Girls on Track

Increasing Middle Grade Girls’ Interest in Math-Related Careers by Engaging them in Computer-Based Mathematical Explorations of Urban Problems in their Communities

First Year Report

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**Principal Investigators**

**Sarah B. Berenson**, principal investigator, directs the curriculum development for the teacher professional development activities and girls’ camp activities for summer 1999. [> 65 days]

**Mladen A. Vouk**, co-principal investigator, directs the acquisition of technical resources for the project and the computer interface between the project’s curriculum, schools, and evaluation. [> 30 days]

**Tracy Robinson**, co-principal investigator, directs the curriculum and professional development activities for the guidance counselors during summer 1999. [> 30 days]

**Virginia Knight**, co-principal investigator, provides technical assistance in the development of the curriculum materials for teachers and students. She will direct the interface between Girls on Track and the Math Mentoring Program in winter 2000. [> 45 days]

**Donald McGurrin**, co-principal investigator, provides the link between the project and the Wake County Public Schools and technical assistance for the curriculum development. [> 45 days]

**Michael Kestner**, co-principal investigator, provides the curriculum reform and state testing perspectives of the State Department of Public Instruction to ensure that Girls on Track is aligned and supports North Carolina’s educational initiatives. [> 15 days]

**Other Senior Personnel**

**Karen Dawkins**, project manager, assists the principal investigator in scheduling, communicating, and organizing all Girls on Track activities. She also provides technical assistance in the development of the curriculum materials. [> 75 days]

**Eileen Williams**, mathematics educator, provides technical assistance to the project in developing curriculum and in the delivery of professional development. Mrs. Williams is supported by the Center for Research in Mathematics and Science Education. [> 40 days from NC State]

**Virginia Bourknight**, Meredith mathematics educator, provides technical assistance for the organization and delivery of the summer camp activities and professional development activities. [> 30 days]

**Sarah Stein**, NC State visual communications educator, has volunteered to participate in the project by providing technical assistance to collect video data during Girls on Track summer activities. [> 40 hours from NC State]
**Project Personnel**

### Graduate and Undergraduate Students

**Laurie Overton Cavey**, doctoral student in mathematics education, assists the investigators in researching and mathematizing the community problems for the summer program. Also she will assist in the summer professional development and camp activities [> 65 days]

**Nancy Helms Smith**, master’s student in mathematics education, assists the investigators in researching the community problems and developing the sports algebra activities. Also she will assist in the summer professional development and camp activities [> 65 days]

**Tiffany M. Barnes**, doctoral student in computer science, assists the investigators’ efforts to integrate technology into the summer curriculum for teachers and girls and the fall tutoring program on the Web. Also she will assist in the summer professional development and camp activities [> 65 days]

**Maria Droujkova**, doctoral student in mathematics education, assists the investigators’ efforts to integrate technology into the summer curriculum for teachers and girls and the fall tutoring program on the Web. [> 40 days from NC State & > 15 days from NSF]

**Andrew Nozer**, a undergraduate degree student in computer science, provides computer science technical help, support of GOT networking, and computing technology [>20 days from NC State]

**Bob Alridge**, a master's student in computer science, provides computer science technical help, support of GOT networking and computing technology to the project [>20 days from NC State]

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**Program Evaluation**

Ann C. Howe, a science education professor with teaching and administrative experiences at Syracuse University, NC State University and University of Maryland, is responsible for the external evaluation of Girls on Track. Additionally, she collaborates with the principal investigators on the project’s research questions.

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**Program Partners**

There are five project partners in this project:
Activities and Findings

- IBM
- Wake County Public Schools
- North Carolina Department of Public Instruction
- North Carolina State University
- Meredith College

IBM has contributed 14 laptop computers, three (3) desktop computing stations, and two (2) servers to the project in its first year. Wake County Public Schools has contributed staff time to develop the curriculum, advertise the project, approve the research and evaluation plans, and provide data for the research and evaluation. In the fall they will provide teachers with instructional materials valued at $2,500. The State Department of Public Instruction has provided staff time to the project. North Carolina State University has provided additional staff and graduate students to the project. Meredith College is providing the facilities for the Summer Camp, which include classrooms, computer lab, gym, and pool facilities.

Research Activities

There are four areas of research planned for this first project year, beginning July 12, 1999, and include:

- Learning and teaching in student-centered, concept-centered, and investigation-centered contexts.
- Teaching using information technologies.
- Learning using information technologies.
- Identifying factors, including project participation, which contribute to girls’ success.

For this research we have received permission from the Wake County Public Schools and the NC State University Internal Review Board for Human Subjects to conduct these research activities. A copy of the WCPS report, including the research instruments for this pilot year, is included in the Appendix.

All summer activities will be video taped and evaluation instruments administered. Test data on four measures and course selections have been collected for 550 control group students and 46 Girls on Track participants.

Presentations given during professional development and camp sessions will be captured and made available over the WEB (video, voice, synchronized slides) using the NC State University’s Web Lecture System (http://renoir.csc.ncsu.edu/WLS).

Education Activities

Professional Development will begin July 12 and continue through the summer camp activities. Ten teachers, five preservice teachers, and three guidance counselors have been selected to participate in this pilot year. Teachers and counselors will learn how to conduct community investigations.
through their participation and reflection during the three weeks of the project. They will explore the following investigations:

- What problems do you anticipate for the communities in Wake County in twenty-five years?
- How fast is Wake County’s population growing?
- Where should Wake County dump its trash?
- Should there be a High Occupancy Vehicle [HOV] lane on I-40 between Wade Avenue and Research Triangle Park?

**Why do men earn more than women do?** Teachers will also explore issues related to gender equity:

- What are the teaching behaviors that exclude and marginalize girls?
- What are the teaching behaviors that encourage girls?
- What can teachers do to motivate and have high expectations for girls?
- How do you mathematize community problems that are interesting to girls?

Teachers will learn how to use the following information technologies:

- Create slide shows with PowerPoint
- Navigate the WEB to find community data and information
- Use Excel as a data collection, representation, and analysis tool
- Take, print, and insert pictures with digital camera
- Create a WEB page
- Use e-mail

**Lessons Learned:** Next year we will alter the way that applications are distributed. This year we depended on department heads to distribute the girls’, teachers’, and counselors’ application. Next year, we will mail applications directly to the teachers, counselors, and parents.

**Girls Summer Camp** will take place July 19-July 30. Although we anticipated selecting 40 girls for this pilot year we have made space for the 47 girls who applied. Girls will investigate the following community problems:

- What problems do your anticipate for the communities in Wake County in twenty-five years?
- How fast is Wake County’s population growing?
- Where should Wake County dump its trash?
- Should there be a High Occupancy Vehicle [HOV] lane on I-40 between Wade Avenue and Research Triangle Park?
- Why do men earn more than women do?

In addition, girls will learn to use the following information technologies:

- Create slide shows with PowerPoint
- Navigate the WEB to find community information and data for investigations
- Use Excel as a data collection, representation, and analysis tool
- Take, print, and insert pictures with digital camera
- Create maps of the community using GIS.
- Create a WEB page
- Use e-mail
The investigations are planned around 5 major activities:

• Introducing the Problem
• Defining Questions about the Problem
• Collecting and Organizing the Data
• Representing and Analyzing the Data
• Presenting the Investigation Results

Each day, girls will participate in games and sports designed to teach algebra skills and concepts. These include:

• Basketball
• Swimming
• Relay Races
• Soccer

The algebra concepts embedded within all of these activities rely heavily on proportional reasoning and algebraic thinking. They include:

• Rational Numbers
• Percent
• Ratio and Proportion
• Rate of Change
• Slope
• Symbolic Language of Algebra
• Pattern Finding and Generalizing
• Graphical and Tabular Representations of Rate of Change
• Independent and Dependent Variables

The planning of all of the educational activities has taken place over the 1998-99 academic year and during early summer 1999. More information can be found about the project: http://ontrack.ncsu.edu. A hard copy of this information is included in the Appendix.

Major Findings

There are no major findings at this time because the activities occur in the final two months of the first year of the project. However, we have noted several items of interest:

• End of Course data for Girls on Track students shows no variance. This implies that we are using an instrument of mathematical achievement that does not differentiate at the higher levels of achievement.
• End of Course data for the Algebra I Control Group shows more variance. This implies that the control group data is essential to the program evaluation in terms of student achievement.
• The Web Lecture System [WLS], designed by M. Vouk and computer science colleagues, will be used to capture the slides, video, and audio of the presentations made during the teachers’ professional development and girls summer camp. These presentations are then converted to html and put on the project’s server for review by the teachers and girls and for analysis by the project’s instructors.
Activities and Findings

The draft of the curriculum materials will be prepared for distribution to the teachers, preservice teachers, and guidance counselors.

Training and Development

The educative benefits achieved by the project to date are sited in the yearlong development of the curriculum, the research instruments and protocols, and the instrumentation of the evaluation plan. The principal investigators and project staff are learning from each other to increase their knowledge of:

- Early adolescent girls’ learning of and disposition toward learning mathematics
- Cultural practices that encourage gender inequity

Graduate students and project staff have begun to learn about the following content and pedagogy:

- Developing open-ended investigation to learn algebra 1
- Developing and mathematizing community problems for algebra 1
- Learning to use information technology as a tool of instruction – synchronous and asynchronous technologies
- Teaching early adolescents mathematics in an informal setting
- Teaching teachers, guidance counselors, and preservice teachers mathematics, information technologies, and pedagogy

All other training and development activities will take place with the target populations July 12 – July 30, after this report is submitted.

Outreach Activities

The only outreach activity to date is the Girls on Track web site http://ontrack.ncsu.edu

Contributions

Girls on Track will provide benefits to the following groups:

- Mathematics Education Faculty, Graduate Students, and Undergraduate Preservice Students
- Computer Science Faculty and Graduate Students
- Middle Grades Mathematics Teachers and Guidance Counselors
- Middle Grade Girls

The contributions are anticipated as follows:

- Encourage and motivate fast track girls to study mathematics and computer science in middle grades and high school.
**Contribution within the Discipline**

- Develop teachers and preservice teachers who can teach using student-centered, classroom investigations and information technologies recommended in the NCTM Standards (1998)
- Teach teachers, preservice teachers, and school counselors strategies that encourage and motivate young women to study difficult mathematics and computer science.
- Provide opportunities for university faculty and graduate students to engage in research concerning gender, teaching and learning.

**Importance of Contributions**

When Girls on Track was envisioned, there were two major problems that were identified. First, girls’ attitudes toward mathematics are increasingly negative as they go through adolescence and high school. Second, girls do not perceive computer science as an attractive area of undergraduate study. These two problems have many negative results. At the national level, these problems promote the underrepresentation of women in SMET careers. At a social level, the problem produces a disproportionate quantity of women in lower socio-economic levels who are underemployed. Since women are the majority of child caregivers in this country, the disproportionate wages of women also speaks to the poverty of 20% of the nation’s children. Girls on Track seek to answer the questions so frequently asked in this country’s mathematics classrooms: When are we ever going to use this stuff? What good is mathematics? Why do we have to learn this stuff?

The major contribution of this project is intended to affect girls’ participation in higher mathematics.

Investigating community problems that girls hear discussed by their parents, teachers, and in the media, girls will increase their enthusiasm for mathematics, and they will acknowledge the importance of learning mathematics.

A secondary contribution of this project is to affect girls’ interest and motivation to learn computer science.

As girls use information technologies to solve community problems, they will increase their enthusiasm and interest in computer science.

**Year Two Plans**

There are several major program components of next year’s plan for the Girls on Track:

- Fall tutoring program
  - Access to GOT Server
  - e-mail accounts
- Fall professional development
• Winter mentoring program
  • Sonja Kovalefsky Day
  • Mentoring Projects
  • Projects/Awards Banquet
• Summer 2000 Applications for teachers, preservice teachers, counselors and girls at 10 Wake County Middle Schools.

The research and evaluation components for next year are:

• Evaluation
  Success of summer 1999 program for girls, teachers, preservice teachers, and counselors.
    • Success of Tutoring Program
    • Uses of server and WLS

• Research
  • What factors contribute to girls’ success in algebra 1?
  • What factors contribute to girls’ enthusiasm for mathematics?
  • What factors contribute to girls’ enthusiasm for information technologies?

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