Native American Women in Computing

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INTRODUCTION

In the 1990s, a number of efforts had been made to increase the representation of women in computer science (CS) and computer engineering (CE) education, mostly to compensate for the expected shortfall of candidates from the traditional source: 18-year-old non-Hispanic, White males. Yet, women remain underrepresented in the CS and CE disciplines. The underrepresentation of minority women is especially conspicuous and is absolutely glaring among Native American women. Though there are studies on the underrepresentation of women in CS and CE education, there are very few studies on minority women, and there is very little scholarly work on Native American women. Because Native Americans—officially classified as American Indians and/or Alaska Natives—are relatively small in number (1.5% of the U.S. population), they are seldom represented in assessments of gender and/or racial disparities in CS and CE education.

The educational attainment levels of Native American women have improved significantly over the last two decades. Despite these advances, the education level of Native American women remains considerably below the levels of the total population. They are less likely than the total population to graduate from high school, to enroll in college, and to graduate from college (Madrid, 1997). Native American women who do enroll in and graduate from college are less likely to be in science or engineering disciplines. Native American women who do graduate in science or engineering disciplines are less likely to be in CS or CE. For instance, in 2001, Native Americans earned only 271 bachelor's degrees in CS. Of these, Native American men earned 193 and women earned 78. Of incoming freshmen in 2002, only 4% of Native American men and 0.5% of Native American women intended to major in CS (National Science Foundation [NSF], 2004). This article discusses why so few Native American women pursue education in CS or CE disciplines after high school.

BACKGROUND

Most scholarly work on the underrepresentation of women in CS and CE education has been about the gender gap in science and engineering. It is generally assumed that many of the reasons that discourage women from science and engineering education also apply to CS and CE. When scholars have studied women in CS and CE disciplines, they have concentrated mostly on White women. If scholars have considered minority women, the focus has been on blacks and/or Hispanic women (e.g., American Association of University Women [AAUW], 2000; Howell, 1993; Margolis & Fisher, 2002; Martin & Burchie-Beyma, 1992; Moses, 1993; Spertus, 1991; Varma, 2002). These studies reveal gender bias in early socialization at home and in school, feelings of being deficient in mathematics and science, a lack of exposure to computers, the use of computers mostly for word processing, the masculine image of computers, and the absence of female role models—all of which contribute to the underrepresentation of women, including minority women, in CS and CE education. Though most of these barriers are likely to apply to Native American women, there may be additional historical and cultural factors that may play an essential role in their relative interest in CS and CE education.

Native Americans tend to maintain tribal traditions and connections to their tribal community. They are likely to live in what has been called "two

worlds": the world of Native American ethos, which holds that sharing, generosity, and thinking as a group contribute to tribal community survival, and the world of American ethos, which values independence, individualism, and competition to enhance individual success (Benhaim & Stein, 2003). The Native American worldview emphasizes the importance of grasping the big picture before studying particular subjects (Megginson, 1990). Native Americans prefer harmony and group-oriented learning environments to environments that promote individual success (Anderson & Stein, 1992). As a result, Native American students may face more challenges in pursuing a major in a CS or CE discipline than White women, blacks, and Hispanics. Because of patriarchy, cultural values, and social norms, Native American women may have more problems studying CS or CE than Native American men.

This research explores different spectrums to explain the low representation of Native American women in CS and CE education at the undergraduate level. It is based on 50 in-depth interviews of Native American undergraduate students (25 females and 25 males) enrolled in a CS or CE program at six nontribal and tribal universities.

MAIN THRUST OF THE ARTICLE

Many interview students noticed that there are very few women studying CS or CE at their universities, and among the few women, very few are Native Americans. The majority of those who recognized a low number of women in CS and CE disciplines were female. Generally, students from nontribal sites were more likely to mention few women as being an issue than students from tribal sites. One female student said,

We are pretty rare in the computer program. Most of my classes, the ratio is like 1 to 10, 1 female per 10 male students ... These women are either white or Hispanic. I am the only Native woman in the class.

A male student observed, "I do not think there are any."

There are multiple reasons why there are few Native American women pursuing degrees in CS or CE programs. Because of the patriarchal way of life that dominates children's social and educational worlds, Native American women are historically seen as physically and intellectually less capable than men. Cultural and social notions about Native American women affect the way men view them in CS and CE programs. Although the majority of respondents (76%) indicated that they did not experience incidents related to gender in the CS and CE programs, gender bias and male preoccupations are prevalent among students. A closer look at the data shows that men's expectations and preconceived stereotypes about Native American women are more common than what the numbers might suggest.

For example, the majority of male students mentioned the gender bias was in favor of women. As one male student mentioned,

I often feel that [Native American women] have an advantage because of low male to female ratio ... In some sense they are more successful because they have all the resources from the smart guys who are always ready to help them out.

Another said, "I think [Native American women] get a lot more offers upon graduation than us because companies are trying to make their workforce diverse and it looks good to have Native American women." Another male student believed, "[Native American girls] receive favorable grades just because they are girls." These quotes show that what might appear as bias in favor of Native American women at first might not be the case at the end. For instance, the first student quoted mentions that girls are successful because they work with the "smart guys." In other words, Native American women succeed not because of their intelligence or hard work, but because of the help of somebody else, a smarter male specifically, and that special aid gives them an advantage over men.

Bias in favor of men differs greatly from bias in favor of women. While bias in favor of women relies on the help of others because of the inability of women to perform tasks by themselves, bias in favor of men is based on the simple fact that the student is male. As one female student said, "There is still a

perception that males are bosses or think they have a better chance of getting further in their career." A male student believed, "Low representation of [Native American] women has to do with the scientific worldview. Because they don't have it, they encounter problems. Since most of us do have it, we don't encounter problems." So, a man's success in CS or CE depends solely on himself, whereas a Native American woman's success depends on acquiring the male scientific worldview. Such perceptions create an intimidating environment for Native American women. For the most part, more women from nontribal sites identified intimidation to be an issue than those from tribal sites. One female student said, "I have to always assure myself that I can do this, I am capable of doing this. I am doing the right thing by being here." Another echoed, "Sometimes, I am scared to speak, or ask questions, because what guys might think if I am wrong."

Yet, when asked if there is a difference in being a woman in a CS or CE program, almost one third of respondents said that there are no gender differences. Of those who believed that there are no gender differences, a large majority was women (58%). Nevertheless, a closer look at the responses of the female respondents shows that there is still a gender bias against women in CS and CE programs. For instance, one female respondent stated,

Well, I don't think that there is a difference in being a woman. I never thought about it. They treat me the same. I always get treated like one of the guys. I even forget that I am a girl.

This student mentions that there is no difference because she gets treated like "one of the guys" and she forgets she is a girl. Such statements show that even when women think that there are no gender differences, these differences are actually internalized. Women look up to men as the ultimate way to succeed in CS and CE programs. If there are no gender differences, why would a female student be pleased to be treated like a male? Or why would a female student forget that she is a female? By undermining their gender, female students have been able to transcend gender stereotypes. Some female students said, "[M]en look down at us just because we are females studying computers. Ironically, they have the power to look down at us."

Nevertheless, gender bias is not the only reason why Native American women are underrepresented in CS and CE programs. Cultural norms and early child socialization are important concepts to consider. There are strong patriarchal attitudes toward Native American women. As one female student said,

There is a disadvantage when you are a girl and you grow up in an unspoken way of life that doesn't allow girls to explore as much as boys would. So when girls get to college they might not have the skills to disassemble logic.

The underrepresentation of Native American women in CS and CE programs is in part a consequence of a historical Native American culture that favors men over women. Cultural patterns such as allowing men to "explore" more than women are closely linked to the different opportunities available to women and men. One male student acknowledged,

In general, computer science is not very attractive to women because it relates back to our culture. I am from Zuni and the women do not have a chance to learn the value of knowing how to program because of cultural aspects.

Another male student believed that "to do computer science, you need a scientific worldview. This is not what we teach our women." One female student regretfully said, "I just think a lot of parents don't encourage us to go in higher education or to study computers…They don't think it is really a woman thing to do."

Besides cultural aspects that do not encourage them to study CS or CE, Native American women face family and community challenges that other students may not. Family has been of paramount importance in Native American communities. The family structure tends to include extended family and several generations living in close proximity to each other. Women, especially grandmothers, play a key role in family affairs (Deloria, 1991). Native American women hold family together by taking care of elderly family members and/or children. They are responsible for exposing children to their traditions and ceremonies, and teaching Native

American languages. Many females, mostly from nontribal sites, identified family affairs to be a barrier to success in CS or CE education. One female student stated,

Because it takes a lot of time, it takes a lot of effort on your part to study computer science; you have to figure out well in advance how you will handle your family matters and community events. Your study schedule has to have time for family and for community.

One male student described the situation like this:

Motherhood comes early for a lot of Native American females. So the success rate of women to get to the point of computer science is very low…Then family is always calling them back home for ceremonies or other matters so they just don't get through far enough into school to get to the point of actually doing computer science.

Cultural norms, early socialization, gender bias, and family matters are not the only factors creating obstacles for Native American women pursuing education in CS or CE; economics play a key role. The U.S. census of 2000 shows less education, lower earnings, more poverty, and poor health status among Native American women than the majority of the population. These economic difficulties experienced by Native American women are linked to the resources they are exposed to and the opportunities they have. It is well known that minority-serving schools, especially tribal schools, face the "digital divide" (Guice & McCoy, 2001). Still, because of socialization and cultural norms, Native American men get exposed to computers earlier than Native American women, and early exposure to computers leads to interest in a career in CS or CE. Female respondents cited a lack of exposure to computer technology more frequently than male respondents. Women from tribal sites cited a lack of resources more than those from nontribal sites. One male student acknowledged, "In order to be interested in computer science, women should be exposed to computers for a while. I mean, they are not cheap, and they are not everywhere. They are mostly in upper- to middle-class white households." One female student narrated, "Where I came from, it wasn't something that people thought about. I never really had heard of computers until I went to high school."

When Native American women do decide to study CS or CE, they are not appreciated within their family and community, mostly because "the image of a computer scientist is of white male." Native American women are often stereotyped as operating outside traditional norms if they pursue degrees in CS or CE. Women who do enter CS or CE programs are seen as social outcasts, plain, and unfeminine. As one female student said, "They think that I am a nerd. I am a geek. I am intimidating." Another said, "My folks see me as nerdy. They complain that I no longer have time for them, for the community. It has been hard for me and for them." Many Native American women also do not enter CS or CE programs because it is a white-male-dominated field, and so Native American women wishing to pursue CS or CE are caught between filial obligations and pervasive stereotypes.

FUTURE TRENDS

Changing the underrepresentation of Native American women in CS and CE will be difficult to accomplish. Some factors can be altered, but others are more challenging to modify because they are historically and culturally based. Gender bias will take some time to change, but ingrained cultural traditions among Native Americans are unlikely to transform. Therefore, one must focus on goals that are more likely to be achieved, such as providing access to resources and early exposure to computers.

When students were asked what could be done to attract more Native American women to the program, none of the suggestions were related to those cultural and historical issues that make Native American women choose not to pursue CS or CE degrees. Nevertheless, the majority of students mentioned program changes such as more female faculty instructors, classes for females only, and an alternative approach to learning. As one male student said, "It might encourage them to see more female professors in computer science because as far as I know, a majority of the CS department is males, mostly males." Another female student said, "More female instructors. I haven't had a female

instructor yet." Students also suggested a number of support services such as scholarships, tutoring, and more computers.

Although these are good techniques to possibly change the underrepresentation of Native American women in CS and CE programs, one should not forget that historically, Native Americans have not had equal opportunities in education. The federal government and the education department must address issues of poverty and income inequality in order to indirectly improve Native Americans' access to technological resources, which will consequently bolster their interest in CS and CE programs.

CONCLUSION

Native American women face several issues that are different from Native American men who pursue degrees in CS or CE. Because they face factors pertaining to both race and gender, Native American women have a long way to go to achieve equality in higher education in CS or CE programs.

ACKNOWLEDGMENTS

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KEY TERMS

Digital Divide: Refers to the socioeconomic gap between communities that have access to computers, the Internet, and computer-related technologies and those who do not.

Native American Cultural Traditions: Practices that include listening to elders; maintaining languages, ceremonies, and powwows; and having a self-perceived identity based on cultural traditions.

Native Americans: People officially classified as American Indians or Alaska Natives. They have origins in any of the original peoples of North and South America and maintain tribal affiliation or community attachment.

Two-Worlds Metaphor: The concept that Native Americans live in two worlds where there is cooperation vs. competition, group emphasis vs. individual emphasis, modesty vs. self-attention, the nonmaterialistic vs. the materialistic, harmony with nature vs. conquest over nature, the spiritual vs. the skeptical, and the aggressive vs. the passive.