaching visually impaired students. Steve Fadden, Landmark College: students with learning disabilities. Virginia Knight, Meredith College: outreach programs. Maureen Biggers, Georgia Tech, Student Leadership Training Magdy Attia, J. C. Smith University: Service learning & minority students (see letter of support)
Lead Industry Liaison	Steve Fadden, Landmark College, will establish an Industry Experts Advisory Panel to serve as a resource to SLC students to answer questions, provide career advice, mentoring, feedback to the partners on opportunities to increase participation of students in computing, explore internships, and offer support as needed. Panel members will provide students with candid, practical advice and guidance relevant to pursuing careers in computing. Panel members include professionals from a number of organizations that represent leaders in the computing field, such as Oracle, Volpe, the U.S. Dept. of Air Force: Air Force Research Lab, and Mitre Corp (see letters of support). Experts from Microsoft and E-Bay have expressed interest and will be submitting letters
Lead Academic Liaisons	A faculty member from each academic partner will serve as an Academic Liaison to coordinate their Star Advisory Board, serve on the Alliance Steering Committee, oversee implementation of SLC, Pair Programming (and other activities) and interface with their institutions to address policy and curriculum changes; These are: Tiffany Barnes, UNC Charlotte; Mladen Vouk, NC State; Kristin Watkins, Meredith College; Cheryl Seals, Auburn; Andrea Lawrence, Spelman; Maureen Biggers, Georgia Tech; Lois Hawkes, FSU; Jason Black, FAMU; Art Karshmer, USF Lakeland, and Steve Fadden, Landmark College.
Lead Community Liaison	Stephanie Counts, CEO and President of Counts & Co. and co-President of the Women's Inter-cultural Exchange. Assist with connecting the alliance to targeted community groups for recruitment and dissemination. See letter of support from Howard Counts of ITS Consulting.
Dissemination	Anthony Chow, FSU will manage alliance dissemination through the ITstars.org web portal, print media, DVD development and distribution. Stephanie Counts will interface with community.
Education Liaisons	Kelvin Norton, FAMU High School, will serve as lead education liaison for the Florida star. Approximately 2-4 middle school or high school educators or administrators will serve as educational liaisons for the other stars. They will coordinate programs that involve their students.

3.2 Growth and Sustainability of the Alliance

Many of us leading the Alliance efforts have existing institutional roles related to broadening participation in computing. The time and monetary resources provided by this grant will enable us to dramatically enhance the impact of our efforts by pooling resources and expertise across multiple diverse institutions. Beyond the timeframe of this grant, we expect to continue serving these institutional roles, but as part of a larger, cohesive effort, rather than as isolated entities. We expect the improvement in our own institutional demographics and the support received from industry and community partners to encourage our administrations to provide the support needed to continue the Alliance Exchange and Faculty Liaison activities. We have already received tremendous institutional support to develop this proposal. We have had numerous teleconference meetings, had a PI team meeting in Baltimore, had an evaluation team meeting in Charlotte, and have secured letters of support from our Deans and Provosts.

We have begun discussions within our institutions about incorporating pair programming as an on-going component of undergraduate programming courses, pending successful results of this project. We are also discussing mechanisms for incorporating the SLC into our undergraduate and graduate programs. Our ideas include: 1) Requiring students to participate in the SLC in order to complete the requirements of the undergraduate program. Johnson C. Smith University (serving as consultant to this project) serves as a model. They require students to perform a minimum of 80 hours of service prior to graduation; 2) Adding SLC concepts as a service component to TA and RA assignments. This would model graduate assistantships similar to faculty positions, combining research, teaching, and service; 3) Providing students with an SLC leadership designation on their transcripts for their participation (e.g., 2-years, bronze; 3-years, silver; 4-years, gold level status), similar to honors program designations; 4) incorporating the SLC into existing Learning Communities; and 5) Making the SLC available to all students, and providing stipends to a select number of students identified by donors providing support. We intend to further demonstrate the efficiency of funding allocated to the SLC by the return in Human Capital provided by SLC students that will effectively aid in recruiting and outreach.

4. Evaluation Plan

Evaluation is a critical component of the STARS Alliance, to assess both the effectiveness of the Alliance and the success of Alliance activities and to motivate other institutions to initiate similar actions. Both formative and summative evaluation measures will be used to inform and refine Alliance activities through the course of the project, and to determine the overall success of the Alliance in reaching its goals and outcomes.

The Alliance offers a unique opportunity to build an outstanding evaluation and assessment team. The STARS Alliance evaluation team includes Stephen Rollins, Juan Gilbert, Sarah Berenson, Nathan Thomas, and Laurie Williams. Stephen Rollins, an educational psychologist and former FSU College of Education Executive Associate Dean, offers a psychology perspective for designing and evaluating all Alliance intervention programs. Juan Gilbert, an Associate Professor of Computer Science and Engineering at Auburn University, provides insight in evaluating the effectiveness of interventions based on his well-designed programs and studies to broaden participation in STEM careers, including a 2004 ITWF grant. Sarah Berenson, Director of the Center for Research in Science and Mathematics Education at North Carolina State University, provides insight and the educational research design perspective, along with experience from ITWF-funded interventions and research projects designed to affect and understand the participation of women in IT. With success in obtaining

more than 40 grants, publishing more than 85 research articles, and giving 60 presentations at national and international meetings, she was awarded the 2005 Alexander Quarles Holladay Medal for Excellence, the highest faculty award presented by the University and its Board of Trustees. Nathan Thomas, Director of Diversity at the University of South Florida at Lakeland, has a background in ecology and psychology. He will serve as the content expert for evaluating the SLC based on his "ecological model" [Tho05] for retention of students in computing programs. Laurie Williams, an Assistant Professor of Computer Science at North Carolina State University, provides expertise and guidance in designing and evaluating the pair-programming interventions for the Alliance. This outstanding team will collaborate to design, refine, guide, and evaluate the effectiveness of the Alliance and its activities.

Daniel Stufflebeam's **Context, Input, Process, Product (CIPP)** model [Mad83,Stu71] will be the fundamental evaluation design employed by the evaluators. This model is well-recognized and broadly used by evaluation researchers to assess projects in K-16 educational settings. Using this model, evaluators record and assess the following:

- **Context**–the larger setting in which the project is being carried out
- **Input**–all crucial staff, materials, and resources that are devoted to the project
- **Process**–strategies, activities, practices, and procedures used to carry out the project. The process component, which constitutes formative evaluation, is used to solicit information to determine modifications and adjustments needed to improve how a project operates;
- **Product**–the ultimate result obtained that can be attributed to interventions carried out through the project. The product component, which constitutes summative evaluation, is used to determine if a project should be continued, modified, or terminated.

The evaluation will include both quantitative and qualitative components. The quantitative component will examine those factors that may be readily quantified, such as number of students involved; number of faculty and professionals in computing disciplinary areas involved; hours contributed by the students and faculty; and number of students taught by teachers involved in the project. The qualitative component will involve electronic journaling by all SLC students and select interviewing or focus groups of key individuals and groups involved in the STARS programs (e.g., mentors, faculty, students). Qualitative data will be solicited from all these individuals and compared using the process called triangulation. Electronic journal entries will be analyzed using Content Analysis techniques to categorize journal entries. These entries should provide insight into the impact of the SLC program, and should reflect affective, behavioral and cognitive (ABC) change in participants. **Affective changes** reflect changes in attitude or perception, such as expressing an increased interest in majoring in a computing discipline**. Behavioral changes** reflect actual change in participant behavior, such as enrolling in a computing degree program. **Cognitive changes** reflect change in knowledge, such as becoming aware of previously unknown programs or scholarships for computing students [Ajz01,Pet97]. Since we seek to effect change in all areas, survey instruments will be designed to capture change relative to computing in all three of these areas.

For the SLC and Pair Programming programs, and any interventions designed and implemented through the Alliance, all participants will take pre- and post-tests to measure changes in these areas. We view the Alliance as an experimental testbed in the southeast, where ideas for BPC can be incorporated and studied on a multi-institutional scale. Therefore, we design our analysis as an exploratory study to determine the variables that contribute to observed outcomes. We plan to augment this analysis through requesting additional funding for REUs or consultants in statistics to explore and analyze the findings we collect throughout the project.

Our evaluation plan works in the following way: Alliance activities are developed to align with research evidence that shows that such activities will impact the overall goals of the Alliance. Evaluation of each activity is tailored to measure the particular factors that contribute to BPC goals. Overall assessment of Alliance success will be determined through a careful comparison of baseline data, disaggregated by race, ethnicity, gender, and physical ability for each institution and observing gains or losses in each of the specific outcomes identified. A summary of assessment objectives, example measures and data collection associated with each of the project activities is given in the following table.

Table 4.1: Summary of Assessment Objectives, Activities, Measures and Data Collection

Goals & Desired Outcomes	Activities	Example Measures	Data Collection
Goal 1: Recruitment **Desired Outcomes:** a. Increased student enrollment in computing b. Increased student awareness about computing	-Alliance Exchange -SLC program -SLC training -SLC peer mentoring -Pair programming -ITSTARS Celebration	- Student participation/ attendance - Faculty & professional participation - Student enrollment & reflections - Attitude scale that assess knowledge & feelings toward computing - No. of papers presented and people affected by service	-Pre-post test -Electronic journals -Exchange report & DVD -Participation -Longitudinal data Collection (Years 2 and 3)
Goal 2: Bridging **Desired Outcomes:** a. Increased student readiness to enter computing b. Increased number of undergrads to enter grad school or workforce	-ITSTARS Web site -Marketing & Careers campaign -SLC training -ITSTARS Celebration	- No. of people affected - Attitude scale that assess knowledge & feelings toward computing - No. of student proposals; applications; interviews; people affected by service	-Marketing report -Project proposals -Enrollment
Goal 3: Retention **Desired Outcomes:** a. Increased computing graduation rates b. Increased year-to-year persistence & declaration of major in computing c. Increased college adjustment & GPA	-Alliance Exchange -SLC program -SLC training -SLC peer mentoring -Pair programming -ITSTARS Celebration	- Mentoring satisfaction scale - Identity development scale - Social, academic, & psych support scale - Sense of belonging scale - Leadership development scale - College Adjustment scale - GPA; Enrollment - No. of cheating incidents	-Pre-post test -Enrollment -Longitudinal data Collection (Years 2 and 3)
Goal 4: Sustainability **Desired Outcomes:** a. Sustain Alliance efficacy b. Institutionalize Alliance partnerships	-Advisory Board -Pair Programming -Peer mentoring -Participation Index -Task Force Dialogues	- No. of institutions & orgs participating - No. of new interchanges between institutions and orgs - No. of policies adopted - Organizational Efficacy scale	-Bi-annual board Report
Goal 5: Dissemination **Desired Outcomes:** a. Increased national awareness of effective practices b. STARS serves as a model & repository for BPC c. Alliance implementation & evaluation method-ology promoted	-Task Force Dialogues -Participation Index -ITSTARS Web site -Marketing & Careers campaign -Alliance exchange -Entire SLC program -ITSTARS Celebration	- Student participation & attendance - No. of policies adopted; papers presented; people affected by service, institutions requesting information, recommendations made & adopted, dissemination activities; - Measures to asses internal and external alliance efficacy	-Marketing report -Exchange report & DVD

5. Results from Prior NSF Support

Tiffany Barnes of UNC Charlotte has been program Technical Director (1998-2004) for NSF grant HRD-9813902, "Girls on Track," a joint project between NC State University, Meredith College, Wake County Public Schools, and the NC Dept. of Public Instruction. The program targets increasing girls' enthusiasm for and confidence in learning mathematics and using computer technology, which ultimately leads to retention of girls in math and technology related careers. The program's main component is a Summer Academy for middle school girls. In the first 4 years the program incorporated professional development, including diversity and gender issues training, for middle school teachers and guidance counselors. Dr. Barnes participated in the design of a set of investigations for students that incorporates social and urban problems with math and technology, including Population Growth, Trash (and recycling), Traffic (carpooling, pollution, road congestion), and Careers.

Dr. Barnes is also the lead PI on a pending proposal through the NSF-CCLI program, titled "Teaching CS1 in a Game-Immersed, Gender-Neutral Environment". The primary goal of this proposal is to establish preliminary evidence that teaching introductory programming using a multiplayer online game that is designed to appeal to a broad audience will improve student *engagement, satisfaction*, and *skill transfer*, particularly for women. Specifically, it seeks to develop a gender-neutral online multiplayer game in which to *immerse* previously successful introductory programming pedagogical materials. If successful, this program is a good candidate for replication in the STARS Alliance.

Sarah Berenson of NC State University designed and implemented the Girls on Track program, described above.

Georgia Tech is a sub-contractor for an ITWF NSF Award # 0420436 which was effective 09/01/04 for $165,627. Project title: Teaching Introductory Computer Science with a Problem Solving Seminar; Principal Investigator: Susan Horwitz, University of Wisconsin, Georgia Tech Co-PI: Maureen Biggers; GT sub-contract amount: $60,000; award duration: 40 months. This is a multi-institutional project to apply and evaluate an Emerging Scholar's Program (ESP) in the area of computer science. The program targets female, minority, and rural students with a good math and science background and minimum scores on the ACT or SAT tests. The selected students will enroll in a computer science course that includes meetings outside of normal class time. These meetings will be run by other undergraduate students, trained by an instructor, and involve problem-solving work in small groups, emphasizing active, collaborative learning. This is an application of the ESP program to CS. As of this date, the Peer Leaders have been selected and, along with the instructor, have attended a training program. They will begin teaching in the Fall 2005 semester.

Georgia Tech is participating in NSF Award # 0332780, A study of gender-based differences and ethnic and cultural models in each of the computing sciences; award duration: 3 years, beginning in fall 2004. The research goals are to: (1) Scientifically investigate by gender, ethnicity, and culture the under-representation of women in the computing sciences (i.e., a collective term for the disciplines of Computer Science, Computer Information Systems, and Computer Engineering, information Technology, etc.), (2) Increase the knowledge-base of gender, ethnic, and cultural models, creating newer models that lead to a more equitable and inviting education in the computing sciences, and (3) Increase national capacity in the field of gender diversity and education in the computing sciences, encouraging new researchers and research-oriented education practitioners. The project is a mixed design, primarily three-year longitudinal with a new sample of first-year students being introduced in the second and third

years (thus introducing successive independent samples). The project will be coordinated from Xavier University of Louisiana but will involve a total of 50 institutions of higher education from across the nation. Twenty-five of these institutions will be Historically Black Colleges and Universities (HBCUs). Georgia Tech will be one of the 25 non-HBCUs. The target population is female and male undergraduates (first-year students through seniors) in the computing sciences. Data collection began in Fall 2004, with subsequent data collections in the Fall 2005 and 2006.

Teresa Dahlberg of UNC Charlotte serves on the Advisory Board and as faculty mentor for NSF grant DGE 0231833 entitled "GK-12 Fellowship cooperative with Philip O. Berry Academy," ($1,507,305, 6/2003-5/2006). In its second year, this Track 1 GK-12 Program Grant involves 10 Science and technology UNC Charlotte graduate students working in a high-poverty, high-minority technology High School.

As a subcontract for the NSF funded project "Girls are I.T." NSF EIA-0204398, ITWF YR2002 awarded to the Girl Scouts, Hornets' Nest Council of N.C. (http://www.girlsareit.org), Teresa Dahlberg developed the Explorebots activity that resides in a mobile technology classroom that is traveling to girl scout troop meetings in Western N.C. The activity is formulated as a game wherein teams of 11-14 year old girls explore a hidden terrain by remote control of mobile robots and video cameras. The technology teaches applications of robotics, sensors, networking, and vision, while emphasizing the social context of the technology for planetary exploration (e.g., Mars Rover), exploring disaster sites, etc.

Juan Gilbert of Auburn University has an active NSF grant ITWF #0420485 "Scholars of the Future: An Implementation Model for Increasing Diversity in Information Technology" (9/15/04-9/15/08, $754,983).   This implementation project is providing upper level undergraduate computing sciences majors with extensive research experiences and mentoring. The primary goal of this award is to increase the number of students entering computing sciences graduate programs and eventually faculty positions. Additionally, the Scholars of the Future Program will be replicated at Virginia Tech in year 3 of the award.

Art Karshmer of USF-Lakeland has participated in the NSF PPD MAVIS Grant, which helped produce the first commercially available translator to convert LaTeX to Nemith Braille math representation. This product is currently being distributed by Duxbury Systems Inc. He is also Project Director/PI for the NSF Workshop on Broadening Participation in Computing and is consulting on several separate NSF Projects, NSF/SBIR Phase I Grant, Dallas, Texas; NSF MII Grant Florida International University; NSF CISE Grant, University of South Florida (Current).

Virginia Knight of Meredith College is funded for years 2 and 3 by Laurie Williams' NSF grant ITWF #00305917, described above. Virginia is also PI for NSF CSEMS DUE-0422180, The Paschal Scholars Program in Mathematics, Computer Science, and Computer Information Systems, $384,996, Sept. 1, 2004 to August 31, 2008.

Laurie Williams of NC State University is the lead PI for active NSF grant ITWF #00305917 "Collaboration through Agile Software Development Practices: Improving the Preparation for and Success of Minorities, the Disabled, and Women in IT Careers" (8/03 – 7/06, $688,941). This is a multi-disciplinary, synergistic research between the Computer Science, the Electrical and Computer Engineering, and the Mathematics, Science and Technology Education departments at North Carolina State University (NCSU). Additionally, NCSU partners with Meredith College (an all-women college) and the North Carolina A&T (a historically black university) to study and demonstrate the potential of agile software development in these environments. Laurie Williams has completed CCLI grant #0088178 "Pair Learning in the Undergraduate Computer Science Curriculum" (1/01 – 8/04**,** $227,110)   The goal of our

proposed research project was to study whether undergraduate computer science students work in pairs on laboratory exercises and programming assignments, their overall learning experience is improved. The success and retention of students were increased with pair programming.