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The reasons why many African-American and Hispanic women do not choose careers in technology

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The reasons why many African-American and Hispanic women do not choose careers in technology

Abstract

There have been numerous statistics showing that minorities including women, African-Americans, Hispanics, and Native Americans, are least likely to choose careers in the science and technology field. Along with those studies have been possible reasons why they choose not to enter into the field. Reasons have ranged from lack of encouragement to people just telling them flat out that there is no possible way that they can succeed in the field.

This study found that African-American and Hispanic women do not choose careers in technology for many of the same reasons. As young children, some factors are the way teachers present math, science, and technology, lack of encouragement, and lack of role models. As women, they are not only dealing with social barriers from work and school, their family members play a major role in how successful women become.

The method used for this research was a one-on-one interview with four women who are in the field of math, science, and technology either by a program they are involved in or by teaching the subjects. Some questions were omitted from some interviews and other questions were added during the interview depending on the direction of the discussion. (See Appendix A) Although the responses given by the four ladies varied, they were similar in content. The answers were also similar to the content in the review of literature.

The reasons why many African-American and Hispanic women do not choose careers in technology

A Graduate research paper

Submitted to the

Division of Curriculum and Instruction

Department of Communications and Training Technology

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

UNIVERSITY OF NORTHERN IOWA

by

Kathryn Elizabeth Guzman

July 2000

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Titled: The reasons why many African-American and Hispanic women do not choose careers in technology

Has been approved as meeting the research requirement for the

Degree of Master of Arts.

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Abstract

There have been numerous statistics showing that minorities including women, African-Americans, Hispanics, and Native Americans, are least likely to choose careers in the science and technology field. Along with those studies have been possible reasons why they choose not to enter into the field. Reasons have ranged from lack of encouragement to people just telling them flat out that there is no possible way that they can succeed in the field.

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Introduction of the Problem

"Minority women face the problems encountered by majority women in science. Not only is science viewed as 'non-black', it is also stereotyped as masculine'" (Harding, 1986, pg. 75). This study has taken an extra step in finding why African-American and Hispanic women do not choose careers in technology. The reason why many cannot choose careers in technology is the weak foundation of math, science, and computer applications. The reason why many do not is because of the dual stereotype that exists for minority women in the science and technology field. This is a problem since there are going to be numerous technology jobs opening within the next couple of years.

In 1995, the Bureau of Labor Statistics, U.S. Department of Labor estimated that technology positions would grow 112% by the year 2005. Technology occupations have relatively good career ladders and are unusually varied. Technology positions can be found in an academic, corporate, government, and nonprofit setting.

Many businesses are also changing the way their companies are run. Technology is being implemented into many positions making most manual labor jobs obsolete. " The need to educate all students to become literate in science and mathematics has taken on increasing importance in order for the United States to remain economically competitive in the global marketplace" (Sanders, Koch, & Urso1997, pg. 74).

With President's initiative on race, the conversation focused on the need for greater racial diversity in the science and technology community, ways to improve minority recruitment programs in science and engineering, and how to deal with the challenges to recruitment programs in science and engineering that target minorities. The following points emerged from the panel discussion:

- First, we still have serious barriers confronting minority participation in science and technology, which must be addressed. According to National Science Board member, Dr. Richard Tapia, "under-representation in science and technology is not just a health of science issue, it's a health of the nation issue"

- Second, the rapidly changing demographics of America in the 21st century requires increased public-private partnerships in science and technology that foster full participation by underrepresented groups.

- Third, the challenge is for public policy to highlight the public-private best practices out there and implement then on the national scale.

- Fourth, we must live up to the promise of life long development of all Americans from childhood to adulthood by encouraging higher-order learning through science, engineering, and mathematics (Office of Science and Technology Policy)

Statement of the Problem

Even though there is a bright future for the technology industry, minorities will still lag behind in numbers because they are not qualified. The majority of the technology positions require a strong background in math and science, which many minorities do not have. A strong link to them not having a solid foundation in math and science starts from the beginning when they were in elementary, junior high, and high school in the math, science, and computer courses. "By the age of 14, girls often develop an anxiety about math, which educators again believe is largely culturally instilled. It's something you hear over and over again from the young men: 'Girls cannot do math.' That stereotype

discourages young women from pursuing computer science, which does require math skills" (Morell, 1996, pg. 1915). It usually is not in the teacher's best interest to push girls or minority students to excel in those classes for one reason or another. Without the encouragement, it is hard for younger girls and minority students to believe that they have a possibility of succeeded in that area.

The computer software industry is believed to be a great influence on how young girls react to technology. Morell's (1996) report, *Computer Culture Deflects Women and Minorities* investigated the decline of girls' interest in technology from the age of 6 until they entered high school.

"Until age 6, girls and boys show an equal aptitude for computers, according to studies compiled by Mattel Inc. By age 7, when sociologists say that gender differences accelerate, girls lose interest in machines, perhaps because most computer games are designed for boys. As a result, boys often spend long hours at the keyboard or delve into a computer's innards, while the girls seldom do" (pg. 1915).

Economics has played a major role in preventing minorities in the United States from not getting ahead in the technology industry. Many minority members do not get an adequate basic education let alone have access to computers. Lack of family encouragement for minorities can also hinder them from not pursuing higher education let alone a degree that has a concentration in math or science. "Blacks are also more likely to come from families with no tradition of higher education. Almost half attend predominately black high schools and tend to receive less encouragement from teachers to go into science and are less likely to take advanced courses in high school" (Holden, 1996, pg. 1316).

Various studies discussed in this review of literature and methodology have found that basic education has hampered many women and minorities from possibly entering the field of technology and have made several suggestions to help diversify the field. The review of literature and methodology will also discuss other possible reasons why they are underrepresented in the field and the possible solutions that can help increase the numbers to diversify the field of technology.

The hypothesis for this study is that many African-American and Hispanic women do not choose careers in technology because they do not feel that this is an area where they can succeed. This mindset can be attributed to several factors:

- Lack of encouragement to pursue classes in math, science, and technology

- Lack of self-motivation.

- They have been told they are incapable of handling classes that would eventually help them to choose a career in technology.

- Isolation- Lack of inclusion, being one of the only females and only African-Americans or Hispanics in class or in the workplace.

Definition of terms

African-American-an American of African (especially of Black African) decent

Hispanic- relating to or being a person of Latin American decent living in the United States; one of Cuban, Mexican, or Puerto Rican origin.

Technology- a manner of accomplishing a task especially using technical processes, methods, or knowledge. (Merriam-Webster's Collegiate Dictionary, 1993).

Introduction to the review of literature

The review of literature will discuss a variety of investigations that have sought to answer the question, "Why are women and minorities underrepresented in the field of math, science and technology?" The majority of technology positions require math, science, and computer courses. Throughout the review, the reader will find that many women and minorities do not have the basic math and science skills so they can advance to the upper level courses that would eventually lead them into a career in technology.

This study will begin by exploring the research on women in technology and then explore the research on African-Americans and Hispanics in technology. A variety of reasons will be discussed why these minority groups have not traditionally chosen to pursue a career that would require a math, science, or technology. Following each reason, there will be solutions recommended.

Review of the research

Why girls start to dislike math and science

Children are easily influenced by the world that surrounds them. When they are younger, they tend to look to adults for the answers rather that their peers. Besides their parents, teachers play a major role in how a child thinks and develops throughout the elementary school years. Often teachers do not realize they led their students to act a certain way by the expectations or lack of expectations they place upon children.

During the elementary years, females tend to be praised for their neat handwriting and appearance of assignments while boys are judged more on the actual content. It has also been discovered that girls think more about what they say in class; therefore, it takes them a longer amount of time to raise their hand in response to a question.

Boys tend to speak as they think, which explains teachers' quick recognition of male students. This forces girls to refrain from answering, and begins the trend that leads to less interest in math and science (Pearl, Pollack, Riskin, Thomas, Wolf, & Wu 1990, pg.3).

Often girls lose interest in mathematics, science, and technology because they find the content based on interests held by males and not females.

While it is important to avoid reaching out to girls exclusively through the traditionally limited to areas that they have been encouraged to engage in, such as cooking and sewing, it is important that pre-service teachers find ways to involve girls in MST (Math, Science, Technology) through that truly interests them" (Sanders, Koch, & Urso, 1997, pg. 60).

When children are introduced to computers at a young age, there seems to be a trend of boys "throwing" girls off the computers and claiming that it is male territory making girls afraid to even touch a computer.

In computerized classrooms, it is not uncommon to see boys of all ages actively seizing the machines, and physically pushing the girls away. This violence can be accompanied by taunts about how girls cannot 'do' computers, and how screens and controls are a boys' game (Spender, 1995, pg.177).

To get younger girls more involved in math and science classes, teachers should point out that math and science are not for boys only. By having the students discuss and research women in the math and science field, it can open many young girls eyes to the possibilities they have when they have a strong background in those subjects.

It is equally important for teachers not to ignore the problem of boys constantly telling girls that they have no business with a computer.

> We need good teachers to become computer support people; we need the arts and humanities values brought into the computer system. It might then be possible to change some of the blatantly sexist practices. If we do not, then the only certainty is that girls face a bleak future (Spender, 1997, pg. 185).

Schools across the nation have found that single-sex classrooms have been better environments for girls to learn math, science, and technology. Kathleen Bennett has made it possible for girls to advance by being surrounded by all females. She opened the Girl's Middle School in Palo Alto, California. The middle school has grades 6-8 and focuses on math, science, and technology "with the goal of shaping technology savvy power babes" (Lehmann-Haupt, 1997,pg. 1).

Bennett knew that an all girls' school that focused on math and science would help to increase the number of women we see in the technology field for several reasons. "Girls benefit from schools that are all their own. At GMS (Girls Middle School), girls have 100% of the teachers' attention in the classroom (as opposed to reports of girls being ignored in coed math and science classrooms). GMS provides an academically challenging curriculum that encourages skill building, creativity, problem solving, and critical thinking. Girls view problems from a variety of perspectives; address questions that have multiple "right" answers, and use information to solve complex problems" (GMS Home Page).

Frank- Loron (1995), suggests that math and science classes should be segregated. "Segregation involves constructing separate math and science classes for males and

females so both sexes feel comfortable in the classroom setting. Girls in exclusive math and science classes have been shown to achieve higher scores in tests and enjoy these subjects more" (pg. 1).

Why African-Americans and Hispanics lose interest in
math, science, and technology at an early age

Welch and Hodges discussed in their research of minority students placed in a predominately white school at a young age can have a negative effect on them. Some teachers and administrators have preconceived ideas on the students' performance.

Research is showing, in fact, that some school processes can disadvantage ethnic minority pupils who do not necessarily enter schools with educational disadvantages, but who fall behind because of the way schools interact with them. These problems include among other things, the outdated belief still present among some educators that different races have different intellectual capacities; the stereotyping of families based on research which linked importance of home and family background in ethnic minority school performance; miscalculation of students' intellectual ability or academic potential because of the level of proficiency in the majority language; the view that migrant parents [are] disinterested in their children's education at school. (Welch & Hodges, 1997, pg. 32)

There is a significant number of Hispanics dropping out of school at an early age. By not attending school, they will not be exposed to any subject that could help them decide on a career especially a career that involves math and science,

Latina/o students drop out of school at a rate nearly four times that of European Americans and a rate more than twice that of African-American students. Latina/o

students drop out of school earlier that other groups. Forty percent of Latina/o dropouts ages 16-24 left school with less than a 9th grade education, compared with 15% of European Americans and 10% of African-American students. Among students with low family incomes, 45% of Latina/os were dropouts compared with 24% of African-Americans and 19% of non-Latina/o Whites (Sanders, Koch, & Urso, 1997, pg. 18).

Why young women lose interest in math, science, and technology during the college years

Pearl, Pollack, Riskin, Thomas, Wolf, & Wu (1990) conducted a study for the Association for Computing Machinery found four possible reasons that contribute to women not choosing careers in technology by situations that occur during the college level. The study found that college women deal with difficulties with self-esteem, lack of mentoring and role models, gender discrimination, difficulties balancing career and family responsibilities.

When students decide to choose a major in college, men and women enter into the programs with about the same level of confidence, but women's level of confidence drops.

"The self-confidence of the men increased slightly during college, while that of the women decreased significantly. More women than men have questioned their ability to handle their workload, found criticism difficult to accept, felt uncomfortable speaking up in class feared speaking up would reveal their inadequacies. Part of the fear is that women are interrupted more frequently than men and their contributions are often either attributed to men or ignored altogether" (Pearl, Pollack, Riskin,

Thomas, Wolf, & Wu 1990. pg.50).

One reason gender differences exist in performances and participation in mathematic, science, and technology is because of the lack of females' confidence when doing them. Achievement motivation, attribution style, and pressures from society can contribute to a lack of confidence and fear of success (Sanders, Koch, & Urso1997, pg. 94).

To deal with self-esteem issues, Pearl, Pollack, Riskin, Thomas, Wolf, & Wu (1990) suggests there needs to be increases sensitivity on the part of male computer scientists and colleagues, an increased awareness by women so that they will not be easily discouraged, and quite simply, an increased number of women in the field. They also suggested to, "Give unambiguous feedback concerning the quality of their work, to provide equal attention to and have equal expectations of female and male students, and to increase awareness of different, especially less aggressive styles. In addition, it is essential to provide women with the opportunity for successful professional experiences (pg. 48).

There tends to be a debate whether the gender or race of a role model plays an important part in women choosing careers in technology or not. The fact that there are not many women role models for girls to emulate in the field gives most researchers reasons to believe that women do not feel that a career in technology is possible.

Mentors play a crucial, though usually informal role in the training of young computer scientists. In general, a mentor shares with a less experienced colleague information about how to get research funding, avenues for publication, the informal

power structure within a department and within the discipline as a whole and so on (Pearl, Pollack, Riskin, Thomas, Wolf, & Wu 1990, pg.52).

The invisibility of women as contemporary scientists, mathematicians, and technologists generates and reinforces girls' belief that these fields are male activities, which do not welcome women's participation. Without role models, it is hard for girls to envision themselves as potential specialists in these fields, and many opt out of continued study" (Sanders, Koch, & Urso1997, pg. 27).

Gibbons (1993) found that a role model is important for everyone no matter what race or sex they are. "While minority faculty may make the ideal role models, it will be years before most science departments have enough minority professors to fill the need. In the meantime, it's up to whites to do the job" (pg.1130).

Gender discrimination seems to be prevalent in all fields where males make up the majority. Women deal with degrading comments, lower pay, and sometimes no possibility of climbing the corporate ladder due to the "old-boys" network. Many women would rather work in a "female-friendly" environment than have to put up with an emotionally disturbing one.

"Overtly disparaging remarks about women, as well as more subtle differential behaviors, can have a critical and lasting effect. When the occur frequently— especially when the involve "gatekeepers' who teach required courses, act as advisors, or serve as chairs of departments—such behaviors can have a profound negative impact on women's academic career development by: causing students to switch majors or subspecialties within majors; minimizing the development on the individual collegial relationships with faculty which are crucial for future professional

development; dampening career aspirations; and undermining confidence"(Pearl, Pollack, Riskin, Thomas, Wolf, & Wu, 1990).

Pearl, Pollack, Riskin, Thomas, Wolf, & Wu (1990) suggested several ways to deal with gender discrimination.

One way to address this problem is to make people aware of it, so that those whose job it is to nominate or appoint people to boards, program committees, etc., can make a conscious effort to include qualified women. Also, it is necessary that departments and universities develop and institute grievance procedures that guarantee confidentiality and freedom from retaliation.

Women in the western society compose half of the work force in their countries making many of them the "bread winners" in both married and single-parent households. To keep up with the demands of their careers, especially in the science and technology field, they must continue their education. This makes women responsible for their families, household income, and demands of their classes.

Most students do not complete their PhD until the middle or late 20s and tenure is typically not granted until the middle 30s. Hence, the childbearing years directly coincide with the period of time during which a woman is completing her PhD and working towards tenure. Both rearing small children and achieving tenure are tremendously time-consuming efforts; doing both at the same time seems to many women to be exceptionally difficult, if not impossible (Pearl, Pollack, Riskin, Thomas, Wolf, & Wu 1990).

Colleges and universities can help a great deal when it comes to women who are balancing career and family responsibilities.

Universities can and should provide affordable, quality childcare. Sufficient

maternity leave policies are also necessary. Many universities have no formal leave

policy at all, while others grant only minimal leave. (One month or less) Universities

must develop not just maternal policies, but parental policies that will allow male as

well as female faculty members to be involved in the rearing of small children. Many

universities today provide no parental leave at all (Pearl, Pollack, Riskin, Thomas,

Wolf, & Wu 1990).

According to the Status of Women in Computing Science, another factor that can

turn women away from furthering their studies in science and technology at the college

level is the fear of being unsafe.

Computer scientists must often be at their workplace after dark. All computer

scientists, male and female, require safe access to the workplace, particularly at

night. Yet, for obvious reasons, such as access is even more essential for women.

Availability of a well-lit, short route to the office from well-lit, safe parking and a

sense of safety in the department at night are crucial. It is accepted academic and

professional practice top work at night, and women should be able to do so safely

(Pearl, Pollack, Riskin, Thomas, Wolf, & Wu 1990, pg. 4).

Why African-Americans and Hispanics lose interest in math, science, and technology during the college years

The majority of the students that attend college in the United States depend on

financial aid and/or scholarships to attend an institution of higher learning. Most studies

have found that minorities worry about how they are going to pay for college more often

than Caucasian students. Even minority students who received financial assistance and

have excelled in their undergraduate education in the math and science field fear that they cannot afford to attend graduate school. "Many of the best students at Spelman College (a Historically Black Institution) had never considered graduate school because they didn't think they could afford it. They didn't realize that graduate students in science, unlike undergraduates, are usually given stipends" (Gibbons, 1993, pg. 1130-1131).

African-American and Hispanic students are even unaware that there are companies who sponsor minority students who pursue degrees in math, science, and technology.

AT&T can claim that 22% of all the minorities who have earned Ph.D.s in electrical engineering in the past 20 years have been part of a program that company had sponsored. AT&T has helped 67 students earn Ph.D.s by paying their graduate tuition, giving them a $13,200 annual stipend and summer employment, and setting them up with a mentor (Gibbons, 1992, pg. 1196).

Some minority students who are aware of the available funding choose not to attend an institution where they are severely outnumbered. This can deter them from leaving their comfort zone. "Blacks who attend white colleges also have serious adjustment problems, and often suffer from feelings of isolation and inadequacy as well as from lack of interaction with professors and a shortage of black role models-particularly in science" (Holden, 1996, pg. 1316).

Teachers and mentors at majority institutions can help make the transition easier for minority students by taking the time to "introduce them to members of the black (and Hispanic) community, such as a black woman's professional group. Student's like this need somebody to go to" (Gibbons, 1993, pg. 1131).

Minority students who are not worried how they will finance their education or being in a majority institution may still have to deal with discrimination. Calvin Sims, an African-American who was raised in inner-city Los Angeles, excelled in math and science all through his formal education and was accepted into Yale's engineering program had to deal with discrimination when he met with his advisor. Sims stated:

> My first week at Yale, I met with my adviser, an engineering professor. He took one look at me and where I had come from, and said I might get more from Yale if I studied humanities. 'You might have gotten straight A's at Compton High, but this is Yale. You'll probably find yourself outclassed, especially in engineering,' he said" Sims stated he found another adviser who encouraged him and gave him advice on how to successfully complete them program (Sims, 1992)

Most universities that have a very low minority student population offer mentorship program to encourage those students to finish their degrees. With the encouragement of faculty members and advisors, minorities will be as successful as their Caucasian classmates.

How gender role stereotypes can hinder women and from choosing careers in technology

Byrne (1993) discussed Elizabeth Fee's discovery that "the sciences have been seen as masculine, not simply because the vast majority of scientists have historically been men, but also the very characteristics of science are perceived and seen as sex-linked". (pg. 17)

The characteristics of masculine science are being rational, authoritative, logical, impersonal, hard and cold. The female antithesis is seen as subjective, irrational,

intuitive and deductive, warm and soft, widely ascribed as normally female. This has been institutionalized structurally within the hierarchy of the sciences-'the "hard" sciences at the top are seen as more male that the "soft" sciences at the bottom" (Byrne, 1993, pg. 17).

Many view science or technology as being "male or masculine". In the 4th and 5th grade, girls and boys have the same career aspirations, but by the sixth grade they lose interest in math and science. Lehmann-Haupt (1997) explains that adolescent girls hit a 'wall of femininity.' " Many no longer want to compete with boys in math and science because they're afraid they will be perceived as too masculine. Society sends very mixed messages, like 'girls can be smart, but not smarter than boys. Many girls feel they won't be popular if they are too aggressive" (pg. 1).

Byrne (1993) also found three reasons why girls feel they will not be seen as 'normally feminine' if they pursue a career in math, science, or technology.

1. The perception of science as a male area by adolescents and young adults making curriculum and discipline choices (which filters young females out from an unconditioned choice).

2. The actual male-dominance of science and technology in terms of the participation of teachers, learners and producers (which creates an ecological niche supportive to males and not to females and raises issues of critical mass).

3. The construction and design of science in disciplines on a paradigm seen as male, patriarchal and instrumental (which is described by some as creating an inappropriate teaching: learning environment for females and for many males). (Byrne, 1993, pg. 16).

Teachers in elementary, junior and high schools must eliminate the stereotypes in girls' and boys' minds right from the start. Sanders, Koch, & Urso (1997) provided numerous solutions to make children aware that science and technology is not for men only. Several pedagogical techniques can aid in erasing the preconceived idea that women have no place in technology.

1. Use precise, gender-neutral language in describing data and presenting theories.

2. Encourage development of theories and hypotheses that are relational, interdependent, and multicausal rather than hierarchal, reductionistic, and dualistic.

3. Use a combination of qualitative methods in data collection.

4. Encourage the uncovering of biases such as race, class, sexual orientation, and religious affiliation, as well as gender, which may permeate theories and conclusions drawn from experimental observation. (pg. 43).

How racial stereotypes can hinder African-Americans and Hispanics

from choosing careers in technology

When anyone conforms to a stereotype that is placed on them, it is possible that they will be affected emotionally and live with the belief that "this is the way it's supposed to be" when, in fact, the stereotype can be very untrue. When society or even a small group of people are constantly telling a certain group that they are inferior the results can be detrimental.

For women, the stereotype is that they have limited ability in math and science compared to men; for blacks, it's that they're short on academic ability compared to

whites. The fear of being judged by and perhaps conforming to the negative stereotype causes them to effectively 'freeze up' and perform worse in the area than they otherwise would (DeAngelis, pg. 1).

Many schools are still trying to integrate their classrooms even years after Brown vs. the Board of Education ruling. While students are learning how to interact with their cultures, there are still many who try making minorities feel inferior. Welch and Hodges (1997) found that minority students encounter prejudices on a daily basis. "These problems include, among other things, the outdated belief still present among some educators that different races have different intellectual capacities" (pg. 32).

Many college professors and advisors do not even give minority students a chance to prove themselves. "Too often minority kids go into an institution and people expect them to fail. They take on a kind of syndrome of the terminally ill, where they stop really caring, because they know sooner or later the ax will fall on them"(Gibbons, 1992 a, pg. 1194).

Maxine Bleich, founder of Ventures in Education (VIE), recognized that many teachers still carried the preconceived notion that all students (especially minorities who are disadvantaged economically) could not learn harder subjects. Through her program, she provided seminars and workshops to help teachers change their attitudes and refine their teaching skills.

How the computer software industry can decrease a girl's interest in technology

At an early age, girls are not given the opportunity to appreciate technology due to the fact that the computer games that are available do not even appeal to them.

The earliest computer artifacts that children encounter are not gender neutral. Recreational and educational software programs reflect the gender biases and stereotypes of their designers, and studies reveal that educational software is generally designed to appeal to boys…girls and boys have been shown to prefer different kinds of software programs. It is thus disturbing that, in an experimental setting, teachers instructed to design software for students tended to build programs that have the characteristics that boys prefer, and few characteristics that girls prefer—even when they are aware of these differences (Pearl, Pollack, Riskin, Thomas, Wolf, & Wu, 1990).

When software companies start to realize that girls as well as boys need to be exposed to a variety of computer programs, there should be a rise in girls' interest level in computers and technology. "There needs to be a variety of games, CD-ROMs and software available, which excite, thrill, charm and delight girls, and which develop their interest in the personal, in relationships, connections, the way people work" (Spender, 1995, pg. 189).

Software does not need to be specifically designated for girls or boys. Software for both classroom and home should focus on the many design elements and themes that engage a broad range of learners, including both boys and girls, and students who do not identify with the 'computer nerd' stereotype" (American Association of University Women, 2000).

Other possible solutions to help increase the number of women, African-

Americans, and Hispanics in the technology field

The Office of Science and Technology Policy supported the President's Initiative on Race by specifying what they were willing to contribute in order to increase the numbers of minorities in the science and technology field.

- Encourage science and technology partnerships with Historically Black Colleges and Universities.

- Initiate work with the American Sociological Association to examine research literature on race.

- Research race and the role of standardized tests to determine the effectiveness of standardized tests as predictors of academic success for people of color.

- Research bilingual education to determine the effectiveness of bi-lingual education in preparing underrepresented minority students for participation in science and technology.

The American Association for American Women reported in the April 17,2000 edition of the Chicago Tribune that women will continue to fall behind in numbers when it comes to careers in technology until several things happen.

- There are changes in "tedious and dull" computer science courses that weed out most students, rather than arouse interest in the field.

- There is more use of classroom technology to study non-technical subjects.

- There is education for today's teachers that goes beyond "drive-by" workshops to emphasize how teachers can design instruction that takes advantage of new technology.

- There is creation of new "high skill" computer games that appeal to boys and girls, versus today's high kill" action games for boys and passive games for girls.

- There are marketing campaigns that smash the stereotype of the high-tech workplace as a sterile set of cubicles full of boring men who are better at relating to machines than people. (Mollison, 2000, pg. 6).

There are many programs that have been developed in the United States to encourage minorities to get involved in technology. One is the Technology Access Foundation. Rainbow on the Web, Part One by Diana Estigarribia wrote an article about Trish Millines, a former Microsoft employee, who created the non-profit organization in the summer of 1996. Its mission is to bring up-to-date technology to Seattle's communities of color and teach them the skills to use it. In October of 1997, the program launched the Technical Teens Internship. The internship provided 20 minority high school students a chance to learn how to navigate software programs, design websites and build computers from scratch. Millines formed partnerships with local community centers to provide other technology learning services and started the Virtual Institute, which provides instruction to thousands of Seattle students.

Other programs include *Institute for Women in Technology, Brookhaven Women in Science, EUREKA Teen Achievement Program, Girls Count, SEED* (Seeking Educational Equity and Diversity), and *Operation SMART* (Science, Math, and Relevant Technology). A host of other organizations and programs can be found on the Internet.

Methodology

In addition to the review of literature, this study used responses from interviews conducted with four women who are working in math, science, and technology in some capacity or a program that helps promote the need for minorities in fields where they are underrepresented. The four women were Michelle Mullings-Shand, former Director of the University of Northern Iowa's Upward Bound Math and Science Program, Latricia Hylton, Math Instructor at Hawkeye Community College, Reygan Freeney, Program Coordinator of the University of Northern Iowa McNair Scholars Program, and Patricia Higby, Adjuct Professor of Activity Based Physical Science and Conceptual Physics and member of American Association of University Women.

These women were chosen for this study based upon several criteria; their association with the field of technology, professional background, how aware they are of problem, and their interest of the topic. Their professional background had to include math, science, or computers since these subjects are the foundation of most technological positions. Availability was also a factor when choosing the participants. Each woman had a preliminary interview to see if they met all of the criteria this study required.

A pilot interview was conducted to test the validity of the initial eleven questions used to find the answers. The test was conducted with Michelle Mullings-Shand, former director of the University of Northern Iowa Upward Bound Math and Science Program.

All of the women were asked to answer the questions according to the personal and professional experience. They were told that questions could be eliminated or added depending on the flow of the interview. Once they were ready to proceed, the interview was audio recorded. The actual transcribed interviews can be found in the appendixes.

(Michelle Mullings-Shand Appendix B; Latricia Hylton Appendix C; Reygan Freeney Appendix D; Patricia Higby Appendix E).

Results

Organization

The hypothesis for this study was that many African-American and Hispanic women do not choose careers in technology because they do not feel that this is an area where they can succeed. This mindset can be attributed to several factors:

- Lack of encouragement to pursue classes in math, science, and technology

- Lack of self-motivation.

- They have been told they are incapable of handling classes that would eventually help them to choose a career in technology.

- Isolation- Lack of inclusion, being one of the only females and only African-Americans or Hispanics in class or in the workplace.

By looking at the responses from the interviewees, the hypothesis was correct. The questions that the interviewees were asked are listed in order. For each question, there will be a brief summary of each respondent's answer. Some interviewees did not get the same questions as others and were asked different questions depending on the flow of the interview.

Question: What made you want to enter into the field of technology?

All of the interviewees stated that they enjoyed math and science in high school and decided to pursue a degree in the field when they entered college. They also felt welcome in the math and science departments in college giving them a reason to stay in the field. It was apparent that none of the interviewees felt inferior in their workplace.

Latricia Hylton stated that she began in the Business College in her freshman year at Florida A&M University but changed her mind because she felt business was a natural talent of hers and decided to strengthen her math skills instead. "I started out as a business major. That's my natural talent. I'm a businessperson. However, when I entered the Business College, I didn't feel like that's where I wanted to be right then and there. And so, I enjoyed math. I really liked it from high school. I decided, why not get a Bachelor of Science degree in Math"

Reygan Freeney was actually encouraged in high school by her teachers to study science because they saw how talented she was in the area. "In high school I had a wonderful physics teacher, so I thought I wanted to do physics initially. So when I got to UNI, I took a physics course and I took a chemistry course my first semester here. Being in physics and chemistry at the same time wasn't too demanding by any means"

Patricia Higby went to Independence High School in Independence, Iowa and shared the same positive high school experience as the other women. She also felt comfortable in the physics department when she entered the University of Northern Iowa. Higby stated:

> I had a good background in math and I think that's where I came in as a math major. I didn't find the math field cold. The physics department was using math. It was like you've got the math, and this is what we are going to use it for. They are a very friendly department. It was a warm feeling there.

Question: Do you recognize a pattern of African-American and Hispanic women not choosing careers in technology?

Hylton and Higby were the participants who were asked this question. The answers to this question varied from the interviewees. Hylton stated that she has noticed that African-American and Hispanic women are choosing careers that include technology, but do not have a specialty in a field that requires a strong math or science background. "They are not getting into the technological field, which is programming, computer repair, and things like that. They are just doing like a secretarial certificate or office administration where that are using the technology, but not necessarily getting deeper in depth into the technology where math and science is required"

Higby noticed in her activity based physical science class that there have been a very small number of minority women who take the course. The course is designed to encourage education majors at the University of Northern Iowa to teach science. "I've observed very few, either African-American or Hispanic, very few minority women in elementary education that are taking my activity based physical science class. In the number of semesters that I've taught it, I can count on one hand probably the number of female minority students that have been in my classes."

Question: What are the possible reasons for that pattern?

Hylton and Higby were asked this question directly and Freeney listed several personal experiences earlier in the interview that answered the question. Again, the answers varied.

Hylton answered right away by referring to the stereotypes that are placed on young girls and minorities and tend to conform to the same mentality of the teachers or

dominant members of the math, science, and technology field. "A lot of these fields are male dominated fields and a lot of teachers feel that women cannot do math. They come from that old school where they have that mentality. They were taught, women cannot do this, women are not supposed to be able to do these certain things. Women were being discouraged from doing things like that. Once they failed it enough times they become hesitant about even touching the subject"

Higby noticed that there is an a high number of minority girls having children at an early age and many times hinders them from even finishing high school let alone finishing a college degree. Her answer stems from a personal experience in the Grout Museum Science Imaginarium. She had several work-study students and to her surprise, the majority of them were young mothers.

"One year in particular I can remember we had four African-American girls from both schools (Hawkeye Tech and University of Northern Iowa). The amazing thing was three of the four girls had babies. They had babies in high school. I could see right there how hard it is to be choosing a career, period, let alone one that is going to require further study. I guess that would be one reason. The problem with babies having babies is definitely going to affect your numbers that you are going to see"

Freeney's positive experience in high school carried over into her college career with her instructors encouraging her to stick with her natural talent of science. When she transferred to the University of Northern Iowa from the University of Wisconsin she thought of changing to the biology department because there were more African-Americans in the department. Once she tried some biology courses, she found that they

were not as challenging and switched back to the chemistry department because of the encouragement she received from the department.

Freeney's desire to go to a department with more African-Americans may indicate to the researcher that there is a trend of talented minorities straying away from sciences because they will find themselves being underrepresented in the department either in the university or the company where they decide to work. Freeney was willing to go back to the chemistry department because of its' ready acceptance of her demonstrates that many minorities will not go into a field where they do not feel welcome. Freeney stated there are not a lot of African-Americans or other minorities who are exposed to great teachers of science, but when there are the "lucky ones" who are exposed, it is easier to embrace the subject.

"It's (science and math) not more difficult than any other subjects, you just have to apply yourself. When you have a great teacher or an instructor, you tend to have an affinity towards that subject. I think a lot of people really do not have that type of teacher or an instructor who really says that science is important. Even though it's not traditionally represented by us (African-Americans), but it's something that you should consider"

Question: Do you feel it is important for African-American and Hispanic women to enter into the field of technology?

Hylton and Higby were asked this question. Higby felt that everyone should be exposed to the opportunities that are available and being given a choice of whether or not they want to enter into the field. Higby stated, "I think it's important to find a career that fits them best. There's no reason why it would not be math, science, or technology. I

think it's wrong to be encouraging them into something that they do not feel comfortable with."

Hylton felt that since there are numerous positions opening up in the technology field along with positions that will require technological skills, it would behoove everyone; especially women who make up almost half of the workforce in the United States, to get the necessary training to stay ahead of the game. "There are opportunities that are not being opened up to you because of your limitations, so it's very important for them to do that. Every job basically now has some kind of technology associated with it that you need to understand or be literate about."

Question: What do you think can be done to encourage African-American and Hispanic women to enter the field of technology?

All three women were asked this question. Hylton and Higby stated that the guidance they get during their primary education (elementary, junior high, and high school) played a major role in encouraging students into various fields. Freeney also felt the primary school years played an important role in encouragement by having the teachers change their methods of how they introduce science.

Hylton felt that parents should get their children involved in extracurricular programs to expose them to the opportunities that are available. "Parents also have to take the time and research and find these things, because they are not being advertised. The parent has to take an interest and get their kids involved in these things"

Higby noticed a change in the high school educational system since when she was in high school. She remembered when her high school guidance counselor helped students find their niches so they could enter into a college program that helped develop their

skills. Sometimes, not knowing who to consult for career guidance can deter people from pursuing what they really want to do because they do not know the proper steps to take.

Higby stated, "For my own children who just graduated four and two years ago from high school, the guidance counselor seemed more involved in conflict resolution. The only way my children got scholarships was the fact that we went out and found them for ourselves. I do not know if they had any information on careers"

Freeney recalls that her high school chemistry teacher taught science in a way that was boring to all students because of his own negative attitude about the subject. Freeney, along with the other women, stated at some point in their interviews that science is a subject that should include hands-on training instead of just lecturing. By changing the teaching style, many instructors can help students "turn on" to science. "It's not just something you can just sit up there and lecture about and expect students to be interested in. If they do not see how it relates to real life or how to apply it, them regardless of the subject, students may not have that strong interest in it"

Question: Do you know of any programs that promote opportunities for women and minorities in technology? What are the organizations?

Although the question was not directly asked to the participants, they all mentioned and described a program at another point in the interview. Hylton mentioned a program where she was involved, SECME, a science and engineering program where high school students would compete at the state and national level. She recalled students building electric cars and getting involved in projects that engineers would normally do.

Freeney's program, McNair Scholars, encourages underrepresented minorities to enroll in Ph.D. programs. Like Upward Bound Math & Science, they are funded by a

grant though the Department of Education and they target low-income first generation college students.

Higby is a member of the American Association of University Women. She mentioned that every year they hold a conference for junior high and high school kids so they can attend sessions with professional women from all career spectrums. She stated they could only target a small number of youth. The conference usually allows up to forty students.

Question: What do you think needs to be done in order to retain African-American and Hispanic women in technology?

Past studies have shown that many African-Americans and Hispanics do not stay in the field of technology because they usually do not see too many other minorities in the field.

For any woman, starting a family is very important, but at the same time their career is too. For anyone to pursue a career in math, science, and technology, they must realize they have to spend long hours doing research if they are to pursue a degree. Hylton and Higby felt it was necessary for universities to get involved by providing adequate day care for their students who are parents. Hylton felt that if more money were put into retaining students by meeting their needs, universities would not waste money on students who drop out. "It's wasted money if a person started the program and doesn't finish it, because that's financial aid money that they could have used for another student that would have successfully completed the program. So in the long run it's paying off"

Question: Do you think African-American and Hispanic women will encounter social barriers if they choose a career in technology?

The researcher did not find many articles that discussed the two barriers minority women have the possibility of encountering. The barriers are gender and race. Most of the interviewees noted that as time goes on and as more women enter the field, the barriers will start to come down if some already have not.

Hylton stated that there is a barrier that minority women encounter that is rarely talked about. Families that do not respect their decision can hinder them more than any barrier that they encounter at work. " Once you've made it, your family can be your worst enemy. For them, a Hispanic or an African-American woman coming out of college might be the first person in their family that has made it and has successfully placed themselves in a position where they are economically independent. They are getting it on their jobs and then they're getting it at home"

Question: Why do you think there are more African-American and Hispanic women in the field now than there were a few years ago?

All the interviewees commented on the fact that programs, fellowships, and the active recruiting of minority women have helped to boost the numbers in the technology field. Freeney stated, "I think really just drive and people being there for them. You have programs; you have schools that are actively recruiting students in those areas. I think that's why you've seen an increase."

Question: What do you see in the future concerning African-American and Hispanic women in technology?

Higby thought that the future seemed bright for African-American and Hispanic women in the technology field. She felt that while they are students it is important to constantly hear about the opportunities available and continued to be encouraged to try math and science, the numbers would continue to grow. Freeney on the other hand sees a questionable future. Affirmative Action programs are starting to disappear and may leave many minorities in the dark once again. "The National Science Foundation actually eliminated a fellowship for minority students. So when you are looking at those things, they are detrimental to us. They are not encouraging us and it doesn't look very good for our future in that aspect" She continued on say that women today are more aggressive and will find a way to get into any field they desire.

According to all of these interviewees' responses, there are many reasons why African-American and Hispanic women do not choose careers in technology. This study found that the hypothesis could be attributed to a domino effect. Young girls, African-Americans and Hispanics, are rarely encouraged in their math and science classes. This lack of encouragement makes them uncomfortable in those subjects. Once they feel that they are inferior in math and science, they tend not to want to have anything to do with the subjects at all. By not applying themselves in math or science, they do not choose classes or majors that have an emphasis in math, science, or technology in their university. If they choose that emphasis in their institution of higher learning, then they will probably not choose a career in those areas.

Discussion

Conclusions

The researcher was able to see similarities in the review of literature and the methodology in the reasons why minorities as a whole do not choose careers in technology and African-American and Hispanic women do not choose careers in technology.

The review of literature began by discussing the foundation of the problem. Math and science skills are needed for most technology positions and a large number of minorities are lacking in that area. Many do not have those skills because of stereotypes placed on them at a young age. Once they have become fearful of those subjects, it is hard to get them interested in the subject again. The review of literature also discussed how there are numerous programs to help girls and minorities become aware of the career possibilities when they excel in math and science.

Even with the programs put into place, the review discussed a pattern of women and minorities not pursuing their PhDs in math, science, and technology. Some of the social barriers they encountered as children sometimes hinder them as adults.

The methodology discussed the past, present, and future state of African-American and Hispanic women in technology. Just as the review of literature discussed, many minorities have a weak foundation in math and science, which can hinder them from choosing technology careers. The interviewees' professional and personal experiences enabled them to answer all of the questions. One of the first questions asked was, "why did they choose a career in technology?" All of them answered because they like it or they were good in that area. Their high school math and science teachers were

also unbiased, making the environment more comfortable. They were also encouraged by teachers to continue studying in that area.

This study can conclude that stereotypes and lack of encouragement can discourage any minority from choosing careers in technology. The problem of there not being many African-American and Hispanic women in the field of technology stems from the foundation of not having the necessary skills needed. It seems that not many are encouraged in their middle school and high school math and sciences classes making it impossible for them to choose a major in college that would eventually lead into a career in technology.

Other facts have been presented as to why African-American and Hispanic women are underrepresented in the technology field such possible social barriers they encounter at work, but many are not even getting their foot in the door again because their foundation in the math and sciences are weak.

Recommendations for future studies

- Include Native Americans in the study

- Interview young African-American, Hispanic, and Native American women

- Interview parents of African-American, Hispanic, and Native American girls to find out whether or not they encourage their daughters to enter into science and technology fields.

- Find out why Americans in general are now starting to stray away from careers in technology and people from other countries are starting to work in the technology field in the United States.

- Do further investigation of why white/Caucasian males are starting to lag in number in American Colleges/Universities and how will that change the demographics of the technology field.

- Visit an area where there is a large representation of African-Americans and Hispanics in the community

- Interview science and mathematics teachers to learn what do they think about their methods of teaching those and if they feel they need to change their methods to increase the interest of girls and minorities.

- Discuss whether or not the increase of women business owners in the Internet industry will affect how women will get involved in technology.

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Appendix A

Interview Questions

1. What is your association with the field of technology?

2. (If the person is a African-American and Hispanic, a woman, or both) What made you want to enter into the field of technology?

3. Do you recognize a pattern of African-American and Hispanic women not choosing careers in technology?

4. What are the possible reasons for that pattern?

5. Do you feel it is important for African-American and Hispanic women to enter into the field of technology?

6. What do you think can be done to encourage African-American and Hispanic women to enter the field of technology?

7. Do you know of any programs that promote opportunities for women and minorities in technology? What are the organizations?

8. What do you think needs to be done in order to retain African-American and Hispanic women technology?

9. Do you think African-American and Hispanic women will encounter social barriers if they choose a career in technology?

10. Why do you think there are more African-American and Hispanic women in the field now than there were a few years ago?

11. What do you see in the future concerning African-American and Hispanic women in technology?

12. What are your feelings about being in a white-male dominated field?

Appendix B

Pilot Test

Interviewee #1 Michelle Mullings-Shand

Former Director, University of Northern Iowa Upward Bound Math and Science

Since November 1994

Bachelor of Science Degree Chemistry and Physics-University of the West Indies Mona Campus

Master's of Science Degree in Industrial Engineering- Purdue University-Lafayette

1. **What is your association with the field of technology?** I have many associations with it but I guess where I see it more in a day-to-day job is that our program is one for high school students. And our aim is to get them interested in math and science so they'll go on to college and major and in a math and science area. So we're always teaching them more about technology. And in the summer they attend classes at UNI (University of Northern Iowa) taught by UNI faculty but they are geared towards high school students. And they are—all the classes are hands on. So they use a lot of technology.

2. **What made you want to enter into the field of technology?** I guess it was always the thing that I liked studying in school so I guess I never thought not to study math and science. I did well with it at high school so it was normal—and then you just keep narrowing your interests kind of gets more specific and so that's why I ended up with Industrial Engineering.

3. **Do you recognize a pattern of African-American and Hispanic women not choosing careers in technology?** Actually, I have not really noticed a pattern. If I look back at different books and stuff the figures show that we do not have many

practicing in that area right now. As to what the pattern of people going into it, I'm not sure about that. What I have noticed in our program is that we do normally have for every one male we have two females. So that's a good thing about out program is that we see a lot more girls coming in which hopefully would mean that a lot more girls would be going on to college and graduating.

4. **Do you feel it is important for African-American and Hispanic women to enter into the field of technology?** Yeah, I think it's important that everybody realize that they could have the opportunity and it would be a good career for them or a good area. So I do not believe anyone should feel they are limited because of their gender or their race.

5. **What do you think can be done to encourage African-American and Hispanic women to enter the field of technology?** I think probably the same thing you can do to encourage anybody to go into the field. That when you are in high school. Well actually I think it should start before high school. I think science needs to be made probably more interesting. Sometimes at the middle school level, because you definitely need to stimulate the interest to keep it going into high school. And I think for a long time—I think all over the world it was that only men did sciences-- and so you just need to have everybody realize that anybody can study sciences and that there is a lot of appeal to it. I think sometimes too people do not think about math and science or technology because it's not as glamorous or seemingly it's not as glamorous as other professions. And sometimes they do not notice that you might study math or science but it can open so many doors to you. Sometimes I think they just think, "I am going to

have to teach math if I study it"—they do not see all the careers. So by having them explore at an early age to what math and science can do for them I think you'd get them more in to the technology degree.

6. **Do you know of any programs that promote opportunities for women and minorities in technology?** Yes, our program is a federally funded program. I think we have about 150 Upward Bound Math and Science programs in the country. And that's the aim of the program. Students qualify for our program by being low income and first generation college students. In many states that would be the minority population. African-Americans and Hispanics would be that group. And so those groups would qualify for programs such as mine. And they (when they get to our program) would be the ones that would be exposed to all of that and every one of our programs is supposed to have guest speakers with regularity. Maybe not everyday, but at least twice a week. And usually encourage speakers to speak on math and science careers. So I think that's a way to get exposure. I think I would be good if the school system would also work with that. Still with 150 programs we still do not serve that many people. If each program serves approximately 50 students we are not reaching everybody.

7. **What do you think needs to be done in order to retain African-American and Hispanic women technology**? Personally I didn't take the position because I thought I would see someone who looks more like me. I took the position because I want to work at that (engineering). And so that's what I think probably we need to start teaching youngsters that you might be the first person there that is Hispanic or African-American. It should be that you're there because you want to

work at it. I'm sure you can make friends there, but your comfort zone should be more than just people of your nationality or you race. You should be able to really work at the job because you enjoy it. In my case when I go places I do not expect to see other Jamaicans there. I think that has just never been an issue for me.

8. **Do you think African-American and Hispanic women will encounter social barriers if they choose a career in technology?** I think it's really more the women—even Caucasian women face this too. I have not had this experience myself. It's more anecdotal where other people have said things. Sometimes it's hard to get the respect from the men that they are working with. I think if you go in to that kind of career—you are demanding respect, but you are demanding it by your actions. I think it grows on them—but that barrier gets broken down when more women go into the field. It's when they see more women doing the job and doing the job well it's when they will be more accepting.

9. **Why do you think there are more African-American and Hispanic women in the field now than there were a few years ago?** Probably because programs like ours— I think even television has something to do with it. You do see sometimes more scientific kind of things on TV and there is a lot more talk about technology. It's becoming more glamorous so they are thinking about it more and so probably they'd be going into it more. And some barriers have been removed. I think initially maybe a barrier to someone who is studying math or science— sometimes I think maybe the professors could have been resistant. When you have a resistant professor, you probably could progress that much further. I think

more and more people are becoming more open-minded about who can really study the area and to give everybody a fair shot.

10. **What do you see in the future concerning African-American and Hispanic women in technology?** I see the group growing. It's my opinion that more women are going to college than men anyway. And so, with the exposure they are going to know that all these choices are available to them. And really technology is entering into every field. You won't be able to progress very far unless you use some technology. I do feel that group will be growing.

11. **What have schools not been doing to encourage African-American and Hispanic women to enter into careers in technology?** I would think if we start looking at even males sometimes—the interest in science sometimes dies quickly. Science is something that's alive and it's active, it's doing stuff and it seems that more and more schools teachers are teaching it by just reading the book. Even though the book will have simple activities—like doing science in your kitchen. They are not encouraging the students to do that. If you think that science is something you just read out a book I think that's how you lose your interest fast. If you lose your interest you are not learning much, you do not have the foundation. Then it's very hard to get caught up when you get to high school. And so you just keep lagging behind so there's just no hope when you get to college. I think if there was more focus is made on how science is taught, I think it will stimulate more people. The teachers will have more ideas on how to make science more interesting.

Appendix C

Interviewee # 2 Latricia Hylton

Mathematics Instructor, Hawkeye Community College

Since August 1997

BS-Mathematics Education-Florida A&M University

MS-Mathematics- University of Northern Iowa

1. **What is your association with the field of technology?** My association with the field of technology is I teach a lot a students that are involved in the technology programs—or studying some area of technology. And I also use technology in my classroom to teach those students. And that is my basic association.

2. **(If the person is a African-American and Hispanic, a woman, or both) What made you want to enter into the field of technology?** Well I started out as business major. That's my natural talent; I'm a businessperson. However, when I entered the Business College, I didn't feel like that's where I wanted to be right then and there. And so, I enjoyed math. I really liked from high school. I decided, "why not get a Bachelor of Science degree in Math" When I entered the mathematics department that was right at the turn of the late 80's early 90's when they were turning over a lot of the Calculus reform and putting technology into the classroom. TI had just come out with their first graphing calculators. Casio was following them. There's a lot of technology in teaching mathematics; using mathematic computer aided instruction. There were a lot of studies going on then. And so I entered that era of mathematics when they were using a lot of those technologies. And that made me want to get into it. And then teaching it, I

enjoyed too that I had some chances to teaching youth some of the new technology. I did a pilot study at one point on whether or students learned better using computer-aided instruction versus the traditional classroom instruction. And that kind of got my feet wet.

3. **Do you recognize a pattern of African-American and Hispanic women not choosing careers in technology?** Yes there is a pattern of them doing that. And if they do choose a career in technology, a lot of times it's a career where they are using the technology, but not necessarily being able to fix the technology, write the programs for the technology. They are not getting into the technological field, which is programming, computer repair, and things like that. They are just doing like a secretarial certificate or office administration where they are using the technology, but not necessarily getting deeper in depth in to the technology, where math and science will be required. When I get in my classroom the first day I ask a lot of students, I say, "How many of you in here hate math?" And 99% of my class of all of my class will raise their hands. And the unique thing about my last two years of teaching at Hawkeye, I've always had more female students than males. My classroom will be about 90% female and the rest will be male. And these are the people that are raising their hands. And then the other comments that they make are that "I've always been bad at math" They never say I'm bad at History, bad at English. Even though they might not speak the English language very well, they do not say they are bad at that, but they'll tell you they're bad at math, they're bad at science. They're bad at those fields that require the analytical skills.

4. **What are the possible reasons for that pattern?** I say it's the previous education that they've received. A lot of people that are teaching math in high school are males. Math was a male dominated field, until probably the late 80s when there was a push and a lot of educators were being turned over in the system. They were retiring and the younger generation was coming in with the females in that generation. A lot of these male dominated fields and a lot of teachers feel that women cannot do math. They come from that old school where they have that mentality. They were taught, "women cannot do this—women are not supposed to be able to do these certain things" And also, women were being discouraged from doing things like that. Once they failed it enough times they become hesitant about even touching the subject. They do not want to deal with it, so they say, "I hate it or I'm very bad at math" And those are two things that really are causing a lot of problems as far as them entering into higher-level fields. Especially now where a lot of the careers that they are going to have a choice to choose from involve math. Programming is math. Teaching does require math. If you're even on a machine McDonalds, you have to have some number sense. If you give somebody a ten-dollar bill, and they just gave you a 20-dollar bill and their bill was 8(dollars) and something you should know how much you should be able to give them whether the machine breaks down or not. And a lot of people are running away from that. They do not have a good number sense. And another part is that students can do the manipulations on the calculator, but they do not necessarily have a concept of what the calculator is doing. So then that goes back to having a number sense and understanding the

logic behind what you are doing. It's a lot of little things that play the part in it. Especially on the college level. I get them at the college level and they'll tell me that, "My teacher always let us use the calculator" And I tell them I want to know do you understand the concept of what you are putting in the calculator. You can put it in the calculator and get an answer, but you should be able to reason if the answer is not logically right. So, it's a lot of things that they do not have that's causing then to steer away from it. Because it does require a lot of logic. It's a lot of logical thinking. The same reasons that apply for women a lot of times apply for African-American and Hispanics. They are not going into those fields because they have a good background in math or in programming. Now there have been exceptions. I've seen a lot of young ladies—one young lady started her own Internet program. She was working in her Associate's Degree in Computer Programming and said she knew enough on her own. So she started her program and cut back on her business and cut back on her classes. And she is doing very well. So there are exceptions. The same thing is that same attitude and what they've been taught. Especially among African-Americans women and Hispanics—minorities in general. Over the years those jobs have not been accessible to them, and I think that's part of it too. The accessibility of the job that they want to enter into. Most of them have had opportunities to be secretaries---to be workers in the blue-collar professions, but these are white-collar jobs. And so therefore they didn't have access. I think past history dictates what you're going to do. So that's one of the things that we have to change in their mind. We can tell them, "Now here's this opportunity, get out of the box that you were in

before" Until the late 80s, a lot of those jobs (white-collar) were really for White males. Not even Black males, White males. And so, if you look at the stock market—technology is very high part of the stock market now. Until the Internet came about and people started having computers at home and computers in the classroom—a lot of Blacks didn't have access to a computer. They didn't have access to a graphing calculator—those things came up to one hundred and something dollars. So they didn't have that accessibility. And a lot of those jobs in those fields were for White males. Even in the factory or John Deere—when you walk out on the floor you see nothing but White males. Then you might see a couple of minorities. And even when you go up into the part where a lot of the technologies are there is a rare exception that you see a lot of Black males. Unless they've worked their way up and learned the system and gotten into it. But their education didn't necessarily include that—technology. They were more geared towards other fields, the Liberal Arts fields. I think it is also a hindrance for them that they do not have the proper role models. Because a lot of what I'm going to do and be in life is going to be based on what I able to see. Going to back into the White male dominated jobs that were in existence—if your father was an accountant, you became an accountant. Because that's what you saw. You were around people that were in the field. You would develop a liking or inkling for it, whereas minority women didn't see that. Their parents weren't necessarily in that upper echelon of the working population. They were more laborers. But now it's changing. Now younger women are seeing more of that. But at the same time it's

turn around and do that" Because they are still seeing the majority of the people that they are encountering are laborers--their parents are laborers. And so they haven't had a chance to turn around and see the other part of it. You have to give them a role model and ask them, " Do you know about this person or that person?" That's what made me go into business. There is this man named David Rand, and he became one of the Chief Executive Officers of one of the branches of IBM. I was reading *Ebony* magazine, I saw this man in there and how he was telling about his life and how he became the Chief Executive Officer. And I was like, "I want to be like that" And I entered the Business School because of him. Just reading about his life. And when I got to the Business School, I took my first semester and decided that it was a natural talent of mine I do not really want to pursue a degree in it. And so our role models do dictate what we become.

5. **Do you feel it is important for African-American and Hispanic women to enter into the field of technology?** Yes. Definitely because most of our jobs are using some form of technology. They are. And you have to have a knowledge base of what you're dealing with. Either if you want to be an executive administrator or secretary—technology is being pushed into those fields. It's no longer the typewriter. It's a computer. If you are in an office or you're an office administrator, you'll need to know how to operate the fax machine, the Internet. You'll have to be able to access email. If you're an administrator of any essence, you're dealing with these things. And now that's what's being pushed. Literally, we are international people. We can communicate with people on the other side of the world in less than minutes. And technology has allowed us to do that. And

we have to understand how to use those technologies. Just like when the typewriter was invented and people started using it everybody in the office had to know how to use it—if you were going to be a secretary. Now, that's changing. We are going towards the computers, the fax machines, and the hand-held communication devices. We're going towards the beepers the cellular phones— all of those things. And you have to be literate at some level to deal with the society you are living in. And a lot of us are not. We can get on the computer and type, but do you know how to access email or even send email. Resumes are being posted on the Internet for people to look and to communicate with you. And if you are still stuck in "I'll send you my resume", and they telling you why do not you fax it to me or even yet why do not you email it to me" –and you're like oh? There are opportunities that are not being opened up to you because of your limitations. So it's very important for them to do that. And I think also that's where the jobs are. If you want to change your life, that's where the jobs are. Every job basically now has some kind of technology associated with it that you need to understand or be literate about.

6. **What do you think can be done to encourage African-American and Hispanic women to enter the field of technology?** It should start in middle school. Now a lot of our children do know how to use a computer because they've had access to it. Even elementary school. To start them off. Start getting our kids involved in programs—summer programs that teach them these things and exposes them to that. And there are programs that do that. There are programs in churches that do that. There programs also in the YWCA. The

Waterloo Library has a program where people that have not used computers can go in and they'll tutor them and teach them how to use the computer system. And even when the kids go in the library—if they want to look up a book they have to know how to use the computer. That's how much our life has become technology oriented. Enroll the kids in those programs. And then when the get to the high school level, start putting them in programs and clubs that do things like that. One of the things we used to do when I was in high school is SECME. And it's a science and engineering program where kids actually had to compete with one another on the same high school level and there was a state competition and a national competition. Where kids would build electric cars to see how they were running. They were doing things that engineers would do. It was exposure to them. They would say, "Maybe I do like this" They were doping experiments and doing things. They might not have successful at it, but it perked their interest. And that's something that we have to get our kids towards. It's getting them involved in those clubs and organizations where they can do that. And in the college level, get involved in the clubs like NASBE (National Association of Black Engineers). National Science Foundation has a lot of programs that are pushing minorities. They want you to be in there. Parents also have to take the time and research and find these things, because they are not being advertised. The parent has to take an interest and get their kids involved in these things.

7. **What do you think needs to be done in order to retain African-American and Hispanic women technology?** There is a college in Philadelphia that students in a high dropout rate because they had children, they were single parents with kids.

Or they had other obstacles and still had to deal with and still deal with their families. And what the program started doing was providing day care for them. So if they went night classes, they had day care them basically all day. And they catered to those needs. They met the needs that were hindering them from entering the program or successfully completing the program. And what they found out is they had an 80% success rate. It's just a matter of meeting the need. And actually it would pay off in the long run because the money that you are spending on day care is the same money you would spend on tracking those students to find out why they are not there. It's wasted money if a person started the program and doesn't finish it, because that's financial aid money that they could have used for another student that would have successfully completed the program. So in the long run it's paying off. And then you're providing services for other parents too, and providing a job base for other people. That was shocking that they had an 80% success rate.

8. **Do you think African-American and Hispanic women will encounter social barriers if they choose a career in technology?** One social barrier is that the mentality that they do not necessarily know what they are doing. Some people still have the attitude that minorities do not know necessarily anything and it was given to them. That's one of the big stigmas of the affirmative action program that was implemented. It's that when they see someone in a technology field, a very difficult field; a field that was male dominated—White male dominated and they see a minority, the question is now "did you earn this or was this given to you?" And that's a barrier that when you enter a job that is technology based or

where it's a male-dominated field that becomes a question in you colleagues mind and you have to overcome that. Sometimes that's the worst door to overcome. That I think is the biggest social barrier—the stigma did you earn this position or was it given to you. And do you have the skills that are necessary. You have to prove yourself—you always have to prove yourself before people accept you. And that's one of the things that they'll have to deal with. And then the other part is that in their mind, they have to deal with themselves to get to a point where they believe they can do it. So dealing with their own setbacks and also dealing with your family. Because once you've made it, your family can be your worst enemy. For them a Hispanic or an African-American women coming out of college might be the first person in their family that has made it and has successfully placed themselves in a position where they are becoming economically independent. That is the problem for the rest of your family. That's a social issue. The family members end to think, "O.K. now you think you are better than me—you're this you're that" That's a problem. They are getting it on their jobs, and then they're getting it a home. So they have a lot to deal with in that aspect and I think those are the two greatest social issues that they'll have to deal with. Mentoring can be done to help them deal with these barriers. When you have a person that is coming into a field, it's good to assign them to someone that has been in the field a long time. Someone on the job they can go talk to run ideas across and give them a chance to verbalize what they are going through. Also to provide a support group and training for your employees.

Appendix D

Interviewee #3 Reygan Freeney

Program Coordinator, University of Northern Iowa McNair Scholars Program

Since September 1999

Bachelor of Science Chemistry -University of Northern Iowa

Master of Arts in Chemistry- University of Northern Iowa

1. **What are the program goals and objectives of the McNair Scholars Program?** Our overall objective of our program is to get students traditionally underrepresented in college education enrolled in PhD programs. So we have a targeted group of people that we look for. We look for minority students, i.e. Hispanic, Black, and Native Americans. We also serve the population of low-income first generation college students. The low-income guidelines are determined by the federal government. We are under the Department of Education.

2. **What made you want to enter into the field where you would help African Americans or Hispanics get into the mainstream?** Well actually I'll give you a little bit of history about myself and then it will kind of lead to your question. The University of Northern Iowa was not my first choice. Actually I went to Wisconsin for a semester. I knew that I wanted to do something in Science. I didn't exactly know what I wanted to do. I enjoyed school in high school—pretty much all my classes except History. I excelled in high school and whatever I did I did well. When you are going into college your freshman year you really do not know what you want to do. You want to do everything. I went to Wisconsin for a

semester and I missed home. So I ended up here at UNI (University of Northern Iowa) because this is where I am from. In high school I had a wonderful Physics teacher, so I thought I wanted to do Physics initially. So when I got to UNI, I took a Physics course, I took a Chemistry course my first semester here. Being in Physics and Chemistry at the same time wasn't too demanding by any means. But just looking at the instructors that I had between the different majors, I felt more comfortable in the Chemistry department than I did in the Physics department. And so I ended up in Chemistry. I wasn't really sure if I wanted to do Chemistry. And there was no one else Black in the Chemistry department or the Physics department. So I figured I would do Biology since there were more Blacks. But Biology was not as challenging as I wanted it to be. And Physics at the university level did not have they type of instruction that fit my needs. However when I was in Chemistry my first instructor was always encouraging. He said, "Reygan you can do this you are really good at this. You should really consider a field in Chemistry" And I told him no. Throughout my undergraduate years I did Chemistry and Physics and Biology all simultaneously. But it always kind of ended up back at Chemistry. I would always hear these horror stories about Organic Chemistry. And I got into Organic Chemistry and realized it was feasible. And then I heard horror stories about Physical Chemistry and again I realized that was feasible. There is a history of people making it through General Chemistry, and then you go to Organic. Organic Chemistry starts to weed people out, but Physical Chemistry really weeds people out. And I wasn't weeded and so I stuck with the field. I did some research in my undergraduate career and also

when I was in high school I did some science programs like at Iowa State. And so

I always knew I wanted to do science. I just didn't know what type of science.

And I didn't have in the field that looked like me who acted like me or had the

same interests as me or came from the same background as me to serve as a role

model. But I always had people around me saying that you're good, you should

consider this and I eventually did. Once I graduated with my undergraduate

degree in Chemistry I went out and I got a job. I thought I was going to find my

dream job, but I only had my Bachelor of Science degree. I was doing bench

work, which is repetitive lab work, and it wasn't challenging and I like

challenges. I didn't stay in that position too long. I actually relocated to the West

Coast and thought that I would find my dream in Chemistry there, and I didn't.

The economy wasn't the best when I was out there, so I ended up in Iowa again

going to graduate school. Then I pursued my Master's in Chemistry and when I

graduated I thought again that I would find my dream job in Chemistry and it

didn't happen. I was offered jobs in Chicago and Des Moines but it wasn't doing

the type of work that I really wanted to do. It was dealing with radioactive and

pharmaceuticals and things of that nature. And it just really wasn't what I wanted

to do. This position opened up and here I am. Not doing Chemistry, but really

enjoying the challenges associated with this program. But I can say from my

undergraduate and graduate experience that a lot of people of my culture

(African-American) are not really exposed to great teachers of science. A lot of

times when you have great teachers of science and people who show interest---it's

not more difficult than any other subjects, you just have to apply yourself. When

you have a great teacher or an instructor, you tend to have an affinity towards that subject. And that's kind of what happened in my case. There was no defining moment; there was no defining one person in my life that said Science is what you ought to do. I think that a lot of people really do not have that type of teacher or an instructor who really says that science is important even though it's not traditionally represented by us (African-Americans), but it's some that you should consider.

3. **What do you think can be done to encourage African-American and Hispanic women to enter the field of technology?** When I was in high school, my Chemistry teacher was not a good teacher. He was an older White male he wasn't really there to say, "Yeah Chemistry!" He was just kind of there in front of the class instructing. I think that coming up with my generation and the generations after, science pretty much has to be a hands-on activity. It's not something you can just up there and lecture about and expect students to be interested in. If they do not see how it relates to real life or how to apply it, then regardless of the subject students may not have that strong interest in it. For me I've always been hands-on, and I'm really the type of person who likes to sit back and get lectured at. I think a lot of African-American women are like me. We do not like to just sit still and just be taught. We like to learn, apply, and do things. I think that a lot of the traditional educational setting doesn't allow this. When you do not have that type of encouragement, that type of hands-on, that type of practicum, then you do not really go towards that. I think there are a lot of rumors and stereotypes. When you picture a scientist you picture Einstein. You do not

generally picture a young African-American or Hispanic female. You do not think about those things. I think that are people that are dominant in our field who excel. But we do not hear about the 'Dr. Mae Jemisons'. We do not hear about people of that nature. We do not necessarily have to look for outside role models. It can be at home. A lot of encouragement at home. My mom was not college educated and she didn't know the first thing about Chemistry. She still doesn't even though I've gone through and obtained two degrees in the field, she still doesn't know. She was just always there to encourage me. I know that regardless of what field you may be interested in; there are tribulations and triumphs. I think that a lot of the science programs nowadays, you have programs targeted towards minority students and women to help them pursue areas that are traditionally underrepresented by us. (Minorities) I think a lot of those programs have initiated a path for women to consider a career in science mathematics.

4. **Do you feel it is important for African-American and Hispanic women to enter into the field of technology?** When you are looking at career objectives and long-term goals, you want to have a job once you graduate. You know that has always been around, science will always be around. When you look at the demographics you have a lot of people who will be retiring. And when you're looking at pay and things of that nature and how you can be on the breaking edge of something—whatever it may be, just to inform students of this. It's so amazing. When I say Chemistry, I would always ask, "What can you do with Chemistry?" I realized everything has to do with Chemistry. Textile dyes, lipstick, perfume, lotion, the car you drive, tires. Everything has to do with

Chemistry. You should ask what cannot you do with Chemistry instead of asking what can you do. I do not think that people are really aware. That has really limited us and harmed us in that area because we are uninformed. We have haven't flourished in that area for lack of knowledge.

5. **What do you think needs to be done in order to retain African-American and Hispanic women technology?** I guess it really depends upon the individual person and meeting their needs. Whatever their needs may be. It depends upon their interests. I think a lot of it has to do with pay and location is a factor. For me I do not want to move to Dover or Wilmington. I didn't want to move to Delaware and work for Pfizer. So location has something to do with it. I know there are places like Bayer in Chicago. Even though they promote people to go into the field it's really hard to get your foot into the door. I think that the "old-boy" network is still existent in our field.

6. **Do you think African-American and Hispanic women will encounter social barriers if they choose a career in technology?** I think that some social barriers that women typically encounter in the field of science, math, and technology ---I will tell you this. When I initially started in the Chemistry department, pretty much everyone over there was an older White male. You have some that are friendly and some who are not so friendly. When I was interviewed for certain positions, I was interviewed by older White males. You can come across as professional and as knowledgeable as possible, but you still do not fit that typical—that "old-boy" image. However since there are more women in the field and there will be more women upcoming in the field hopefully we won't have to

go though he same type of "old-boy network. There will be women who will be interviewing us across the table and women who look like us (Minority women) and asking question to see what we are really about and not just looking at well you went to an HBCU (Historically Black University and College) so how much Chemistry do you really know.

7. **Why do you think there are more African-American and Hispanic women in the field now than there were a few years ago?** I think really just drive and people being there for them. You have programs, you have schools that are actively recruiting students in those area. I think that's why you've seen an increase.

8. **What do you see in the future concerning African-American and Hispanic women in technology?** The future is questionable. I think technology will always be around; however when you look at things that are being done in the news. Affirmative action, cutting programs that recruit or have special funding. The National Science Foundation actually eliminated a fellowship for minority students. So when you are looking at those things, they are detrimental to us. They are not encouraging us and it doesn't look very good for our future in that aspect. However I think that we have more women who are more demanding, who are encouraged more. That may help in increasing the employment of African-American and Hispanic women in the field of science, technology, and mathematics.

9. **What are your feelings about being in a white-male dominated field?** I always different. My thing was always to go and get my work done. I was never really

there to hang around. A lot of the students there in the Chemistry department hung around, socialized, and hung out together. But that wasn't my thing. I was there to get my education get my work done and that was pretty much it. I think that initially when I did that people over there in that department really weren't used to that. They were used to students hanging around and doing things. Whenever I had a question I would ask a question. When I had a concern I would address my concern. I think they saw that I had a good work ethic and I was just as smart as the rest of them, I just didn't hang out and socialize with them.

10. **Who were your role models and can you apply your experiences to help young women to succeed?** I was always told from my mom, from my family member, from teachers that I was smart. So I believed it. My mom always rewarded me when I got good grades. When you're a kid generally the reward is nothing big, but to you it is so I strived to achieve. I had lot of role models. I was actually a participant in the Upward Bound Program. They were able to help me make the transition from high school to college. My mom wasn't familiar because she didn't go to college. Upward Bound was beneficial in that aspect. And there are some professors over there in the Chemistry department who encouraged me. People need encouragement. Especially if you are going into a setting that is not traditionally applied or sought by someone of your nature. That's why I stuck around. They told me that I could do it and I was good and continued to tell me those things. Finally I started to believe it. My initial classes as an undergrad, I had one Black girl with me and we were close. Whenever we had issues or problems I knew that I could turn to her. She was only there for my

beginning. Then when I got to my upper level, I didn't have anybody and I was used to studying alone. It really does depend upon you. You can either see a situation as half empty or half full depending on how you want to look at it. You can make the best of a situation, make it a learning experience and apply it and excel and make it a defining moment or you can see it as a set back or an obstacle you cannot get around and literally let it take control of your life. You really need to work hard and work for the best.

11. **What other programs encourage African-American and Hispanic young women to enter into the field of technology?** I was able to work with Upward Bound Math-Science. I think when I started to work with the program they really did a lot to encourage African-Americans male and female and Hispanic male and female about science. I think that a program of that setting and a program with those goals and objective are really beneficial. You are getting them at that age when they are adolescents. We know how adolescence is, especially for boys. If you have someone there who is really encouraging them at that point in their life, then I think it can only mean success.

Appendix E

Interviewee #4Patricia Higby

Adjuct Professor (Activity Based Physical Science and Conceptual Physics)

University of Northern Iowa

Bachelor of Science in Physics Teaching Math Minor –University of Northern Iowa

Master's of Science-General Science-University of Northern Iowa

Master of Arts Degree- Home Economics University of Northern Iowa

1. **(If the person is a African-American and Hispanic, a woman, or both) What made you want to enter into the field of technology?** I think it was the high school experience I had. We had some excellent teachers. I went to Independence high school. You're kind of looking for mentors. Unfortunately they were all men, but that didn't seem to matter. I had a good background in math and I think that's where I came in as a math major. I didn't find the math field cold. The Physics department was using the math. It was like, you've got the math, and this is what we are going to use it for. They are a very friendly department. It was a warm feeling there.

2. **Do you recognize a pattern of African-American and Hispanic women not choosing careers in technology?** I've observed very few, either African-American or Hispanic, very few minority women in elementary education that are taking my activity based physical science class. In the number of semesters that I've taught it, I can count on one hand probably the number of female minority students that have been in my classes. Each of those classes has had 30-35 students in it. It's just a very small proportion. The interesting thing is that I've

taught Upward Bound last summer and I'll be teaching it again this summer and we see plenty of minority females in the Upward Bound Program, but that's kind of a small group to be looking at. I would hope that a lot of them would go on and continue with the science and math. So far I have not seen them at the university level in the teacher education field.

3. **What are the possible reasons for that pattern?** I guess here is where I would want to go back to my personal experience. Five or six years ago when I was at the Grout Museum Science Imaginarium, we had a lot of work-study students from the University of Northern Iowa and also from Hawkeye Tech. One year in particular I can remember we had four African-American girls from both of the schools. And the amazing thing was three of the four girls had babies. They had had babies in high school. I could see right there how hard it is to be choosing a career period let alone one that is going to require a lot of further study. One of the girls I know has continued. She graduated from Hawkeye Tech. And I see her occasionally on campus now. So I know that she's gone on with it. It's very difficult for them. They have those babies to be taking care of and then still trying to go to school and find a career. It just amazed me. Three out of four just seemed like a high number. I guess that would be one reason, the problem with babies having babies is definitely going to affect your numbers that you are going to see.

4. **Do you feel it is important for African-American and Hispanic women to enter into the field of technology?** I think it's important to find the career that fits them best. There's no reason why it would not be math, science, technology. I think it's wrong to be encouraging them into something that they do not feel

comfortable with. It's hard to say, "You should be in this," if you are not happy with it. It's like my starting out as a math major, but I wasn't comfortable with it so I switched to Physics. We have to make them aware it, but we cannot force them into it. If they are happier in Law or Psychology or Philosophy, then that's where they belong.

5. **What do you think can be done to make African-American and Hispanic women ware of the careers in technology available to give them a broader scope of what's available?** I do not know how much work is being done at the high school level at this point. I know when I went to high school, figuring out a career was an important part of the guidance counselor's job. But at the same time, so was finding scholarships for all of us in the senior class. He was working very hard to get as many scholarships as he could for all of us. I do not think that's their role any longer. For my own children who just graduated four and two years ago from high school, the guidance counselor seemed more involved in conflict resolution. The only way my children got scholarships was the fact that we went out and found them for ourselves. I do not know if they had any information on careers. They kind of information about careers that I grew up with in my high school time were so different than what the kids have now. My son is in Industrial Technology my daughter was very good in math and science, but she chose History. She liked History much better. Now she is going on to library work. Even though they've had a background at home where we emphasized science, it didn't feel right for my daughter so she didn't choose it. WE used to do more with careers I think than we do now. It's not just the

minorities that need help with it; I think it's the entire high school groups. I belong to the American Association of University Women. One thing that we do every year is to have a conference for kids. It can be junior high/high school; mostly girls that come to us and at that meeting that they come to we have sessions by a number of women in different professions. Science and math as well the other professions law and so forth. That is good for them to see and talk to somebody in a career and start to get some ideas like that. But that's just one program for thirty or forty girls. It's not going to be affect, but it's something that we do to make girls more aware of the different career choices.

6. **What do you think needs to be done in order to retain African-American and Hispanic women technology?** I think for them to feel comfortable, the first thing is having a good math background. If you do not have the tools to do a job, it's very difficult and math is the tool. I know in my own experience, without Calculus III without differential equations it was very difficult to go on in Physics. You had to have a math background. For women now it's not just the math skills, but the computer skills as well. That I think is the first thing. Make sure they have a good foundation in the math and technology so that they are ready to go on in that field. But then the second problem is if you've got a family at home, then what? It's not just math and science, but any career. What are you going to do with that family? You've got to have the support of your own family helping you out. The university I know has a day care, but it's very limited. I'm working with a teacher now who just had a baby and I think it's like a two-year wait for them to get into the day care. Childcare is one of those crucial things. If

we are talking about women and trying to get women into careers, then you've got to look at that aspect of it.

7. **Do you think African-American and Hispanic women will encounter social barriers if they choose a career in technology?** It is kind of an "old-boys" network. But it shouldn't be as much of a barrier now as it used to be. Again, I belong to the American Association of University Women that has funding available for women who have that they have been discriminated against. It's amazing how many of those women are discriminated against at universities. Even something like Stanford in California—it's just amazing. Not being promoted as their male peers are being promoted. I think when companies or universities realize that it's a case for legal action and there is a fund available for these women to draw on to take that legal action and even more important than that, they have the support of all these other women across the nation to help them, I think that they're going to find less problems in being accepted by their male peers. I cannot really say that I've felt discriminated against as a woman. I do know that I was never really encouraged to go on to get my PhD in Physics. It was not something that anybody in the Physics department had ever said that I should do this. It was just kind of assumed that I would continue to take that lower level job. It's a traditional old-fashioned male dominated profession. It was just never encouraged. I went on in my other degree work in Home Economics. I was never encouraged from the Physics department.

8. **Why do you think there are more African-American and Hispanic women in the field now than there were a few years ago?** I would hope it's because there have been fellowships available for them. Perhaps there were role models more mentors to help them into it. I know in Ames, there is a Woman in Science Program. There are more programs going on now to encourage girls into science and technology. If there has been an increase, maybe that's why. We've actually been working at it.

9. **What do you see in the future concerning African-American and Hispanic women in technology?** I hope that they find it to be comfortable there and stay there. There is really no reason why they shouldn't be there. It's a field to that could benefit from their background. Sometimes I think that our theories and our ideas are so based on our dominant culture and because of that we have blinders on we see things only this one way. If we can get different cultural backgrounds looking at different problems they might be able to see it in a different perspective. I think it's a very good thing to get other cultures involved. We want to encourage girls into the field, but we do not want to make them feel uncomfortable there. I think the mentoring and the encouraging at junior high/high school is maybe the best way of getting them in. It's very difficult after you're at a college level, even though you might be very interested Physics, without the background in the math and technology, it would be very difficult to play catch up at that point. I think it's really crucial that you get the good math foundation—the Algebra, the Geometry at the high school level. We've gotten lax about that in high school. I know I find that science and math background of

the students I'm teaching in Elementary Education is very poor. Sometimes I feel I'm teaching catch-up science things they should have learned in high school. Maybe that's where it needs to really be directed, right back there at the school level. We do what we can in college, but when we have to feel like we're trying to play catch-up, then it's hard to advance from there.