1 Section C: Project Description

According to the Bureau of Labor and Statistics, the Computer Science (CS) and Software Engineering job markets are expected to “increase more than average” (Bureau of Labor Statistics 2007a, 2007b) from now until the year 2014. Yet the computing community is seeing a decrease in women and African-American CS majors across the country (Vegso 2005; Zweben 2006; Zweben 2007). North Carolina A&T State University, an HBCU, has seen the number of women CS majors drop drastically from about 50% in 1998 to about 30% in 2004 (Williams & Brown 2005). The CS department at A&T has also experienced a drop in total enrollment consistent with the national trend.

The PIs believe that one of the reasons for this loss of interest in CS is the widening gap between theory & practice. Students are not seeing clearly how concepts covered in the classroom are used in practice in the real-world. CS students are given the knowledge to be competitive but are never really given a sustained opportunity to compete with it. Therefore, the knowledge and ability given in ones coursework during a given semester is not retained because it is not used or cultivated. CS students rarely get a opportunity to see where and how they fit in the world of Computing until they co-op. By this time, in many CS curricula, it is typically too late. Many students will have changed their major. Another reason for the loss of interest in CS is that many students are not being integrated into strong social networks. With the increased use of laptops by many CS students the computer lab is no longer a place where CS students congregate. Therefore, CS students may find it more difficult to discover a sense of community. This is especially true for women and African-American students in departments where there are few underrepresented minorities.

CS students need to see, early on, that they are part of and contribute to something much larger. They need to be recruited to and retained within a community that they can immediately be recognized and accepted in. It is difficult for anyone to be expected to join any organization and then sit on the sidelines for two or three years before they can formally apply their knowledge and creativity (and be recognized and accepted for their contributions).

One does not need to look any further than a university’s athletic department to see this concept in action. Quite frequently in the world of collegiate athletics student-athletes will ultimately choose to attend a university based on how soon they will be able to contribute on the playing field. Many college coaches see that redshirting\(^2\) a prize recruit can result in that student transferring to another university that will allow them to play immediately and provide them with a sense that they are a part of something much larger than themselves.

Today’s CS students need to have this same sense of belonging. Today’s CS students need to be given an opportunity to contribute to something larger than course assignments. This sense of belonging and the ability to make a well appreciated contribution is a basic need. It is just as important to today’s CS students as it is to student-athletes.

Continuing on the theme of intercollegiate athletics, the PIs’ proposed SGER demonstration project (DP) is to develop an intercollegiate sport in the area of software design and development (SDD). Like many of the sports in intercollegiate athletics, there will be an associated SDD season. The SDD season will consist of four competitions: three friendlies and one tournament. The SDD season will provide students with an opportunity to compete in

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\(^2\)When a player is redshirted, that particular student-athlete must practice with the team, participate in all conditioning drills, and attend all team meetings; however, they are not allowed to play and in some cases are not allowed to even suit-up with the team on game days.
a year-round SDD program and will allow students to apply what they have learned (and/or are learning) in the classroom immediately. The interaction with students from other participating schools on a year-round basis will allow students to develop a much stronger sense of community extending beyond the borders of their campus.

In this proposed SGER BPC-DP, software design and development teams (SDDTs) will consist of four members. Two members will be involved in pair-design while the other two members will be involved in pair-programming (Canfora et al. 2005; Steinberg & Palmer 2004). For each team, at least two of the team members will be women\(^3\). This team structure will allow freshmen to contribute to a SDDT immediately. SDDTs will work on problems relevant to companies including Intuit and Cargill in practice sessions as well as in team competitions.

2  SDDTT ≠ ACM Programming Contests

The proposed SDDTT project should not be confused with simply having more ACM-like Programming Contests (ACM 2007). There are a number of fundamental differences. However, the PIs believe that both have a place in the overall development of well-rounded CS students.

First, the ACM Programming Contests are interested in ultimately crowning one winner. The SDDTT project is concerned with making every team a winning team. In the SDDTT project, friendlies will be used to develop and adjust a team’s ‘handicap’ (as is done in many bowling leagues). The goal of each team is simply to ‘beat’ their handicap! Thus, the SDDTT project seeks to crown several ‘Champions’.

Since each team is actually competing to show progress rather than competing against one another, it is envisaged by the PIs that a sense of camaraderie will develop among the participants. Therefore, teams and coaches will be more apt to share experiences, design/development techniques, practice plans, as well as strategies for what they did to improve their performance.

Secondly, for most teams the ACM Programming Contest is a once-a-year event. Students and coaches get together briefly in the weeks prior to the competition to practice. However, after the competition the interaction between teammates and coaches typically ends until the next competition one year later. With SDDTT, students, teams, and coaches will have nearly year-round interaction.

Thirdly, ACM Programming Contests are narrowly focused on programming which does not adequately reflect computing in the 21st Century. SDDTT is more balanced in that software design is esteemed as highly as software development. It is the PIs’ belief that software design requires a different skill set. This is important because SDDTT will be appealing to a greater number of individuals with widely diverse skill sets, perspectives, life experiences, etc.

Fourthly, from year to year it is difficult for teams and coaches to adequately gauge team progress in the ACM Programming Contests. With SDDTT, the teams and coaches will have four guaranteed opportunities to measure progress. After the season, coaches will be better able to assess how graduation as well as changes in team composition will affect their set of teams for the next SDD season. This is similar to what happens at the end of each season in intercollegiate athletics.

Also, changes in team competition will allow for more diverse (and targeted) recruiting policies. No longer will coaches simply pick the best ‘coders’. Coaches and teams will have to

\(^3\)Three of the participating universities: Bennett College, North Carolina A&T State University, and Winston-Salem State University are Historically Black Colleges and Universities (HBCUs).
apply need-based recruiting strategies similar to what intercollegiate athletics coaches do on a yearly basis.

Finally, practice and competition problems will be based on current issues of participating companies including Intuit and Cargill. It is planned to have representatives from academia and industry at all of the SDDTT events. These representatives will be able to interview, encourage, and provide advice for the participants and coaches.

3 Software Design & Development Teams and Tournament

In this section, the components of the SDDTT project will be discussed. These components include: an overview of the friendlies & tournament, team composition & practice plans, the judging of team submissions, the coaches symposia, the tournament banquet, and the responsibilities of the PIs & coaches. This section will also include example schedules for the friendlies and the tournament.

3.1 Overview of Friendlies & Tournament

The friendlies and tournament will consist of two parts: a regular team competition and a mixed-team competition. The basic unit of a team is a ‘cell’. A cell is composed of two individuals. Therefore, each team will be composed of a software design cell and a software development cell. Software design cells will develop domain models (Larman 2005) using pair-design (Canfora et al. 2005) while the software development cells will implement and develop software solutions using pair-programming (Steinberg & Palmer 2004).

During the regular team competition each team will be given a total of three hours to design and develop solutions to three problems. After the regular team competition, there will be a mixed-team competition where the design cell of a team from one school will be partnered (combined) with a development cell from a different school. Each of the mixed teams will have at least two women. During the mixed-team competition, teams will also be given a total of three hours to develop solutions to three problems.

Coaches will notify the director at least two weeks before a friendly and/or the tournament concerning the composition of each of the cells that will be participating. This will allow the director to properly form mixed teams and allow the paired cells an opportunity to contact and get acquainted with one another before the competition. Coaches will be encouraged to facilitate the correspondence between the paired cells.

3.2 Team Composition & Practice

Each participating university will have a total of three teams with four members in each team. The basic unit of a team is a ‘cell’ where a cell is composed of two individuals. This means that each university will have three design and development cells resulting in a total of nine possible team configurations. Although there will be no restriction on cell composition, each team must consist of at least two women4. It should be noted that the more valid team configurations a school has the better prepared the school will be for the mixed-team competition.

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4Three of the participating universities: Bennett College, North Carolina A&T State University, and Winston-Salem State University are Historically Black Colleges and Universities (HBCUs).
Practice schedules should allow each of the design cells to practice solving problems with a variety of design/development cell combinations. Not only will this allow the cells to prepare for the mixed-team competition but it will allow for more interaction between the students of a particular team. The PIs believe that this will result in the development of stronger bonds between teammates.

It is the coaches decision to designate cell composition. Thus, it will be the coaches responsibility to match personalities and personal strengths. A list of practice problems will be made available. The practice problems as well as the problems for the friendlies and tournament will use as many vocabulary words taken from GRE prep guides as possible. Thus, a typical practice session will begin with the coaches and teams reviewing the vocabulary words of the practice problems. There will be no such review of vocabulary between coaches and players during the friendlies or the tournament; however, teams may bring with them any books they feel may be necessary.

3.3 Submission and Judging of Design and Implementations

Software development cells will work with the design cells in implementing solutions. For each problem, initially the design cell will submit a preliminary domain model using the Unified Modeling Language (UML) (Booch, Jacobson, & Rumbaugh 1999) consisting of concepts, attributes, and associations. The submitted domain model will be judge for minimally capturing the essence of the system architecture that may be needed in developing a solution. The judges will use noun phrase identification (Larman 2005) in an effort to determine that a domain model is consistent with a particular problem to be solved.

Implementations will be judged base on test cases developed by the director and co-directors. Teams will be notified whether their software has passed. Revised domain models will be judged on how closely the concepts, associations, and attributes match the implementation.

3.4 Coaches Symposia

During each friendly (and the tournament), the coaches will get together for a Coaches Symposium that will be organized by the co-directors. The symposium will provide an opportunity to discuss best practices, different techniques, and approaches for encouraging, motivating, and mentoring the students, as well as the dissemination of information concerning BPC alliances, projects, activities, and opportunities. The symposium will also provide an opportunity for the coaches to meet and talk with industry representatives concerning employment opportunities. During the symposium, representatives from participating schools will also have an opportunity to talk with coaches concerning the recruitment of students for undergraduate (for those students attending junior colleges) and graduate programs.

3.5 Tournament Banquet

After the tournament, there will be a SDDTT Banquet which will allow the participants an opportunity to interact with one another and strengthen bonds between one another. Awards

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5Although the PIs believe the GRE to be culturally bias, it is still used by many university graduate programs. The PIs see practice, friendlies, and the tournament as a fun way of building a student’s vocabulary.
will be given to each team meeting or exceeding their handicap. Team Characteristic Awards will also be given to each participating school based on an observed trait exhibited by their set of teams. All participants will vote for the designation for a particular school. For example, some team character awards may be: easiest-to-work-with, hardest working, most spirited, most improved, best collaborators, etc.

3.6 SDDTT Responsibility Assignments

The SDDTT administration team will consist of a director (Ed Carr), an expert in the area pair design & programming (Cheryl Seals), an evaluator (Jerlando Jackson), three co-Chairs of the Coaches Symposia (Anna Yu, Shearon Brown, and Gerry Dozier) and a number of coaches (one from each of the participating colleges and universities).

The director, Ed Carr, will be responsible for all aspects of the SDDTT. He will keep in contact with the coaches at the participating schools. He will also oversee the development of the Coaches Manual (along with Cheryl Seals and Gerry Dozier). This manual will provide the rules and regulations of the SDDTT, as well as the formats for practice, friendlies, and the tournament. The Coaches Manual will also provide a tutorial on pair design/programming (Cheryl Seals) and Domain Model development (Cheryl Seals & Gerry Dozier). The director will oversee the communication and scheduling of all friendlies and the tournament and will also be on hand to run the tournament software (PC\textsuperscript{2} (Ashoo et al. 2007)).

The pair design/programming expert, Cheryl Seals, will be responsible for developing a tutorial on pair design/programming as part of the SDDTT Coaches Manual as well as practice formats. She will also work with Gerry Dozier in the development of a tutorial for Domain Model development using UML.

The evaluator, Jerlando Jackson, will be responsible for developing the evaluation instrumentation for this DP and will provide intermediate and final evaluations of this DP.

The Co-Chairs of the Coaches Symposia, Anna Yu, Shearon Brown, and Gerry Dozier, will be responsible for the planning and scheduling of each of the Coaches Symposia. They will also assist in the development of practice and competition problems.

3.7 Example Schedules

3.7.1 Friendlies

In Figure 1 an example schedule for a friendly is presented. We are anticipating that the three friendlies will take place on September 27, 2008, November 15, 2008, and January 24, 2009.

Each of the friendlies will begin with a team competition from 9am until noon. Just before lunch, the results will be announced. During lunch, it is anticipated that the design and development cells will get together to try to finalize their strategy for the upcoming mixed-team competition.

The mixed-team competition will take place from 1pm-4pm. From 2pm-3:30pm, there will be a coaches symposium. After the mixed-team competition, the results of the mixed-team competition will be announced as well as the overall results for each team and participating school. After the competition, team, coaches, and other corporate or university representatives will have an opportunity socialize with one another. During this time, the PIs will be able to interview participants in an effort to collect feedback concerning the day’s event and their activities leading up to the friendly.
3.7.2 Tournament

The tournament will have a format that is similar to the friendlies with the major difference being the tournament banquet. The purpose of the banquet is to reward all of the SDDTT participants: students, coaches, corporate sponsors, and university representatives for their effort during the SDD season. After this banquet, the PIs will collect final feedback from all participants concerning the season. Figure 2 provides an example schedule of the Tournament.

4 External Support: Corporate Sponsorship

North Carolina A&T State University has enjoyed a strong relationship with Cargill and Intuit. These two companies sponsor A&T’s Programming Contest Initiative (directed by Ed Carr) at a combined level of $7K annually. Two A&T alumni, Joy Hill (Cargill) and Dan Richardson (Intuit), routinely attend the A&T Programming Contests to participate as judges, interview participants, and answer questions related to employment.

5 Evaluation Plan

5.1 Overview

The primary objectives of the evaluation plan is to measure the effect of the SDDTT Program on undergraduate students, both women and African-American and their coaches in the Triad area (i.e., Greensboro, Winston-Salem, and High Point, NC) and to determine the efficacy of the SDDTT Program in regards to meeting individual and programmatic goals which are as follows:
Program-Level Goals:

1. Increase the number of women and African-American students entering computing sciences undergraduate programs.

2. To increase SDDTT students’ level of engagement with activities related to the field of computing sciences.

3. To provide initiatives to aid in the retention and matriculation of SDDTT students toward an undergraduate degree.

4. To provide access to and promote participation in a targeted computing sciences social network for both the SDDTT students and coaches.

Individual-Level Goals:

1. Change the disposition, attitudes, and perceptions of SDDTT students regarding computing sciences related disciplines.

2. To increase the knowledge of SDDTT students about the benefits and career options of majoring in computing sciences.

3. To increase the sense of belonging and commitment of SDDTT students to the field of computing sciences.

4. To encourage the pursuit of undergraduate degrees by SDDTT students in computing sciences with the goal of pursuing a career in the field of computing sciences.

Three methods will be used to measure the SDDTT goals:
1. Surveys/Evaluation Forms: To be distributed at each of three programmatic interventions (friendly competitions, coaches’ symposium, and tournament)

2. In-Person Interviews and Focus Groups: To be conducted at the tournament to measure more accurately the effect of the SDDTT Program on participants.

3. Data Tracking:
   a) Monitor the contact hours and interactions between SDDTT students and coaches.
   b) Monitor the contact hours outside of practice interacting with team mates and other SDDTT students.

5.2 Evaluation of the SDDTT


The primary objectives of the evaluation component is to: (a) to measure the effect of the SDDTT Program on undergraduate students, both women and African-American students and their coaches in the Triad area (i.e., Greensboro, Winston-Salem, and High Point, NC); and (b) to determine the efficacy of the SDDTT Program in regards to meeting individual and programmatic goals. The programs goals are two-fold: (a) program-level goals; and (b) individual-level goals. The program level goals are: (a) increase the number of women and African-American students entering Computing Sciences undergraduate programs; (b) increase SDDTT students’ level of engagement with activities related to the field of computing sciences; (c) to provide initiatives to aid in the retention and matriculation of SDDTT students toward an undergraduate degree; and (d) to provide access to and promote participation in a targeted computing sciences social network for both the SDDTT students and coaches.

Individual-level goals are: (a) change the disposition, attitudes, and perceptions of SDDTT students regarding computing sciences related disciplines; (b) to increase the knowledge of SDDTT students about the benefits and career options of majoring in computing sciences; (c) to increase the sense of belonging and commitment of SDDTT students to the field of computing sciences; and (d) to encourage the pursuit of undergraduate degrees by SDDTT students in computing sciences with the goal of pursuing a career in the field of computing sciences. In order to achieve this objective, survey questionnaires, focus groups, individual interviews, and
data tracking will be used to yield data regarding the effectiveness of the SDDTT program. Taken as a whole, the evaluation component will consist of a mixed methods study on the change in the disposition, attitudes, and perceptions of SDDTT students toward computing sciences, the change in educational and occupational aspirations for SDDTT students toward computing sciences, and to track the change in the level of participation of SDDTT participants in the computing sciences. Because of the different context for inquiry and discovery, the increased validity through triangulation, using both research methodologies (i.e., quantitative and qualitative) will increase the scope and depth of the program evaluation component (Jorgensen, 1989; Mason, 1996; Patton, 1980). Overall, the program evaluation will assess the quality and effectiveness of the SDDTT. Findings from the program evaluation will provide institutional decision makers with empirically-based data on providing environments and opportunities for women and students of color to be successful as undergraduates in computing sciences fields.

5.3 Conceptual Framework

A social network is a social structure made of nodes (which are generally individuals or organizations) that are tied by one or more specific types of relations, such as financial exchange, friends, kinship, dislike, trade, web links, sexual relations, disease transmission (epidemiology), or airline routes. Social network analysis views social relationships in terms of nodes and ties. Nodes are the individual actors within the networks, and ties are the relationships between the actors. There can be many kinds of ties between the nodes. Research in a number of academic fields has shown that social networks operate on many levels, from families up to the level of nations, and play a critical role in determining the way problems are solved, organizations are run, and the degree to which individuals succeed in achieving their goals. In its simplest form, a social network is a map of all of the relevant ties between the nodes being studied. The network can also be used to determine the social capital of individual actors. These concepts are often displayed in a social network diagram, where nodes are the points and ties are the lines.

This program has at its core notions of social networking theory. Authors (e.g., D’Augelli & Hersberger, 1993; Pike & Kuh) have observed that African-American students tend to have dense social networks. Dense social networks have been identified as a disadvantage for those posed with constructing multiple strategies and developing creative solutions to problems (Reagans, Zuckerman, & McEvily, 2004). In turn, dense social networks combined with low mastery of content knowledge results in unsuccessful social and academic behaviors (Moore, 2003). Needless to say, this poses a problem for anyone entering computing sciences. That said, mentoring and support networks that dispel feelings of isolation and loneliness among female students are vital to attracting and keeping women in STEM disciplines (Ferreira, 2003; Hackney & Bock, 2000; O’Callaghan & Jerger, 2006). Moreover, the social relevance of science and engineering careers should be stressed to increase retention of women and people of color in STEM disciplines (AAUW, 2000; Busch-Vishniac & Jarosz, 2004; Seymour, 1995; Siann & Callaghan, 2001; Strenta, Elliot, Adair, Matier, & Scott, 1994).

Wider exposure to technology will motivate girls to pursue science and engineering careers (AAUW, 2000; Burack & Franks, 2004). Women are often turned off by the competitive and individual nature of science and engineering, this fact has also been attributed to the attrition of students of color (Moyer, Salovey, & Casey-Cannon, 1999; Seymour, 1995). Interestingly
enough, Bafile (2004) found that it is possible to foster community through friendly competition. Therefore, women’s sports participation aids in collective identity formation (Taylor & Whittier, 1992) which in turn may be used to combat perceived gender inequalities. Constructing collective identities as marginalized groups and fostering a critical awareness of under-representation allows members to challenge current and past discriminatory practices (Pelak, 2002). Social networking theory guides the overall development of SDDTT, and subsequently has been used to inform the evaluation component.

5.4 Quantitative Research Component of the Program Evaluation

5.4.1 Data Collection for the Quantitative Research Component of the Program Evaluation

The data for the quantitative research component of the program evaluation will be collected from the participants of the SDDTT at three phases (i.e., friendly competitions, coaches’ symposia, and tournament) of the program. Three instruments will be used to collect quantitative data for the evaluation. These instruments will be developed by the Co-Principal Investigator and Project Assistant. Items on the survey questionnaires will be based on a comprehensive review of the literature addressing issues germane to women and people of color in computing sciences fields and occupation aspirations (e.g., Gottfredson, 1981; Gottfredson, 2002; Hall & Post-Kamer, 1987; Hrabowski & Maton, 1995). The three survey questionnaires are: (a) evaluation form for friendly competitions; (b) evaluation form for coaches’ symposia; and (c) evaluation form for the tournament. Pilot testing of the survey questionnaires will be done using students that fit the target population for the program. Respondents will be asked to complete the survey questionnaire, give comments on the clarity of statements, and identify other items that should be included. Comments will be analyzed, feedback will be reviewed, revisions will be made, and the instrument will be revised.

5.4.2 Analytical Procedures for the Quantitative Research Component of the Program Evaluation

Data analysis will occur in multiple stages. In the first stage of data analysis, employing ordinary least squares regression, while applying statistical controls for the effects of demographic variables and experiences during college, students’ scores from each subscale (nine) on academic and professional goals will be regressed against program phase (i.e., friendly competitions, coaches symposia, and tournament). The second stage of the data analysis will consider whether the effects of program phase are general or conditional. More specifically, is the influence of the program phase on academic and professional goals similar in magnitude for all SDDTT participants, or does it differ for SDDTT participants with different demographic characteristics or experiences during college? To test for the presence of conditional effects, a series of cross-product terms will be computed between dummy variables indicating program phase, and each of the other independent variables of the prediction model. The set of cross-product terms will then be added to the general effects equations employed in the direct effect analyses. A significant increase in explained variance (R2) due to the set of cross-product terms will indicate the presence of significant conditional effects (Pedhazur, 1997).
5.5 Qualitative Research Component of the Program Evaluation

5.5.1 Qualitative Study Design

The qualitative research component will consist of two parts: (a) individual interviews; and (b) focus groups. Both parts will occur at the tournament. The tournament will serve as the only aspect of the SDDTT were all participants, both undergraduate and coaches, will be together. Therefore, this venue serves as a prime opportunity to collect qualitative data since the participants will have prolonged engagement with the program prior to their attendance of the tournament. Data collection will follow a comprehensive interview protocol.

The primary objective of the qualitative research component is to obtain data by exploring various topics (e.g., students’ SDDTT experience and their perceptions of the SDDTT program) by engaging those participants involved with the SDDTT program (Flowers & Moore, 2003; Moore & Flowers, 2003). Given the complexity of the SDDTT program, a qualitative component of the evaluation is deemed necessary and will permit the evaluation team to collect in-depth data reflective of SDDTT participants.

Attending to reliability and validity are just as important in qualitative research as it is in quantitative research (Miles, Huberman, 1984; Moore & Flowers, 2003). To enhance reliability in qualitative research, it is recommended that researchers spend sufficient time with the study’s participants to check for discrepancies in responses (e.g., prolonged engagement and persistent observation), verify the accuracy of participants’ responses (e.g., member checking), and explore each participant’s experience meticulously (Lincoln & Guba, 1985). To ensure validity in qualitative research, it is recommended that participants’ responses are accurately reported and represented and that multiple sources of information are used to triangulate the qualitative data (Miles & Huberman, 1984; Scott, 1995). Accordingly, to ensure validity and quality of the program evaluation, the research team will collect multiple types of data (e.g., experiences during college and perceptions of the program quality) and use multiple modes of data collection (e.g., quantitative and qualitative) at various phases and times throughout the program implementation (Greene, Caracelli, & Graham, 1989).

5.5.2 Analytical Procedure for Qualitative Research Component of the Program Evaluation

All data from the qualitative component of the program evaluation will be coded and analyzed utilizing the grounded theory approach. This qualitative technique (Glaser & Straus, 1967; Lincoln & Guba, 1985; Mason, 1996; Scott, 1995) refers to collecting and analyzing data simultaneously for the purpose of developing theoretical and thematic explanations, in turn, to explain, compare, and trace the development of the researched phenomena. The process involves the following steps: “(a) comparing the data applicable to each conceptual category; (b) integrating the categories and their properties; (c) delimiting the emergent theory; and (d) writing up the theory” (Jorgensen, 1989, p. 113). This procedure will continue until saturation and redundancy occurs (Scott, 1995). The researchers will rely heavily on the transcripts for analyzing the data. This procedure is referred to as transcript-based analysis (Morgan, 1998).

All focus groups and individual interviews will be both coded and analyzed utilizing the grounded theory approach. Specifically, the evaluation team, will review and analyze the data throughout the study. This process will be continued until the evaluation team is able to formulate a comprehensible picture of the participants and is able to answer the research
questions. During this phase, the evaluation team will be instructed to look for patterns in the data and will be asked to code the data so themes and sub-themes could be easily identified.

The evaluation team will initially code the data, independently, and after this process the research team will meet collectively to discuss the patterns in the data. Employing this method, patterns and emergent themes will be identified and discussed. Thus, each member of the evaluation team will discuss "how" and/or "why" he or she identified certain themes in the data. This method of analysis will again allow the data to be constantly compared and organized as recommended by the grounded theory approach (Glaser & Strauss, 1967; Jorgensen, 1989; Scott, 1995). Once patterns and themes are identified, the evaluation team will use direct excerpts from the transcripts to present and illustrate the themes and sub-themes.

5.6 Data Tracking Component of the Program Evaluation

The evaluation team will maintain a computer database on all SDDTT participants throughout the project period. Each semester follow-up activities will occur to determine which undergraduate students have applied to majors in computing sciences and have been subsequently admitted. Likewise, information regarding their level of interaction with the coaches and other SDDTT participants will be tracked. This follow-up process will be managed through e-mails and phone calls. Additionally, coaches participating in the program will be tracked. These coaches will be contacted each semester to determine the level of interaction they had with their students and other coaches. Every effort will be made to gain information from these individuals as to whether they are seeing growth in the students not documented elsewhere. This process will too be managed through e-mail and phone calls.

6 Participating Colleges & Universities

The colleges/universities that will be participating in the SDDTT will include: Bennett College, Elon University, High Point University, North Carolina A&T State University, the University of North Carolina at Greensboro, Wake Forest University, and Winston-Salem State University.

7 Qualifications of the Principal Investigators

Ed Carr (Director) North Carolina A&T State University.

Edward C. Carr is an adjunct assistant professor at North Carolina A&T State University and has been a professor at the undergraduate level since graduating from Western Carolina University with a Masters in Applied Mathematics, in 1989. Ed received his Masters in Computer Science from North Carolina A&T State University in 1996, and joined the department in 2001 as a full-time adjunct assistant professor. Ed has over 17 years of teaching experience and has been active in ACM Programming Contests since 2001. He has been the director of North Carolina A&T State University Triad Programming Contest since 2001 and was the director of the IEEE Southeastern Programming Contest in 2004. He has been a PC2 (software used for ACM Programming Contests) administrator since 2002.
Gerry Dozier (Co-Chair, Coaches Symposia)  North Carolina A&T State University.

Gerry is the chair of the Computer Science Department at North Carolina A&T State University. He is currently a member of the Technical Committee on Evolutionary Computation of the IEEE Computational Intelligence Society. Gerry is currently and associate editor for (1) IEEE Transactions on Evolutionary Computation, (2) Intelligent Automation and Soft Computing (AutoSoft), (3) the Journal on Education and Information Technologies, and (4) the International Journal in Intelligent Computing and Cybernetics. Gerry has served as a special session co-chair for the 2005 IEEE International Conference on Systems, Man, and Cybernetics, as a technical co-Chair for the 2004 IEEE Congress on Evolutionary Computation, and as an associate editor for the 2002 International Conference on Artificial Intelligence.

Anna Yu (Co-Chair, Coaches Symposia)  North Carolina A&T State University.

Anna is the Graduate Program Coordinator in the Computer Science Department at North Carolina A&T State University. Anna has served on a number of conference program committees.

Shearon Brown (Co-Chair, Coaches Symposia)  North Carolina A&T State University.

Shearon is the coordinator of the Undergraduate Program in the Computer Science Department at North Carolina A&T State University. She is also the director of the department’s colloquium series.

Jerlando Jackson (Evaluator)  University of Wisconsin.

Jerlando F. L. Jackson is interested in the study of administrative diversity, executive behavior, and academic entrepreneurship in higher and postsecondary education. He is an Associate Professor of Higher and Postsecondary Education in Educational Leadership and Policy Analysis, Faculty Affiliate for the Wisconsin Center for the Advancement of Postsecondary Education, and Faculty Affiliate in the Weinert Center for Entrepreneurship (School of Business) at the University of Wisconsin-Madison. Dr. Jackson’s central interest has been to contribute to administrative science, with a focus on administrators on higher and postsecondary education. Moreover, his research intersects with science, in that, he is concerned with patterns of entrepreneurship for academic scientists and institutional practices in higher education that promote higher rates of participation for African-Americans in science-based fields. Dr. Jackson has over 60 publications, including two books. Presently, Dr. Jackson serves as the lead evaluator on two National Science Foundation grants (i.e., African American Researchers in Computing Sciences and PC2Main).

Cheryl Seals (Coaches Manual Coordinator)  Auburn University.

Cheryl Seals is an assistant professor at Auburn University and is a member of the Intelligent and Interactive Systems Lab. Seals completed her PhD work at Virginia Tech in the area of human computer interaction with an emphasis on visual programming techniques for novice programmers. Cheryl has experience in the areas of human computer interaction, user interface design, usability evaluation, educational technologies (i.e. investigating ways to improve methods of programming for novices) and pair design/programming. Cheryl has had prior experience with conference organization (executive committee of 4 prior conferences). She has also worked with national programs for youth (e.g. guiding their creation of research
& outreach programs, judging ACM research poster competitions and judging programming contests.)

8 Dissemination Plan

The dissemination plan consists of three phases. The first phase will be the dissemination of the SDDTT Coaches Manual (via the SDDTT webpage). The second phase is to disseminate preliminary results to participants at the Coaches Symposia. The third phase will be the dissemination of project results via:

- published articles in professional journals and presentations at various education conferences, such as SIGCSE Technical Symposium on Computer Science Education, ADMI, IEEE Computer, etc.,
- the SDDTT website, which will be used to post project results and distribute project materials, and
- an organized session at SIGCSE.

9 Intellectual Merit and Broader Impacts

**Intellectual Merit:** This demonstration project will measure the level of interest of women and African-Americans in participating in a sustained, year-round, intercollegiate software design and development program.

**Broader Impacts:** The model presented in this demonstration project can be implemented widely at a variety of colleges & universities. The broader impact of this DP is that it will provide CS departments with an effective aid in the retention of women and African-American students as well as provide a set of assessment tools to measure the overall effectiveness of the program. This SGER will be a tool to address some issues related to the following covenants in *The Covenant with Black America* (Smiley 2006):

- **Covenant II:** Establishing A System of Public Education in Which All Children Achieve at High Levels and Reach Their Full Potential,
- **Covenant VIII:** Accessing Good Jobs, Wealth, and Economic Prosperity, and
- **Covenant X:** Closing the Racial Digital Divide.

10 Prior Support from NSF Grants


