MERIDIAN

Girls on Track with Information Technology

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Introduction

"This National Science Foundation project aims to keep talented middle grade girls on the fast math track into college."

Imagine a math classroom that hums with activity and debate as to how the community can change its dependence on the automobile. Students gather data from the Internet to build their argumentation to support different solutions. Excel is used to generate graphs and tables to portray the quantitative dimensions of their problems. "What if we made an HOV lane on Interstate-40—would that work?" questions one twelve year-old. "I think we need to have better public transportation," chimes in another. "Yeah, but how do you go about getting people to leave their cars at home," retorts a third student.

This type of dialogue was repeated again and again during the Girls on Track Math Camp for 40 talented seventh and eighth graders last summer. This National Science Foundation project aims to keep talented middle-grade girls on the fast math track into college. Principle investigators at NC State University are Sarah Berenson (Mathematics Education), Mladen Vouk (Computer Science), and Tracy Robinson (Counselor Education). They collaborate to integrate mathematics, information technologies, and leadership skills into a comprehensive treatment to address the problem of decreasing interest in mathematics and computers among females. Over the next three years 200 girls, 50 teachers, 30 preservice teachers, and 15 guidance counselors will participate in Girls

on Track, investigating community problems with information technology tools.

"Girls on Track focuses on mathematical investigations of community problems that are compelling and engaging to talented middle grade girls."

Nationally the underrepresentation of women in science, engineering, mathematics, and information technology careers is of great concern. Over the past 20 years, female enrollments in computer science have declined more than 40% (Rogers & Kaiser, 1995). Rigorous undergraduate mathematics preparation is a gateway to high-paying careers in science, engineering, and information technologies. While girls are increasing their enrollments in high school mathematics courses, they tend to drop off the fast math track in high school and college tool (American Association of University Women, 1998). Girls' interest in mathematics begins to change dramatically in the middle grades and high school. Studies have found that girls do not see mathematics as a useful tool. For this reason, Girls on Track focuses on mathematical investigations of community problems that are compelling and engaging to talented middle grade girls.

In this article we highlight the information technologies used as tools for the mathematical investigations and some positive, first-year results. First, we examine how uses of information technologies enhance the context for learning. Second, increases in girls' interest in using the technology are reported. Third, a description of ways that the information tools increased girls' confidence is provided.

Tools to Enhance

Investigations depend on rich and authentic contexts to engage students' interest. While they may know some things about the selected context, more information is usually required to support the learning experience. The web provides this background information so that information concerning the context is provided to the students. We begin our investigation of population increases in the community by asking students to determine the population in Wake County in 20 years. The girls engage in a web exploratory activity to connect their ideas of population growth in the world before moving to the population growth in the community. Two valuable websites for population investigations are: http://www.popexpo.net/eMain.html and http://www.co.wake.nc.us/planning/Demographics.

World Population Website

Wake County Demographic & Economic Data Center

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With some background information, students are ready to begin asking questions they choose to explore about population growth. Which town in the county is growing the fastest? What area will need new schools? What area of the county has an aging population? Where are the more dense populations for public transportation routes? Once again, the web becomes a source of data to answer the students' questions.

Excel is used as a data collection and data display tool for the investigations. Then girls select from a variety of tables and graph formats to convey the results of their investigations to others. For this communication aspect, girls use PowerPoint with Web and Excel graphics to convey their results and concerns. There were several benefits accruing from the uses of these tools. First, the girls were deeply interested in the community problems but did not know how to find current and up-to-date information. The web was exactly the right tool to fill that void. Second, a tool that can manipulate, calculate, and graph numerical data is extremely useful for collecting and analyzing the data of the investigations. Finally, PowerPoint provides a multimedia palette for girls to communicate the results of their investigations to others. Their individuality and creativity can be fully expressed with this semi-professional tool.

Interest in Math, Science, and Technology

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In addition to the community investigations, girls learn how to build their own web pages and send e-mail to each other and their counselors. E-Mail reflections at the end of each day provide an ideal source of evaluation data to the counselors. When asked what they enjoyed most during the two-week camp experience, more than half of the girls selected information technologies as a favored activity.

S: My favorite part of GOT was learning about computers. Before coming here I wasn't very good at computers and the web. I am now very excited about technology as well as Algebra.

T: The best thing I liked about GOT was the web page. I've always wanted to know how to do it,

but I never got the time to learn and this was a really good opportunity.

U: The websites rocked!!!

While the web page construction was a definite favorite, PowerPoint and E-Mail were camp highlights too.

V: My favorite part of GOT was using the computer to do E-Mail and our websites. It was really cool how GOT put together math real events and computers to make presentations [PowerPoint]. I wish school was like this!!!

An important component of Girls on Track is career awareness. Women with interesting jobs in science, engineering, and information technologies speak enthusiastically about their careers with the girls. To highlight the importance of studying mathematics, one of the investigation problems considers why men earn more than women do. The combinations of investigation and speakers proved to have a powerful effect on the girls' thinking.

D: GOT has changed the way I think about my education by making me think about how good it is to take math classes. I'm going to be taking a lot of math classes now! GOT has changed the way I think about future jobs too. I didn't know what I wanted to be before, but now I want to be in a computer related job.

E: Girls on Track has helped me become more interested in mathematics and computer sciences. This camp has changed my mind about what I want to learn and what job I want to try to get. GOT has made me think about getting a job as a web site manager, a computer engineer, or something that has to do with computers and involves math.

Seventy-five percent of the girls reported changes in thinking about their careers because of the summer camp experience. These changes were all related to increased interest careers in computers [28%], mathematics [32%], and science [32%].

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Increased Confidence

Building girls' confidence is one of the more important objectives of Girls on Track. Two activities are noted as confidence builders for girls participating in the summer camp. It appears that the activities involving Excel, PowerPoint, Web design, and E-Mail give girls confidence with information technologies.

> **M:** GOT has changed my thinking by making me more confident that I can pass the computer test. By me being in the band I did not have the chance to take keyboarding of any type. Now I have had to use the computer more then I would have been able to at home.

Additionally, the PowerPoint presentations of investigations were given in an auditorium setting before their peers. One day, community and university dignitaries and two US congressmen were part of that audience. Each girl participated in these public speaking activities and counselors noted the changes in the girls' confidence with each presentation.

"Significant changes are needed in education, in particular mathematics education, to better motivate and retain girls and women in science, math, engineering, and technology curriculum and careers."

Impact of Information Technologies

It is an established fact that women earn 70% of the average male salary. Part of the problem is that women are underrepresented in science, math, engineering, and technology careers [SMET] that traditionally command higher salaries (American Association of University Women, 1998). While enrollments in high school mathematics have increased dramatically for females, their enrollments in college mathematics are considerably less than males (Secada, Fennema, & Adajian, 1995). Significant changes are needed in education, in particular mathematics education, to better motivate and retain girls and women in SMET curriculum and careers. From one perspective, many girls' discomfort with traditional mathematics may result from its presentation as an utterly abstracted exercise, devoid of connectedness to real people, real contexts, and ways to help improve others' lives. Girls on Track creates learning environments centered on community problems where information technologies support the girls' problem-solving efforts.

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