EXPANDING YOUR HORIZONS: A STUDY OF GIRLS PARTICIPATION IN MATH AND SCIENCE

HUMBOLDT STATE UNIVERSITY

By

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ABSTRACT

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Lori Ann Cortez-Regan

The purpose of my project is to provide both a report of the 2005 Expanding Your Horizons (EYH) conference and a longitudinal evaluation of the effects that past EYH Conferences have had for middle school girls in Northern California. The goal of each conference is to get girls to take more math and science in high school so they have more options later on in life. The 2005 report will examine both the demographics of the participants and their evaluations of the conference. The longitudinal portion will assist the local AAUW branch in determining how to best allocate their resources by examining whether or not past EYH attendees did take more math and science in high school compared to girls who never attended a conference. This information will aid in the future planning of conferences to ensure that AAUW’s goal of encouraging girls to explore and pursue careers in math and science.
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CHAPTER 1:
INTRODUCTION

“Science and technology have never been more essential to the defense of the nation and the health of our economy” – President George W. Bush (2001)

“When I compare our high schools to what I see when I’m traveling abroad, I am terrified for our workforce of tomorrow.” – Bill Gates, Chairman & Chief Software Architect of Microsoft Corporation (2005)

There is a crisis that is happening to this country. In this ever advancing technological world, we are falling behind. A report for the Committee on Prospering in the Global Economy of the 21st Century (United States, 2007), states the following:

- US 15-year olds ranked 24th out of 40 countries that participated in a 2003 administration of the Program for International Student Assessment examination, which assessed student’s ability to apply mathematical concepts to real-world problems.
• Fewer than one-third of the US 4th-grade and 8th-grade students performed at or above a level called “proficient” in mathematics.

• In South Korea, 38% of all undergraduates receive their degrees in natural science or engineering. In France, the figure is 47%, in China, 50%, and in Singapore, 67%. In the United States, the corresponding figure is 15%.

• About one-third of US Students intending to major in engineering switch majors before graduating.

According to the National Science Foundation (NSF) (2007), there is indeed low percentage of students graduating with science and engineering degrees. In 2004, only 452,338 bachelor degrees in science and engineering were awarded compared to 954,671 degrees in non-science and engineering fields. Fifty percent of the degrees in S&E fields were awarded to females. In 1995, only 47% of S&E degrees were awarded to women. Even though the numbers are slowly rising, the concern of involving more girls and minorities in STEM courses and careers is still very valid.
Even though females make up half of the recipients of bachelor degrees in S&E, when one takes a closer look at the fields of study, there is still a significant gender gap. While females made up the majority of bachelor’s degree recipients in psychology and biological sciences, they made up 42% in physical sciences, 25% in computer science, and 21% in engineering. When race is added into the equation, the numbers get even smaller.

In 2003 (NSF, 2007) only 3% of awarded bachelor’s degrees in S&E respectively went to women of African-American or Hispanic descent. For Master’s degrees in S&E, African-American women represent 4% of the recipients, Hispanic women 2%. Two percent of Doctorate degrees were given to African-American women, and only 1% to Hispanic women. For all three degrees, women of Alaskan Native or American Indian descent made up less than 1% of the total degree recipients.

For my master’s field placement I worked on two connected projects directly related to Expanding Your Horizons and conference efforts to address inequalities in education for science, technology, engineering and math (STEM). I assisted with the coordination of a 2005 science and math conference for middle school girls. I also participated in the design, administration, analysis and reporting of the conference
evaluation. Later I worked on a longitudinal study that followed attendees from earlier conferences into their high school years.

In chapter two of this project, I explain the history of Expanding Your Horizons conferences for girls and the program theory. In chapter three, I engage in an expanded review of research and theory that explains STEM inequalities. Chapter four is a stand alone evaluation report on the 2005 HSU Expanding Horizons Conference. Chapter five discusses my participation in the longitudinal study. Data collection on that study continued after my field placement was complete. Chapter five does include my writing of the methodology, my analysis, and writing on part of the qualitative data. I close this project in chapter six with a summary discussion and reflection on my field placement experiences and their connections to my graduate education experience.
CHAPTER 2:
EXPANDING YOUR HORIZONS CONFERENCES

Program History

In 1976 the Math/Science Network created the first Expanding Your Horizons (EYH) in Science and Mathematics conference at Mills College in Oakland, California. The conferences were created to encourage and support girls’ interest in the areas of math and science. The expectation of the conferences is that girls who attend will be encouraged to consider careers in these disciplines. In 1974 a group of female math and science educators in San Francisco formed the Math/Science Network. The original founders were concerned with the low participation rates of female students in math and science courses (Thompson and Virnoche 2003).

Since the first EYH event, more than 625,000 young girls have attended EYH conferences. In 2003, 26,000 6-12th grade girls attended an Expanding Your Horizons conference in over 89 locales. EYH conferences are developed based on the following assumptions:
• In order to increase the participation of women in mathematics, science, and engineering careers, there must be an increase in the pool of qualified women.

• In order for young women to have the option to enter mathematics, science, and engineering careers, they need to choose to take the appropriate mathematics and science courses in high school.

• Intervention strategies are needed that increase the participation of girls in mathematics by nurturing enjoyment and confidence in mathematics, by connecting the value of mathematics to career opportunities, by providing career role models, and by actively encouraging girls to persevere in mathematics coursework.

(Expanding Your Horizons Network 2007)
Program Theory

Expanding Your Horizons conferences are grounded in sociological theory that explains inequalities in participation in STEM education and professions. While there are many structural and interactional factors that converge and explain STEM inequalities, EYH builds particularly on those grounded in theories of identity and role theory.

The theory of self-concept (Rosenberg 1979) asserts that issues such as social comparison, people judging and evaluating themselves in comparison to particular individual or groups, and self-attribution, individuals drawing conclusions about themselves by observing their own actions and their outcomes, can play an integral part in how a young person develops her concept of self. EYH organizers understand that adolescence is a critical time, in which we lose girls who abandon their belief that they can do anything and shift to stereotypical vocations (Kilbourne and Lazarus 1987). They also drop in self esteem (Pipher 1994). It is important to catch these young girls while this process is still happening; to make them aware of the many opportunities that are available to them.

It has been discovered that role models play an important role in influencing a young individual’s career development (Fadigan and Hammrich 2004). Paa and
McWhirter (2000), found in their study of high school students that same-sex role models were perceived as being more influential on current career expectations than were role models of the opposite sex.

In addition to role-models, girls also ranked ability as more influential on their current career expectations in comparison to their male peers (Paa and McWhirter 2000). Other research has discovered that career interests are better predicted from perceived ability than from actual ability and that perceived barriers might be just as influential as real ones (e.g. Barak 1981; Swanson and Woitke 1997).

Based on these theories, EYH brings girls together to reinvent and reinforce their affinity for STEM fields, to expose them to peer and professional role models, and to connect STEM education to hands on activities that are fun and meaningful. In chapter three of this project I provide an expanded discussion of research and theory that informs STEM inequalities.

EYH Conferences at Humboldt State University

In 1982, Humboldt State University held its first EYH conference. Through 1989, the conferences were held annually for 6\textsuperscript{th} –12\textsuperscript{th} grade girls. From 1990 to present the conferences are held biennially. 1995, Humboldt State University limited its
conference to 6th–8th grade girls due to the high number of girls attending and the low availability of human resources needed to accommodate the attendees. In 2003, 251 girls and 231 adults attended the conference at Humboldt State University (Thompson and Virnoche 2003).

The typical EYH conference at HSU takes place on a Saturday between 9 a.m. and 2 p.m. drawing between 200-500 elementary school girls and around 50 adult participants from Northern California. The conference schedule includes a keynote address and two hands-on formats for the day: workshops and the science mall. Workshops allow the girls to have extended hands-on participation in a small group class format and to hear experiences from women scientists, mathematicians, & engineers. HSU faculty, students and community members, mostly women, facilitate these workshops. In any given year there may be as many as 60 workshops. Girls participate in two of these workshops ranging from dentistry to fun with mathematical modeling. The science mall presenters set up tables in the main meeting room. Girls visit these tables over their lunch period. Exhibits have included hands-on physics and chemistry experiments to animal exhibits. All conference volunteers serve as potential role models and are encouraged to share career information such as, a typical day on the job, job satisfaction, and necessary education. The central message is “take more math and science in high school so you have more choices later on.”
CHAPTER 3:
INEQUALITIES IN STEM PARTICIPATION:
THEORIZING AT CHILDHOOD SOCIALIZATION AND INSTITUTIONAL
PRACTICES AND STRUCTURES

In this section, some of the key issues in inequalities in STEM participation will be introduced. I will explore the process of childhood socialization and its effect on the concept of self and gender identity. I will also examine the importance of role models in the development of self identity and how the lack of role models translates into the inability to locate oneself in a certain role. Next, I will look at gender and STEM ability, in particular, the differences in perceived ability and perceived competency beliefs and how gendered expectations could be responsible for normalizing these differences. In closing, I will examine two structures of education, curriculum offerings and the process of tracking, and their effects on course and career decisions.

Childhood Gender Socialization and Career Constraints

Socialization is the process in which people acquire the knowledge, attitudes, values, and behaviors essential for effective participation in society through social interaction (Hughes, Kroehler, and Vander Zanden 2002). Rokeach (qtd in Maio et al. 2003:286) defines values as “enduring beliefs that a specific mode of conduct or end-state existence is personally or socially preferable to an opposite or converse mode of
conduct or end-state existence.” Schwartz considers values as “abstract ideals that are important guiding principles in one’s life” (Maio et al. 2003:287). Knowledge and attitudes are attained by imitation and conditioning, in which behaviors can be either reinforced or punished depending on how socially desirable they are. Thus, socialization occurs when a person’s behaviors are produced from the rewards and punishments that people and groups offer (Hughes, Kroehler, and Vander Zanden 2002).

During early childhood, parents and immediate family members are the primary agents of socialization. As children become school age and their world expands, teachers and peers become significant reference points for socialization (Mead 1934/1962). The media plays a significant role in this process as well. Media, such as television, movies, comic books, etc. are important agents of socialization because they provide models of behavior and images that assist in the shaping of one’s understanding and place in the world. In 2002, American children age 2-17 watched an average of 25 hours of television per week, or 3 ½ hours per day (Gentile and Walsh, 2002). Some theorists feel, however, that socialization is used to control people and to perpetuate social inequalities (Bowles and Gintis 1976; 2000). It is during this process that perceived abilities and competencies in subjects such as art, literature, math, and science, along with the types of people who work in certain careers or fields are engraved as being gender related.
According to Tesson and Youniss (1995), Piaget advocates a more active view of the child in development; “enable children to make sense of the world as a set of possibilities for action and thereby they can build a framework within which theses possibilities may be envisioned”. As children grow and develop, they interpret the world around them and try to get a sense of where they fit. As they interpret, they also appropriate, reinvent, and reproduce the reality that surrounds them. This means that they are striving to reinterpret that which they observe in the adult culture and also reproduce it in their own sub-culture (Corsaro and Fingerson 2003).

Entrance into elementary school marks a critical transition for children. Attitudes that are established early in education may follow children throughout their lives. Ongoing gender socialization and gender boundary marking and separation occurs (Thorne [1986] 2003). According to Davies (1989), preschool children place an extreme amount of importance on accurate gender definitions for themselves and their peers. The gender categories are created and sustained by the children’s narrative structure. They are mutually exclusive, rigid, and impenetrable. During her research, Davies read feminist stories to preschoolers. She discovered that even when children are presented with alternative discourse, “it is hard for children to imagine, much less accept, and practice, any alternative to their existing dualistic gender order. Some children might be interested in doing things assigned to the other gender, but they are constrained by their
gender categories and the threat of peer sanctions” (Davies qtd. in Corsaro and Fingerson 2003).

In a study focusing on gender stereotypes in elementary school students, Andre et al. (1999) found that the students’ gendered stereotyping of certain careers was consistent with cultural stereotypes. Both boys and girls rated jobs that are scientific and/or mathematical as more masculine. This can create problems for children who show interest in areas that are not gender typical and can have some effect on the child’s perception of the self. In their review on the literature, Peterson & Colangelo (1996) found that girls are more likely to forego academic interests and underachieve as a trade-off for peer acceptance.

Since parents are the primary source of information for children in the beginning of their life, it only makes sense that children’s attitudes and values correlate significantly with their parents’ attitudes and values. It has been found that an interaction exists between parents’ gender stereotypes and children’s self-perception that influences children’s performance. Andre et al. (1999) asked K-6 grade children and their parents at a school in Iowa to complete a questionnaire related to attitude and belief of school subjects. They found that parents perceived boys as more competent in science. Parents perceived science as more important for boys and expected higher performance from
them. Overall, jobs requiring science and mathematics were viewed as masculine by both students and parents. Interestingly, a positive affect was discovered in the father’s perception of ability related to child’s liking of physical science, but did relate in other subjects. It is perceived importance that is significant since it can directly affect the amount of encouragement a child receives from their parents. This could translate into the parents’ perceived importance being manifested in the opportunities and activities that they make available to their children. Consequently, it is possible that girls may be adversely affected by indirect influences (Andre et al. 1999; Peterson and Colangelo 1996).

Self and Identity and STEM Role Models

Self and identity have been distinctly theorized. While the self is a process and organization born of self-reflection (Mead 1943/1962), identity is used as a marker in which an individual or group can locate their social orientation to the world. Processes of self are important to decisions about one’s place in society. People assess their performance, abilities, and characteristics through social comparison. They use the comparison to rate themselves in relation to others. During this process, people may draw conclusions about themselves through self-attribution, internalizing failures, and externalizing successes. According to Rosenberg, there are four main principles in the
development of self-concept that are evident in “most of the theoretical reasoning employed in the literature to understand the bearing of interpersonal and social structural processes on the self-concept” (1979: 62).

- Reflected appraisal – that the self is a social product derived from the attitudes that others have of one’s self and thus become the way one eventually sees one’s self.

- Social comparisons – people judging and evaluating themselves in comparison to particular individuals or groups.

- Self-attribution – individuals drawing conclusions about themselves by observing their own actions and their outcomes.

- Psychological centrality – belief that the self is an interrelated system of hierarchically organized components, with some attributes and qualities being more important to the self than to others.

It has been found that role models play a significant role in influencing young individuals’ career development (e.g. Fadigan and Hammrich 2004). Paa and McWhirter
(2000), found in their study of high school students that for girls, the three strongest environmental influences were mother, father, and female friends. Male teachers and counselors had the lowest perceived influence. Same-sex role models were perceived as being more influential on current career expectations than were role models of the opposite sex.

Young girls often have few immediate same-sex role-models in math and science education. Even the course curriculum at times fails to provide girls with female role models. Sadker and Sadker (1994) found that science textbooks and curricula fail to equally represent girls and women in photos, text narratives and illustrations. Also, the concepts that were frequently used were presented from male-oriented examples such as sports and cars.

This lack of female examples limits the opportunities that girls have for social comparison. It limits their choices by restricting information regarding existing options. Children learn early on what is expected of their gender role and how to model it. By not having representable role-models for these young girls, gender stereotypes are perpetuated and girls are left out.
There is an identity/perception problem that remains as a principle factor in STEM inequalities. Studies (Chambers 1983; Daniels and Kahle 1987; Mead and Metraux 1962; Schibeci and Sorenson 1983) have found that a majority of students from kindergarten through college have portrayed a scientist as “a bald, middle-aged or elderly white man with a lot of facial hair who wears a lab coat and glasses” (Parsons 1997:749). In a similar study, African-American females high school students were asked to draw a sketch of what a scientist looks like to them. A majority of the girls described the scientist as a white male. Only two girls described the scientist as being an African-American woman (Parson 1997). Women, especially those of color are having a difficult time identifying themselves with the role models and perceptions that are made available to them.

Gender and STEM Ability

In addition to role-models, girls also ranked ability as more influential on their current career expectations in comparison to their male peers (Paa and McWhirter 2000). Further research has discovered that career interests are better predicted from perceived ability than from actual ability and that perceived barriers might be just as influential as real ones (e.g. Barak 1981; Swanson & Woitke 1997). Even though girls perform as well as boys in science and math, there is a drastic loss of interest in science, math,
engineering, and technology (STEM) that happens in junior high (Fennema and Sherman 1978; James and Smith 1985). Andre et al. (1999) found that in grades 4-6, boys rated their physical competence higher than the girls did. This difference was not present in grades K-3. Due to negative attitudes to STEM courses, girls may elect to take other courses that they might find more enjoyable.

Expectation States Theory

According to expectation states theory, there are some advantages that some members of society have that are denied to others. These structural hierarchies are referred to as “power and prestige structures”. Berger claims that this is a theory of an underlying process that accounts for the formation of interactional status structures and can explain how these structures develop in both groups where people are equal and where they differ in socially significant ways. He further states that people often have implicit anticipations regarding the quality of an individual’s performance, which is also known as performance expectation states (Correll and Ridgeway 2003).

An attribute must be salient to affect performance expectations. It must stand out in some significant way. Actors then use these attributes, also known as status characteristics, to anticipate the quality of anticipated performance (Correll and Ridgeway 2003). Gender is an example of a salient attribute that affects performance
expectations. Many shared cultural beliefs about gender include expectations that women are better than men with some tasks and vice-versa. For example, women are believed to perform better in language and arts and men in math and science.

In a study on competency beliefs and gender stereotypes (Andre et al. 1999), it was discovered that the older girls in the study expected to perform higher in art, social skills, computer science, reading, language arts, music, and team sports than in all other subjects and lowest in physical science and dance/gymnastics. They also rated physical science as being among their least liked subjects.

These characteristics can then be applied to entire groups and can become the basis of stereotyping. Part of the issue, however is that research (e.g. Gurian 1997; Pollack 1998; Sommers 1999) has begun to naturalize gender differences. People use such research to maintain mistaken perceptions regarding gender and do not take into account the social environment that is responsible for these gendered orientations (Kimmel 2004). Since, girls and boys each have their own distinct social reality, their process of socialization are different. Thus, their experiences and perceptions are different as well.
The fact that the process of stereotyping is consensual means that even those disadvantaged by the belief, accept the social fact that their group is evaluated as being socially inferior. This leads to individuals having to go through the burden of proof process, where they feel as though they have to prove that they are worthy of their place despite their salient attribute (Steele and Aronson 1995).

Educational Structures and Career Foundations

Two main structures that dictate the courses that are available to students are the curriculum and tracking. Curriculum offerings are often connected to the socioeconomics of their neighborhoods. Schools get some of their funding from local taxes, in addition to monetary parental support at school fundraisers. Higher property values translate into more money for more teachers, classes, programs, opportunities. Schools in lower socioeconomic and rural areas are often forced to stretch their resources due to limited funds.

Tracking is the practice of placing students in different curriculum sequences based on a test, previous grades, or a teacher’s recommendation. So, even if a school has a large span of course offerings, not all of the students get to participate equally. Therefore, the availability of advanced courses provides opportunities to those students in
academic tracks, but not to those in non-academic tracks. This intensifies the differences between the groups and makes the gap even wider (Gamoran and Mare 1989).

Curricular Offerings

Richard Coley (1999) studied the courses U.S. high school students select, differences in course offerings across different types of schools, and course taking patterns by race, gender, and socioeconomic status. Coley found that while public, secular private, and Catholic schools were similar in their course offerings, they lacked advanced course offerings in science and foreign languages. These shortfalls were even more prevalent in secular private schools. Just under half of all schools required 3 or more years of mathematics, and only 32% of public high school students took 3 years of math. Breadth and depth of the course offerings were constricted in schools in small rural communities. African-American and Hispanic students tended to take fewer math and science classes regardless of school type. According to a study by Orfield and Paul (1994), only 45% of African-American seniors had completed geometry, a “gateway-to-college” course. In contrast, 66% of white seniors reported completing the course.

In rural towns, students are not always given the same opportunities and exposure that their urban counter-parts receive. Coley (1999) found that students attending schools
in smaller communities, in general, had fewer advanced placement course offerings and lower graduation requirements. These students were also more likely to report taking fewer and less-advanced math, science, and foreign language courses.

During their research on Australian youths' course selection, Fullarton and Ainley (2000) found that previous studies (Lamb and Ainley 1999; Lamb and Ball 1999) demonstrated that students who were most likely to participate in advanced courses came from higher socioeconomic backgrounds and private schools. They were also more likely to be from non-English speaking backgrounds and were high achievers early on in their school careers. Students from disadvantaged backgrounds tended to take more vocationally oriented courses. According to the Longitudinal Surveys of Australian Youth (LSAY) project, in the 90’s, 90% of typical Australian youths were enrolled in at least one mathematic course in their final year of secondary school. In terms of gender, males predominated in areas of math, physical sciences, technical studies, computer studies, and physical education. Females tended to predominate in areas of English, humanities and social sciences, the arts, languages, and biological sciences. Enrollment in both math and physical science were found to be influenced by socioeconomic background.
Research shows that the gender gap in STEM is closing. In 2004, 50% of STEM bachelor’s degrees were awarded to women (American Association of Women Educational Foundation 2006). Women are starting to match the numbers of their male counterparts. Race, however, continues to play a significant role in course taking and advising. Often times, minority students are the first in their families to attend college and have difficulties adjusting to life away from their family and finding peers and mentors who relate to their situation. African-America, Hispanic, Native American, and Alaskan Native women make up less than 5% of S&E Master’s & Doctorate degree recipients (NSF 2006). Of all the people employed in a S&E occupation in 2003 (NSF 2006), 7% were African-American females, 5% were Hispanic females, and less than one percent were women of Alaskan Native or American Native descent. This low number translates into a deficiency of role-models for young girls of color. Without proper role-models, it is hard for individuals to envision themselves in a certain role.

Tracking and Course and Career Decisions

Many different factors are in play when a student chooses his or her course work in high school. One of the main practices that are utilized for course placement is the tracking system. Tracking is described as the practice of separating children into different courses according to their academic ability (Wikipedia 2007). Using this
method, students are placed in different levels of courses based either on some sort of placement test or on the recommendation of their eighth grade teachers. According to Hallinan (1994), tracking’s original purpose was to increase the effectiveness and efficiency of instruction. However, due to undesirable consequences, tracking has become an obstacle to goal attainment. Gamoran felt that tracking may “affect the dispersion of achievement, or educational inequality. Tracking adds to inequality when placement in a high-status track permits students to gain more than if they had been assigned to a lower track” (1992:812).

Coley believes that this system is detrimental to the students. By assigning students to non-academic classes, the system is basically shutting doors for opportunity and advancement. He feels that “[T]hese students might be subjected to lower expectations, receive lower-quality instruction, be exposed to ‘watered-down’ content, have little access to other school resources, and have little or no opportunity to progress to a more challenging program” (199:10). He also found that students in non-academic tracks did not take as extensive or advanced coursework as their academic tracked peers.

In one study of a mid-west town, less than 1/3 of African-American seniors were enrolled in college preparatory courses compared to more than half of the white students. In addition to “gateway” classes, colleges and universities also rely on tests such as SATs
and ACTs to select potential students. Only 31% of African-American seniors reported taking the PSATs, a practice SAT test that is usually taken in the junior year of high school. A mere 18% reported taking the SATs. In comparison, 57% of the White students took the PSATs and 45% took the SATs (Coley 1999). The study also found that compared to White students, African-American and Hispanic students took fewer courses in mathematics, science, and foreign language, all of which are college requirements (Coley 1999).

High school counselors serve as “gatekeepers” of class placement. In 1997, the National Science Foundation reported that high school counselors encouraged fewer girls than boys to take elective and advanced science and math courses. It has long been the practice to have counselors use their professional training and personal judgment to recommend students to the “appropriate” courses. The problem, though, is that by doing this, the counselors are essentially deciding which opportunities should be presented to which students. This role “grew out of the philosophy that not all students should be educated in the same way but should be schooled according to their abilities and interests and society’s perceived needs” (Orfield and Paul 1994:114). Work-bound girls were more likely to report that their teachers and counselors had not counseled them on college. These girls were also less likely to consult with a counselor regarding long-term academic plans, including college information and financial aid.
At times, students are forced to make these decisions without support or assistance from the school. In a report on Hoosier teens and education (Orfield and Paul 1994), it was discovered that only 31% of the students said that received information regarding school programs and the career opportunities linked to them either before or at the key decision point. Twenty-five percent reported getting this information too late.

Discussion

It has been shown that gendered stereotyping of careers occurs at an early age. Children pattern themselves after the people and images that are made available to them, therefore, it is important to provide girls with STEM role models early on in their educational experience. By early exposure to representative role models, perhaps we can help girls to visualize themselves in STEM courses and career and prevent gendered stereotypes of careers. It is also crucial that we examine the structures of course curriculum and tracking and their effects on course taking and career opportunities. Another area of interest is in the programs that have been specifically designed to foster STEM participation for girls. These programs seek to provide young girls with women and minority role models and to provide them with early exposure to STEM opportunities.
There are a number of programs aimed at encouraging and fostering young girls’ interest in STEM subjects. Some examples include Girls Go Tech, All Girls/All Math, Sciencescape, and of course, Expanding Your Horizon. Programs such as these often provide opportunities for mentoring, improvement of skills, and offsetting gender-role stereotypes that are related to STEM careers. Science programs which are designed specifically for girls aid in increasing their understanding and perceived importance of science (American Association of Women Educational Foundation 1998). They also provide them with opportunities to explore and develop skills that they may have otherwise missed out on.

Clearly the factors that contribute to low female participation in STEM courses are much more complicated than attributing it to a few causes. The very process of early childhood development and socialization can have lasting effects that help shape our ideas of who and what we should be. Sadly, this topic remains understudied. It is important to take a closer look at the programs that are available to girls to ensure that their message is reaching the girls. In the next two chapters, I will evaluate the successes and effectiveness of the Humboldt State University EYH conference.
CHAPTER 4:
PROGRAM EVALUATION OF THE HUMBOLDT STATE UNIVERSITY
2005 EXPANDING YOUR HORIZONS CONFERENCE

This chapter is a stand alone report prepared for the HSU Expanding Your Horizons Steering Committee

Expanding Your Horizons
2005 Conference

Humboldt State University

Conference Evaluation

Prepared for the Humboldt State University EYH Steering Committee

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Expanding Your Horizons Conferences for girls are held each year in cities across the U.S. The central conference objective is to encourage and support girls’ interests in math and science. Since the first EYH event, more than 625,000 young girls and have attended EYH conferences. In 2003, 26,000 6-12th grade girls attended Expanding Your Horizons conference in over 89 locales (Expanding Your Horizons Network 2007).

Since 1975, HSU has hosted EYH conferences on campus drawing participants from across Northern California. This report is an evaluation of the 16th EYH conference hosted by Humboldt State University in 2005. The conference director estimated that 325 girls and 50 adults participated in the 2005 conference.

Conference Organization and Methodology

Girls gathered in the HSU West Gymnasium where they picked up their conference materials and workshop assignments. The conference began with a welcome from the Conference Director and Professor of Environmental Resources Engineering, Beth Eschenbach. Two staff members from the San Diego Zoo gave the opening presentation to all attendees. Next girls broke into assigned workshop groups. Most girls who pre-registered received one of their top choices. Workshop numbers and titles were posted around the perimeter of the gym and girls were asked to find their numbers. Then the groups were escorted to one of twenty-six workshops. After the workshops, the girls
were escorted back to the gym where they reorganized and were again escorted by volunteers to their second workshop.

After the two workshops, there was a break for lunch. Girls brought their own lunches and picnicked in the gym. At the same time they collected their science kits in exchange for a “ticket” included in their packet. They also explored the science mall, a series of hands-on exhibits staffed by students, faculty and professionals from the area. After the lunch and science mall break, everyone reconvened for a closing presentation from a woman who studied the redwood forest canopy. Beth Eschenbach closed the conference reminding girls to “Take more math and science” and to complete and turn in their conference evaluations (Appendices A). Completed evaluations were exchanged for a conference T-shirt, as girls exited the gym. This report is based on the 303 questionnaires that were collected from 2005 EYH girl participants. Data was entered into SPSS and analyzed.

Demographics of the Girls

The girls who attended the conference were in 5th to the 8th grade with the exception of one participant who stated that she was in the 4th grade. Most of the participants were in either the 6th or 7th grade (27 percent each), 25 percent were in the 5th grade, and 21 percent were in the 8th grade. Girls primarily identified as either Caucasian
(66 percent) or Native-American (21 percent) including 2 percent who identified as Hispanic/Native-American and one percent who identified as Asian/Native-American. The other 12 percent of the girls identified with other ethnic or multi-ethnic groups: Hispanic (6%), African-American (3%), Other (3%), Asian-American (2%) (Table 1).

The girls came from 55 different schools and 40 different cities or townships in Northern California (Table 2). Arcata, the city that hosts the conference had the largest percentage of attendees with 12 percent. Ten percent of the girls came from Eureka and another 8 percent were from McKinleyville. Other locations with high attendance were Point Arena (8 percent), Crescent City (7 percent), Hayfork (6 percent) and Weaverville (6 percent). Small populations of rural localities likely influenced the low turn out from other school locations. For example, only 1 percent of the girls were from Hoopa, the primary city on the Hoopa Valley Indian reservation located in Trinity County. Other towns that contributed 5% or less of the participants include Bayside, Petrolia, Fortuna, Lewiston, Mad River, Blockburg, Freshwater, Gasquet, Trinidad, Cutten, Fort Dick, Big Lagoon, Bridgeville, Van Duzen, Fieldbroook, Redway, Loleta, Whitehorn, Alderpoint, Legget, Zenia, Mendocino, Ferndale, Douglas City, Crescent Elk, Big Bar, Ukiah, Dinsmore, Blue Lake, Manila, Hydesville, Kneeland.
Recruitment and Marketing

Most of the girls (78%) reported that they heard about EYH from their teacher. Eleven percent said that they heard about it from a parent and eight percent had heard about EYH from a friend. Ten percent found out about the conference through other means including their school counselor, a newspaper ad, a newspaper article or school visitor.

Using a Likert-scale, the girls were asked how they felt about the statement, “I would recommend EYH to my Friends”. Given that eight percent of this year’s girls reported hearing about EYH from a friend, this question is one of special importance because it aids us in evaluating the potential success of word-of-mouth advertising as EYH alumni return to their schools. A majority of the girls (70 percent) agreed with this statement. Still seven percent of the participants would not recommend EYH to their friends (Table 3).

Program Packet and Workshop Materials

The girls were asked to evaluate the program packets and the workshop materials. Most of the girls rated them as being either excellent or good. Only a few girls rated them as fair, and even fewer as poor (Table 4).
Opening and Closing Guest Speakers

The 2005 conference opened with two women from the San Diego Zoo. Their opening presentation was well received with three-fourths of the girls rating them at “excellent.” The closing speaker, a woman who studied the redwood forest canopy, was not as highly scored as the opening speakers. Still most of the girls (59%) rated the closing speaking as being “excellent” (Table 5).

First Session Workshops

The girls were asked to rank the workshop presenter’s ability to communicate the topic, the quality of the activities, and the extent that workshop encouraged further learning. Overall, the girls gave high rankings to all three measures in the first workshop that they had attended. Sixty-two percent said that the quality of the workshop was excellent. Another 25% ranked it as good. Six percent said it was fair and only 1% rated it as poor. In terms of the presenter’s ability to effectively communicate the concepts, 64% percent felt that they did an excellent job. Twenty-nine percent rated their ability as good, 5% as fair and 1% as poor. When asked to rank what extent the workshop made on their individual desires to learn more about the topic, more than half felt that the workshop had done an excellent job at encouraging further learning and exploration (Table 6).
Second Session Workshops

The girls were asked the same questions about the second workshop. Again the girls gave high marks to the workshops. Most felt that the presenters did an excellent job (66%), 27% ranked them as being good, 7% fair. Less than 1% felt that the presenter had done a poor job. The quality of the workshop was rated as being excellent by 70% of the girls. Eighteen percent rated it as good, 11% as fair, and 2% as poor (Table 7).

Science Mall Exhibits

Even though most of the girls who evaluated the science mall gave it high ratings (91 percent rated it good to excellent), 67 girls failed to respond to this question (Table 8). It is possible that the low response rate on this question could be interpreted to mean that girls did not participate: we did not include an “NA” category and the science mall overlapped with eating and socializing time. Yet another interpretation could be that girls did not realize that the exhibits that they engaged were identified as the “science mall” on the questionnaire.
Changes in Interest in Math and Science

Most girls who participate in EYH come to the conference with already established interests in math and science. We asked the girls to reflect on these interests and tell us if they had changed after participating in the conference.

A majority of girls reported interests in both the subjects of math (67%) and science (79%). Participating in the conference strengthened that interest for most of the girls. Forty-seven percent of the girls who were already interested in math reported an increase in their interest. Likewise, 71% of the girls already interested in science reported an increased interest in science (Table 9).

We also asked the girls about their interests in math and science careers. Again, most of the girls with pre-existing interests in a math and science careers reported increases in those interests after participating in EYH (48 percent and 60 percent respectively).

We note here that change was measured with a statement that asked about “increased interest”. For the girls reporting no increased interest, the data could be interpreted to mean that their interests either stayed the same or decreased. While it is
possible that the conference could have had a negative impact on girls’ interests in math and science, the overall message of the data is that girls enjoyed the conference. Therefore, we interpret the results to mean that interests were sustained but not increased when girls reported no increase in interests.

EYH also had an impact on girls who were not interested in math or science before the conference. Girls with little prior interest in math and math careers increased their interests (15 percent and 18 percent respectively). Girls with little prior interest in the subject of science and science careers increased their interests as well (12 percent and 15 percent respectively).

Still a small number of girls came to the conference uninterested and left uninterested in math and science. Most notably, interest in math careers continues to be the most recalcitrant with a full 29% of girls not interested in math careers prior to EYH still reporting no interest in math careers. A part of this lack of interest may be explained by a lack of concrete and interesting examples of “math careers.” Yet a considerable number of girls (20 percent) also reported no prior and no gained interest in science careers. As other research has suggested, girls’ interests and engagement in the academic subjects of math and science is not yet fully translating into shifts in career trajectories (American Association of University Women, 2000).
Due to the small number of girls of color of any particular minority background attending the conference, it was necessary for statistical purposes to create one group of all girls of color. Of the respondents, 66% self-identified as Caucasian and 34% as girls of color. Caucasian girls (72%) were more likely to have come to the conference with a pre-established interest in math compared to the girls of color (61%). Yet both Caucasian girls and girls of color came to the conference with similar likelihood of interest in science: 78 percent and 79 percent respectively.

When questioned about their interest in math & science after attending EYH, about an equal amount of the girls from both groups responded the same. There were no statistical differences present to suggest a relationship between race/ethnicity in interest in math and science. Sixty-one percent of Caucasian girls agreed that their interest in math increased due to EYH compared to sixty percent of girls of color. Forty percent of both Caucasian girls and girls of color felt that EYH did not increase their interest in math. When asked about an interest in a math career, fifty-three percent of the Caucasian girls and fifty percent of the girls of color reported having an interest in a math career prior to attending EYH. Sixty-five percent of the Caucasian girls reported an increased interest in a math career due to EYH compared to sixty-six percent of the girls of color.
When questioned about their interest in science, eighty-one percent of Caucasian girls and eighty-six percent of girls of color agreed that their interest in science had increased due to their participation in EYH. Sixty-three percent both Caucasian and girls of color reported having an interest in science before attending EYH. Seventy-four percent of Caucasian girls agreed to an increased interest in a science career after attending EYH compared to seventy-five percent of girls of color.

Summary and Recommendations

Overall, the 2005 EYH conference was a success. On all measures of quality and satisfaction, girls overwhelmingly reported high ratings. In addition, on measures of interest, a majority of girls reported sustained or increased interests in math and science subjects and careers.

We have the following recommendations for EYH programs and their evaluations in the future:

- As most girls continue to find out about the conference through teachers, the EYH steering committee should continue to concentrate efforts in developing and sustaining relationships with school teachers.
Given the recalcitrance of shifting interests in math careers, the steering committee should give special attention to highlighting “math careers,” providing concrete examples and real women role models who identify with “math careers.”

The low response rate on the “science mall” question may have been because girls did not identify the lunch activities as a “science mall.” Change future evaluations to describe that event to avoid confusion.
CHAPTER 5:
HUMBOLDT STATE UNIVERSITY
EXPANDING YOUR HORIZONS LONGITUDINAL STUDY

Participation Description

During Spring 2005 I joined an ongoing applied sociology project linked with the Department of Sociology at HSU. Since 2001 Dr. Mary Virnoche had been involved in the planning and evaluation of EYH conferences at HSU and involved student teams in the project. I became both involved with the coordination of the 2005 conference and its evaluation, as well as in the development, coordination and administration of a longitudinal outcomes study of earlier EYH conference participants. In the last section I presented the evaluation report I wrote for the 2005 conference. In this section I discuss my experiences working on the longitudinal study.

The purpose of the study was to look in depth at the conference and see if it was really making an impact on the courses that its participants chose in high school, especially for girls of color. When I joined the study, Mary Virnoche and Leah Thompson had established contacts at three local high schools.

For the beginning portion of the study, I worked closely with a co-researcher, Leah Thompson. Together, we constructed our sample population and designed and sent
out mailers to our subjects requesting an interview with them. We constructed and
maintained a database of the participants and their demographic information.

I also contacted by phone all the girls who returned permission slips and set up
focus groups. For Bayside High, I went to the school and personally handed out the
mailers. I also supervised individual telephone interviews. The biggest challenge that we
faced was in setting up the focus groups. It was very time consuming to reach all of the
girls via telephone to schedule the focus groups. It was even harder to find a time frame
that worked well with everyone’s schedule. One challenge that I was not anticipating
was telephoning non-English speaking households. We had a couple of instances were a
research assistant was hung up on because of language barriers. Keeping track of the
data base also proved to be somewhat problematic because there were a number of
research assistants working on it collectively.

At some time in the middle of our study, one of our schools decided to drop out. I
set up a liaison with a teacher that I knew at another high school and was able to work out
an agreement with the superintendent to utilize that school’s population.

I transcribed a number of the interviews that were then entered in Nvivo, a
qualitative analysis program. Together, with a number of co-researchers, we completed
initial coding of the data for common themes that informed future interviewing. Part of my involvement also included authoring and co-authoring drafts of methodology as the study developed. The sections below represent the version of methodology that was last drafted before I left the placement.

Sample Description

The qualitative data for this study were drawn from a sample of 44 girls (change as we add more girls) who attended three High Schools in Northern California. For confidentiality reasons, we chose to use pseudonyms for the high school names. These three schools were chosen because they were likely to capture the most EYH past participants given estimations based on elementary school enrollment of EYH attendees. One of the high schools, Big Bear High School, was selected because of its high enrollment of Native American Students.

We sent consent forms to all 2003 and 2005 EYH participants who were enrolled in our sample schools. For non-EYH participants, we had staff contact all minority female students who were enrolled in 9th-11th grade in the 2004-05 school year. For white non-EYH participants, we had staff generate a random sample to fill a specified number that we provided them with.
Most (52%) participants were white, 20% were Native American and 28% identified with other ethnicities including African American, Hawaiian, Hmong, Japanese, Latina, Mexican and multiethnic identities. All Past EYH participants were either white (80%) or Native American (20%) (Table 10).

Big Bear High School Sample

Big Bear High School in the 2004-05 school year* enrolled 219 students in grades 9 through 12. Most students (68%) were Native American, 24% were Anglo, 5% were Hispanic, and 1% identified with African-American, Asian, Filipino, Pacific Islander, or Multiple ethnicities. The students at Big Bear High school were served by a staff of 15 teachers including 2 Native Language teachers, 2 administrators, a counseling staff of 2, one librarian, and 10-support personnel, including one School Tribal Police Officer (Information drawn from schools accountability report card for 2004-05).

In Spring 2005, working with a counseling staff member, we solicited the involvement of a total of 177 girls from Big Bear High. Given the small population and

* This was the most current enrollment data made publicly available.
our emphasis on understanding Native American girls, we solicited the involvement of all Non-EYH girls in grades 9-11. A total of 93 Non-EYH and 24 EYH girls received research study packets through their homerooms. After two rounds of solicitation, 6 EYH girls and 14 Non-EYH girls at Big Bear returned permission slips (Table 11).

Bayview High School Sample

Bayview High School in the 2006-07 school year enrolled 1,600 students in grades 9 through 12. Information regarding ethnicity for this time period could not be found on the schools web site, however, I was able to find data for the 2005-2006* school year from the California Department of Education. Most students (67%) were white, 12% were Native American or Alaska Native, 7% were Asian, 9% were Hispanic and 2% were African American and 3% identified with other ethnicities. The students at Bayview High school were served by a staff of 81 teachers and 4 administrators, 4 counseling staff members, 22 clerical staff and numerous other support staff including instructional aids. (Data draw from school “Accountability Report Card”).

* This was the most current enrollment data made publicly available.
In Spring 2005 working with a counseling staff member and a clerical staff member who we paid, we solicited the involvement of a total of 246 girls from Bayview High. We solicited the involvement of total 27 Non-EYH girls and 219 EYH girls. Seven (7) EYH girls and 47 Non-EYH girls at Bayview returned permission slips (Table 12).

At this school, the paid clerical staff person sent notes to each student requesting them to come to the office and pick up a packet. She then handed them their research study packets, explained the study and encouraged the girls to bring back signed consent forms. A second round of solicitation was done at the end of the school year by a graduate research assistant. Together with the school counselor, they identified the students that had not responded and sent slips to their 2nd and 3rd period classes, containing a short statement about the study and a request for them to come to the office and speak to the graduate research assistant about the study. This is the only school where this was done.
Oceanview High School Sample

Oceanview High School in the 2005-2006 school year* enrolled 774 students in grades 9 through 12. Most students (83%) were white, 10% were Native American/Alaska Native, 5% were Hispanic, and 1% were African-American or Multiple. Filipino, Pacific Islanders and Asians made up less than one percent of the school’s student population. The students at Oceanview High school were served by a staff of 44 teachers, 3 academic counselors, and numerous other staff including administrators, clerical staff, and instructional aids (Data drawn from school web site).

In Spring 2005 working through the district office we secured the involvement of Oceanview High School students. This school was added late because another high school dropped out of the study due to personnel changes. We searched for another school likely to be hosting a sizable number of past-EYH participants. We solicited the involvement of a total of 181 girls from Oceanview High: 131 Non-EYH girls and 50 EYH girls. We received 12 signed consent forms, 10 of which granted us permission.

* This was the most current enrollment data made publicly available.
All of the consent forms we received were from girls who had been past EYH participants (Table 13).

Since this school was a late participant, we were given access to a master list of all the female students who were enrolled at Oceanview High in the 2004-05 school year. This list included names, grade levels, and a code for race. The race code master list was also provided to us. This is also the only school where we were able to send the packet directly to the girls via mail because the school also provided us with pre-printed mailing labels for all the female students enrolled at the school for the specified academic year stated above.

Focus Groups and Interviews

Since focus groups are flexible and more intimate (Berg, 2004), we decided that the best way to elicit responses from the girls would be to group them in peer groups and conduct focus groups. We felt that by having a focus group setting, that we would solicit more responses, since the girls had each other to bounce the conversation around with, than if we had done just one-on-one interviews (Rubin & Rubin, 1995). One-to-one interviews were conducted when there was only one student in a racial group or if the other students who were scheduled for a focus group did not show up. There is a single
one-to-one interview that was conducted because the girl could not attend when her peer group was scheduled.

The focus groups were set up according to EYH status and race. We chose race as a sorting factor to see if we would observe any differences between groups in the themes that emerged from the interviews. When a certain school had a low number of minority students, we would sometimes schedule a multi-racial focus group to prevent it from becoming a one-to-one interview.

The focus groups were set up by graduate research assistants who went through the received consent forms and sorted them according to EYH status and race. The graduate research assistants then contacted each girl by phone and spoke to them briefly about the study and then asked them if they would be willing to participate in a group discussion with a few of their peers. A series of phone calls were made to reach all of the girls and to coordinate a meeting time. A follow up call was also placed 1-2 days before the agreed upon date to serve as a reminder.

The focus groups and interviews for Bayview stretched out for a period of four months. All but two of the interviews were conducted after school in an on-campus room
that was provided for us by the school. The remaining interviews occurred during the summer but were conducted in school-provided on-campus classroom.

All of the focus groups for Bigbear high were conducted in one day due to the school’s distance. Due to low levels of participation, two focus groups were held simultaneously, one for EYH participants and the other for non-EYH participants. Both interviews were conducted after school in on-campus rooms provided to us by the school.

Due to Oceanview joining late and the interviews being set up close to beginning of the 2005-06 school year, not all of the interviews were able to be conducted on site at the school because of room availability issues. To solve this problem, we set up focus groups with a few of the girls at a local restaurant.

Transcription and Analysis

After all of the interviews were conducted, they were transcribed by graduate research assistants into Word documents. The files were then downloaded into Nvivo, a qualitative data analysis program, and coded for emerging themes by another graduate research assistant. To date, some of the themes that have been observed include:
- a preference to having hands-on and group work incorporated into the class rather than lecture and note taking only.

- feeling as though they have not received adequate advising from counselors.

- taking math and science classes only because they are college requirements.

- not anticipating having to use math or science in their future careers.

Limitations

Problems arose as we tried to stratify across too many ethnic groups with small numbers to begin with and over-sampling on white students. As the study was designed, we anticipated multiple focus groups at each class level including at least two focus groups for Native American, Hispanic and White students. We chose the focus group format to address power differences between high school girls and research team staff. We felt girls in groups of their peers would be more comfortable talking about their high school experiences and would build on each other’s stories. Yet to compile the groups, we needed a large stratified sample from each grade level and ethnicity. In addition, we needed to work with high school staff members who are very busy. To their credit, they worked very hard to help us contact the girls. Yet by the same token, we felt we could
not tax them to contact and recontact the list of girls randomly selected to participate in the study. As the schools would not release the list of names directly to us, we had to rely on the school staff to generate the random sample of Non-EYH girls, as well as direct the letters to Non-EYH and EYH girls whose names we did have. This dissemination role proved to be very time consuming for school staff. In retrospect, had we limited our Non-EYH sample to a smaller group of Native American and white juniors, we could have probably worked out a mechanism for multiple contacts to the list of girls, and may likely have had a better response rate, and less suspicion of sample bias.

Other problems that we encountered related to scheduling issues with the girls. We found that although we would contact the girls a number of times to remind them about the focus groups, some would either not show up or call the day of or before to tell us they were not coming because they made other plans. During the summer, it was also difficult to set up meeting times and locations due to the school’s limited hours.

Results

Even though only a few girls participated in EYH, almost all the girls mentioned being involved in some sort of special program that encouraged students to think about their future, either in terms of college preparation or career exploration. These programs ranged from Talent Search and College Knowledge to HROP job shadowing and science
and job fairs. Some of these girls were referred to these programs by either a teacher or the school via a counselor or bulletins that were read in class. A couple of the interviewee’s, both EYH attendees, stated that their mothers told them about the conference. Two girls, however, were unaware about such programs.

**EYH and STEM Interest**

Some of the girls stated that EYH helped foster an interest in a certain subject or career. Some of the statements the girls made regarding EYH included, “…that’s where I heard what engineering was and what it means…”, and, “…maybe this is what got me interested in the genetics research…” Others believed that the conference helped to further their pre-existing interest in science. “I do remember there was a lot of people there really interested in science and I was surprised at how many people were there, like how many girls were actually interested in that, math and science”, said one conference participant.

**EYH and Course Selection**

Some of the girls interviewed did feel that taking part in the EYH conference did make an impact on their course selection. One girl stated, “… I was in the science room and thinking about labs and stuff. I think it gave me a new look at science, how it would
feel to take classes in high school. Maybe a small introduction.” Another girl declared, “Maybe if it wouldn’t have been for that conference I wouldn’t have wanted to take as many science classes but maybe because of it I did.” Another girl said,” It made me really interested in science.” Still, there were a handful of girls who felt that the conference did not make any impact on their course selection.

EYH and Career Interest

A few of the girls who participated in EYH spoke of how the conference helped spark an interest in an area that they had been previously unfamiliar with. One EYH attendee claimed, “Every time I think of it [the conference] I think of the dentistry lab… it has influenced me so much on what I’m doing and what I’m going to do…” Another girl stated that it was the conference that got her interested in genetics research. Other claimed that it was helpful to have someone that they could discuss potential careers with in depth. Still others claimed that the conference did not have any impact on their future career goals.

Impact of EYH

Some of the girls mentioned that the conference did make a difference for them in middle school but that their interest began to wane in high school due to negative
experiences in the classroom or an increased awareness of available career options. One girl who attended the conference when she was a fifth grader said, “I think [EYH] more influenced my middle school interests in math and science... I don’t remember it affecting what I did in high school though because it was a pretty long time ago.” The one girl who became interested in genetic research due to EYH stated, “For a while I wanted to do genetics research but I think high school changed that for me since I thought I wasn’t as good at science or math. When you think you’re not good at something you can’t really have a career in it.”

After reviewing the transcripts for the girls who attended the EYH conferences, some common themes emerged. Most of these girls already had an interest in math or science. Most were told about the conference and encouraged to attend it adult role models such as teachers and mothers.
CHAPTER 6:
DISCUSSION AND REFLECTIONS

In Chapter one, I familiarized the reader with U.S. STEM education and workforce issues. I focused especially on the low number of women and minorities participating in STEM fields. In Chapter two of this project, I explained the history of Expanding Your Horizons conferences, the organization of a typical HSU conference and the program theory. In Chapter three, I investigated the inequalities in STEM participation by reviewing the research and theories that help explain these inequalities, including the need for women role-models and the impact that parents’ perceptions can make on their children’s course and career selection. Chapter four is a stand alone evaluation report of the 2005 HSU Expanding Your Horizons conference. In chapter five, I discussed my participation in the on-going longitudinal study. In that chapter, I also included my writing of the methodology, my analysis, and writing on a portion of the qualitative data. Data collection on that study continued after my placement was complete.

I feel that this was great placement for me because it gave me the opportunity to start in planning stages of a project. Being involved at the start, allowed me to see first hand the entire behind the scenes work that is involved in a study. Getting out the
consent forms was a lot more challenging and time consuming than I had thought it would be. Also, one of our schools dropped out in the middle of the study.

This taught me that you should not take things for granted and it gave me the opportunity to use my social capital to find a replacement school. In addition, it taught me a lot about working with adolescents. It was a challenge to arrange the focus groups and appease everyone’s schedule. There were also instances when girls would not show up. We would telephone to see what happened and were told that they had decided to do something else instead. Learning how to facilitate focus groups is another excellent experience that I garnered out of this experience. I never knew how hard it would be to get a group of teens together to talk about a subject and stay on topic. Due to my irrational fear of teen-aged girls, I was very unsure of myself and my ability to facilitate. During the first focus group that I led, I thought I was going to have an anxiety attack the whole time. I was so grateful to have my fellow assistant researching, Karen Sherman, there to assist in asking follow up questions. As time went by, I became much more comfortable and at ease. It was much easier for me to get the girls to engage in a conversation and stay on topic towards the end of the project.

I think that the best part of this project was that it forced me to use all of the research skills that I had learned. When I first began this project, most of the literature
was very out of date. I had to scour the stacks to find slightly related subjects and use their references to back track to original studies. As time went on, I was able to find more recent articles that supported my findings as well. This research gave me the ability to create frameworks for both my qualitative and quantitative data analysis.

The issue of qualitative and quantitative research was especially challenging for me. Try as I may, I have always been a numbers girl. I like the feeling of objectivity, though I understand the critiques, when responses are neatly arranged into one of four response categories. I know that the very fact that a researcher created the instrument means it is subjective. Yet participants and consumers of research respond to numbers with great respect because math was used.

Working with qualitative data was a first for me. First, I had to overcome my insecurities of being a focus group facilitator. Then I had to trust my judgment in analyzing the data. I had a hard time with the subjectivity of analysis and the knowledge that a few people were coding the data, each with their own subjectivity. I must say I was relieved when I received a request to analyze the 2005 quantitative data. Dealing with numbers again, I felt like I was back in my territory. However, after working so closely with the interviews, I realized that the quantitative data lacked a richness and clarity that I got from the qualitative data. It helped me to see that there is a lot more to research than
just numbers and statistics. It gave me a deeper and richer understanding for the necessity of studying personal experiences.

Future Work

I think that more longitudinal studies would be beneficial to this research. It is important to see if programs such as EYH are truly making an impact in women and minorities STEM participation. It would be interesting to perform a follow-up study on the girls that we interviewed after they graduated from college to see if EYH attendees had a larger percentage of STEM graduates than non-EYH attendees.

I also feel that maybe there should be some programs for girls both younger and older than the EYH age bracket. Andre et al (1999) felt that the sex-role stereotypes of occupations that they observed in young children pointed for a need in career education and positive role-models at an early age. Some of the girls interviewed also stated that once they started high school, their interest in STEM began to shift to other subjects. Perhaps a long-term program that followed girls through high school would assist in maintaining their interest in math and science (Fadigan and Hammrich 2004).
Table 1. Girls’ Ethnic Backgrounds

<table>
<thead>
<tr>
<th>Ethnic background</th>
<th>Frequency*</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro-American/Caucasian</td>
<td>182</td>
<td>66%</td>
</tr>
<tr>
<td>Native American</td>
<td>48</td>
<td>18%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>16</td>
<td>6%</td>
</tr>
<tr>
<td>African-American</td>
<td>8</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>3%</td>
</tr>
<tr>
<td>Asian-American</td>
<td>6</td>
<td>2%</td>
</tr>
<tr>
<td>Hispanic/Native American</td>
<td>4</td>
<td>2%</td>
</tr>
<tr>
<td>Asian/Native American</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>275</td>
<td>100%</td>
</tr>
</tbody>
</table>

*28 girls did not respond to this question
Table 2. Location of Girls’ Schools

<table>
<thead>
<tr>
<th>City</th>
<th>Frequency*</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arcata</td>
<td>37</td>
<td>12%</td>
</tr>
<tr>
<td>Eurkea</td>
<td>30</td>
<td>10%</td>
</tr>
<tr>
<td>McKinleyville</td>
<td>25</td>
<td>8%</td>
</tr>
<tr>
<td>Point Arena</td>
<td>24</td>
<td>8%</td>
</tr>
<tr>
<td>Crescent City</td>
<td>22</td>
<td>7%</td>
</tr>
<tr>
<td>Hayfork</td>
<td>18</td>
<td>6%</td>
</tr>
<tr>
<td>Weaverville</td>
<td>18</td>
<td>6%</td>
</tr>
<tr>
<td>Hoopa</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>125</td>
<td>42%</td>
</tr>
<tr>
<td>Total</td>
<td>302</td>
<td>100%</td>
</tr>
</tbody>
</table>

*1 girl did not respond to this question
Table 3. Girls’ Attitudes on Statement: “I would recommend EYH to my friends.”

<table>
<thead>
<tr>
<th>Ratings</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>206</td>
<td>70%</td>
</tr>
<tr>
<td>Agree</td>
<td>67</td>
<td>23%</td>
</tr>
<tr>
<td>Disagree</td>
<td>19</td>
<td>6%</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>295</td>
<td>100%</td>
</tr>
</tbody>
</table>

*8 girls did not respond to this question
Table 4. Girls’ Evaluation of Program Packet and Workshop Materials

<table>
<thead>
<tr>
<th>Packet &amp; Material Rating</th>
<th>Frequency*</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>161</td>
<td>56%</td>
</tr>
<tr>
<td>Good</td>
<td>113</td>
<td>39%</td>
</tr>
<tr>
<td>Fair</td>
<td>11</td>
<td>4%</td>
</tr>
<tr>
<td>Poor</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>287</td>
<td>100%</td>
</tr>
</tbody>
</table>

* 16 girls did not respond to this question
Table 5. Girls’ Evaluation of Speakers

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening Speaker*</td>
<td>75% (219)</td>
<td>20% (59)</td>
<td>5% (13)</td>
<td>--</td>
<td>291</td>
</tr>
<tr>
<td>Closing Speaker**</td>
<td>59% (87)</td>
<td>35% (87)</td>
<td>4% (10)</td>
<td>1% (3)</td>
<td>246</td>
</tr>
</tbody>
</table>

*12 girls did not respond to this question  **57 girls did not respond to this question
Table 6. Girls’ Evaluation of First Workshop

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presenter’s Ability on Topic*</td>
<td>64% (187)</td>
<td>30% (88)</td>
<td>5% (14)</td>
<td>1% (3)</td>
<td>292</td>
</tr>
<tr>
<td>Workshop Activities**</td>
<td>66% (187)</td>
<td>27% (76)</td>
<td>6% (18)</td>
<td>1% (2)</td>
<td>283</td>
</tr>
<tr>
<td>Encouraged Learning***</td>
<td>55% (157)</td>
<td>35% (99)</td>
<td>8% (22)</td>
<td>3% (8)</td>
<td>286</td>
</tr>
</tbody>
</table>

*11 girls did not respond to this question  **20 girls did not respond to this question  ***17 girls did not respond to this question
### Table 7. Girls’ Evaluation of First Workshop

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presenter’s Ability on Topic*</td>
<td>66% (190)</td>
<td>27%  (78)</td>
<td>7%  (19)</td>
<td>&gt;1%  (1)</td>
<td>288</td>
</tr>
<tr>
<td>Workshop Activities**</td>
<td>70% (197)</td>
<td>18% (50)</td>
<td>11% (30)</td>
<td>2%  (6)</td>
<td>283</td>
</tr>
<tr>
<td>Encouraged Learning***</td>
<td>57% (166)</td>
<td>29% (83)</td>
<td>10% (28)</td>
<td>4%  (12)</td>
<td>289</td>
</tr>
</tbody>
</table>

*15 girls did not respond to this question  **20 girls did not respond to this question  ***20 girls did not respond to this question
Table 8. Girls’ Evaluation of Science Mall Exhibits

<table>
<thead>
<tr>
<th>Science Mall Exhibits Ratings</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>138</td>
<td>59%</td>
</tr>
<tr>
<td>Good</td>
<td>81</td>
<td>34%</td>
</tr>
<tr>
<td>Fair</td>
<td>14</td>
<td>6%</td>
</tr>
<tr>
<td>Poor</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>236</td>
<td>100%</td>
</tr>
</tbody>
</table>

*67 girls did not answer this question*
Table 9. Changes in Interest in Math and Science

<table>
<thead>
<tr>
<th></th>
<th>Interested &amp; Post EYH Increase</th>
<th>Interested &amp; No Increase</th>
<th>Not Interested &amp; Post EYH Increase</th>
<th>Not Interested &amp; No Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math *</td>
<td>47% (N)*</td>
<td>20% (N)</td>
<td>15% (N)</td>
<td>18% (N)</td>
</tr>
<tr>
<td>Math Career^</td>
<td>48% (N)</td>
<td>5% (N)</td>
<td>18% (N)</td>
<td>29% (N)</td>
</tr>
<tr>
<td>Science **</td>
<td>71% (N)</td>
<td>8% (N)</td>
<td>12% (N)</td>
<td>9% (N)</td>
</tr>
<tr>
<td>Science Career^^</td>
<td>60% (N)</td>
<td>5% (N)</td>
<td>15% (N)</td>
<td>20% (N)</td>
</tr>
</tbody>
</table>

*18 girls did not respond to this question  **20 girls did not respond to this question  ^57 girls did not respond to this question  ^^48 girls did not respond to this question
Table 10. Description of Study Sample

<table>
<thead>
<tr>
<th></th>
<th>PastEYH Participants</th>
<th>Non-EYH Participants</th>
<th>All Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>80% (16)</td>
<td>29% (7)</td>
<td>52% (23)</td>
</tr>
<tr>
<td>Native American</td>
<td>20% (4)</td>
<td>21% (5)</td>
<td>20% (9)</td>
</tr>
<tr>
<td>African-American</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13% (3)</td>
<td></td>
<td>7% (3)</td>
</tr>
<tr>
<td>Hmong</td>
<td>13% (3)</td>
<td></td>
<td>7% (3)</td>
</tr>
<tr>
<td></td>
<td>Past EYH Participants</td>
<td>Non-EYH Participants</td>
<td>All Participants</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------</td>
<td>----------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>25% (6)</td>
<td>14% (6)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100% (20)</td>
<td>100% (24)</td>
<td>100% (44)</td>
</tr>
</tbody>
</table>

**Consent Forms**

<table>
<thead>
<tr>
<th></th>
<th>Consent Forms</th>
<th>Consent Forms</th>
<th>Consent Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received:</td>
<td>25</td>
<td>58</td>
<td>83</td>
</tr>
<tr>
<td>Total Packets Mailed:</td>
<td>101</td>
<td>458</td>
<td>559</td>
</tr>
</tbody>
</table>

**Response Rate:**

- **Past EYH Participants:** 25%
- **Non-EYH Participants:** 13%
- **All Participants:** 15%

*Since we did not have race information on our EYH past participants, we were unable to analyze response rate by race. Due to privacy restrictions, the high school contacts could not release ethnicity information on the names of past EYH participants.*
<table>
<thead>
<tr>
<th></th>
<th>Past EYH Participants</th>
<th>Non-EYH Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>60% (3)</td>
<td>29% (2)</td>
</tr>
<tr>
<td>Native American</td>
<td>40% (2)</td>
<td>43% (3)</td>
</tr>
<tr>
<td>African-American</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hmong</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>29% (2)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100% (5)</td>
<td>100% (7)</td>
</tr>
</tbody>
</table>

Table 11. Description of Study Sample of Big Bear High School
<table>
<thead>
<tr>
<th></th>
<th>Past EYH Participants</th>
<th>Non-EYH Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>100% (7)</td>
<td>30% (11)</td>
</tr>
<tr>
<td>Native American</td>
<td>11% (4)</td>
<td></td>
</tr>
<tr>
<td>African-American</td>
<td>14% (5)</td>
<td></td>
</tr>
<tr>
<td>Hmong</td>
<td></td>
<td>27% (10)</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>19% (7)</td>
</tr>
<tr>
<td>Total</td>
<td>100% (7)</td>
<td>100% (37)</td>
</tr>
</tbody>
</table>
Table 13. Description of Study Sample of Oceanview High School

<table>
<thead>
<tr>
<th>Past EYH Participants</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>80% (8)</td>
</tr>
<tr>
<td>Native American</td>
<td>20% (2)</td>
</tr>
<tr>
<td>African-American</td>
<td></td>
</tr>
<tr>
<td>Hmong</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100% (10)</td>
</tr>
</tbody>
</table>
REFERENCES


APPENDIX A
2005 EXPANDING YOUR HORIZONS CONFERENCE EVALUATION
STUDENT PARTICIPANTS

Tell us how to make EYH 2007 better and pick up an awesome T-Shirt. Just complete this form and bring it to the West Gym at the end of the day. To protect your anonymity, please do not write your name anywhere on this form.

1. Your School Name: ____________________________  2. School Location (city/town):

3. Your Grade in School: __________  4. Gender   Female   Male


   (You may circle more than one.)   Hispanic   Native American   Other ________________

6. How did you hear about the conference? (Circle all that apply.)

   Teacher    School Counselor    Parent    Friend    Newspaper Ad    Newspaper Article    Classroom Visitor    Other_________
Circle the number that corresponds to the response that best reflects how you feel about each item below.

<table>
<thead>
<tr>
<th>Item</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Program Packets &amp; Workshop Materials</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>8. Opening Guest Speaker:</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>9. The ability of the 1st workshop presenter(s) to talk with girls our age about the topic.</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>10. The activities that the 1st workshop presenter had prepared for us to do.</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Circle the number that corresponds to the response that best reflects how you feel about each item below.

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. The extent to which the 1st workshop made me want to know more about the topic.</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>12. Science Mall Exhibits</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>13. The ability of the 2nd workshop presenter(s) to talk with girls our age about the topic.</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>14. The activities that the 2nd workshop presenter had prepared for us to do.</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>15. The extent to which the 2nd workshop made me want to know more about the topic.</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>16. Closing Guest Speakers:</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>----------------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>17.</td>
<td>I was interested in math before coming to EYH.</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>18.</td>
<td>I am more interested in math because of EYH.</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>19.</td>
<td>I was interested in science before coming to EYH.</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>20.</td>
<td>I am more interested in science because of EYH.</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>21.</td>
<td>Before attending EYH, I was considering a career that uses math.</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>
Circle the number that corresponds to the response that best reflects how you feel about each item below

<table>
<thead>
<tr>
<th>Item</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>22. After attending EYH, I am considering a career that uses math.</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>23. Before attending EYH, I was considering a career that uses science.</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>24. After attending EYH, I am considering a career that uses science.</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>25. I would recommend EYH to my friends.</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

26. How can we make the conference better? (Use the back of this form. Write “26” and your answer)

27. If you were telling a friend about something memorable that happened to you at the conference, what would it be?

(Use the back of this form. Write “27” and your story.)