

Internet Explorers: An NSF Sponsored Internship

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1. Introduction

Summer research internships were extended to twenty high school girls who had completed their junior year with the primary goal of increasing middle school girls' participation in science, engineering, and mathematics (SEM). The interns spent eight weeks during the summer of 1997 on the Iowa State University campus where they researched science and engineering topics, learned programming methods and developed SEM units for the Internet.

The summer research interns were directed by a team of four female undergraduate students who have demonstrated ability in computers, were trained in courseware development, and were majoring in SEM-related fields. A female graduate student in secondary education, and also a practicing middle school science teacher, worked as a consultant to the team to provide expertise in curricular content, educational delivery, and impact on the targeted middle school students. Another female graduate student in secondary education, specializing in assessment, worked to assess the program and to provide valuable "self discovery" information for the interns through Learning Styles Inventories and the Myers-Briggs Test. A secondary goal was the enhancement of the undergraduate and graduate women's own professional development.

2. Project Results

Twenty-nine internet explorations covering human biology, natural sciences, and technology were created and can be viewed at <http://ecss.eng.iastate.edu/explorer/>. The four undergraduate students provided the training and day-to-day assistance for the interns in the use of computer technology to design and develop the explorations package. The interns learned quickly and made significant use of the internet and their programming abilities to produce the explorations. A special dimension was added to the undergraduate school experience of the undergraduate mentors. End-of-project reports from the undergraduates showed their experience in serving as mentors to be very positive.

A middle school teacher/graduate student helped aim the explorations at the target audience of middle school girls. She also arranged for visits by members of the target audience to

provide feedback to the interns. Girl scout groups and other middle school age girls were included in the feedback process during the internship. Pictures of their visits with the interns are included in the web site. A letter announcing the explorations packages was sent to every middle school science teacher in the state of Iowa and to the home schools of the interns. Preliminary results include many messages from Iowa middle school teachers and e-mail directly to some of the interns from users of their explorations who are complimentary of the work done. Several of the interns have responded to teachers, families, or individual students through e-mail. Follow-up is planned with middle schools and follow-up visits to the home schools of the interns were conducted, including a trip to Louisiana where nine of the interns live. At these visits the interns did presentations on their research work for their high school classmates. Audience questions about careers in science and engineering were also answered.

3. Assessment Results

The assessment of this project focused on three areas: the impact of the web sites on junior high girls who access the interns' projects, the impact of the internship on the high school girls (Explorers), and given the racial diversity of the Explorers, if differences in their backgrounds were related to differences in their perceptions concerning the role of women in science careers and in their responses to the internship.

The impact web sites developed by the Explorers had on junior high girls:

This area of assessment is ongoing. A "counter" was incorporated into the web site which will track the number of hits recorded on this web site. More importantly, that Iowa State is receiving feedback from middle school teachers and the Explorers are receiving feedback from site users indicates that the image projected by the Explorers is positive. This is the positive role modeling to junior high girls that the internship hoped to achieve. Over the winter, more data will be collected for further analysis.

Impact of the Internship on the Explorers.

Assessment on this aspect of the internship was conducted quantitatively and qualitatively. Quantitative data was gathered through pre-internship and post-internship surveys. Three variables rated by the Explorers on the surveys were 1) their understanding of how scientific research is carried out, 2) their ability to perform scientific research, and 3) their interest in pursuing a career in science. Although the ratings for all three increased between the pre and the post-surveys, the ratings did not show a statistical significance. This is possibly due

to the relatively high ratings the Explorers gave all three areas in the pre-survey – the ratings didn't have very far to move up! The Explorers' gains in these areas were substantiated by interviews and observation. Although many of the Explorers acknowledged they enjoyed working with science early in the internship, the concluding interviews established they felt their knowledge and interest was increased: with enthusiasm!

Another career indicator affected by the internship was the difference in Explorers' expected educational levels between the pre- and the post-internship surveys. Initially, nine of the Explorers expected to attain a Doctoral degree, and one expected to reach the Bachelor's level. The post-survey indicated the number of Doctoral degrees expected raised to thirteen and the rest expected to reach the Master's level. All of the Explorers interviewed mentioned the impact meeting women actively engaged in science careers during the internship impressed them. They indicated surprise at the diversity of opportunities available to them as women with careers in science.

Interestingly, the focus of the science interest also changed. Initially and during the internship, many of the Explorers viewed themselves in careers related to biology and health sciences. The change in their perception did not evidence itself until recently when all of the Iowa participants shifted their career goals to include engineering. The rest of the participants have not been contacted, but a shift would not be surprising since they were not substantially different from the Iowans initially. It apparently takes time for the Explorers to process all of the experiences from the internship and for ideas to germinate, so continued follow-up is necessary.

Other gains from the internship program reported by the Explorers were:

- Improved social skills and coping with diversity. = 11
- Improved computer knowledge / skills. = 9
- Increased confidence, understanding of people. = 9
- Improved knowledge and use of the html / www. = 8
- Increased readiness for college life. = 2

Fifteen Explorers also reported that the internship would make a difference in their school work or participation in school activities. Reasons given for this difference were 1) their increased personal maturity, 2) improved ability to use computer and the web, 3) and increased self-confidence.

Sixteen of the Explorers reported that the internship influenced the way in which they react to the image(s) of men and women scientists and engineers. The influence was positive with the increased awareness of women as scientists / engineers and the awareness of possible careers for them.

Background influence on the Explorers' interest in careers in science.

No relationship was found between differences in the Explorers' background related to differences in their interest in careers in science. This was explored statistically with variables of race (white and minority), High School class size (range 8 to 440), Father's educational level, and Mother's educational level. The high mean rating score of 8.53 on a 10 point scale for the Explorer's science interest did not allow much room for variance to discern the influence of background factors. A larger sample would probably be needed to find differences in such a "tight" group.

The surveys and the interviews yielded interesting results in who or what influenced the Explorers in life and in their choice of careers. The most important influence on the Explorers life in general, by survey, was the Explorers' mothers. The Explorers' fathers came in second. This was supported in the interviews. The surveys indicated that the Explorers' enjoyment of "subject matter" was the major influencing factor for their choice of a career. The interviews indicated, their parents support was also an important factor in career choice: not by role modeling a career in science but by the acceptance of the Explorer's academic goals. Few female role models pursuing science careers were mentioned and those were in the field of education.

Longitudinal assessment of the Explorers would be ideal. We could follow the impact that developmental stages of college experiences have on the Explorers' career goals and changing perceptions of women in science and engineering.

4. Conclusions

As a result of this project, 20 high school girls from minority and rural backgrounds had the opportunity to acquire a high level of computer skills, experience a developmental research project, and increase their self-esteem by successfully completing a sophisticated computer project addressing the socially relevant issue of increasing girls' access to and interest in SEM. Four female undergraduate students in SEM and one in education had the opportunity to mentor and to teach a group of minimally trained but extremely capable interns. Apart from financial support in the summer, the experience of working in a research setting where they are the leaders

has bolstered these women's self-confidence and added a dimension of diversity to their education. All 20 interns intend to attend college and almost all have indicated their intention to major in a technological field. All eight interns from Iowa plan to enroll at Iowa State, seven in engineering.

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