

# One CISTer at a Time: Building Strong Relationships through a Female Mentoring Program in Computer Information Systems

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## Abstract

The under-representation of women entering into IT-related fields remains a persistent issue that affects the Information Systems Discipline. Among the causes and address, and remedies to explore is to establish role-models and exemplars for women considering computing programs for their educational path. We share our experiences in developing a mentoring program for women in a Computer Information Systems to explore and reflect on options and opportunities to make the discipline a more inclusive space. Both our mentoring program and early activities of the women who have participated in the program are explored and juxtaposed against guidance in the literature on the phenomenon.

**Keywords:** IS education, Women in IT, Coding bootcamps, IS curriculum, IS workforce preparation

## 1. INTRODUCTION

Technology is ubiquitous in every aspect of society; yet, women continue to be underrepresented in technology related fields. Even though information technology related jobs grew 2.4% in 2014 (Synder, 2015), women held only 25% of all computing jobs (Bureau of Labor, 2016). While this is not a particularly new problem reported in the Information Systems context, it remains a compelling problem worth addressing (Ahuja, 2002; Mathis, 2008; Menlo et al., 2008; Nicolai, 2003). Rather, even as there will be an estimated 1.4 million jobs estimated in computing related fields in the short term, unfortunately, women are expected to fill only 3% of these jobs (U.S. Department of Labor, 2015).

As such, providing the means, particularly within higher education, to encourage participation and enfranchisement of women is undeniably crucial to improve their access to professions in computing (Hill, Corbett, & St. Rose, 2010).

A survey, entitled "The Future Tech Workforce: Breaking Gender Barriers," conducted by the Information Systems Audit and Control Association (2017), identified a lack of mentorship as among the principal barriers experienced by women in technology fields. This is consistent with earlier research which identifies the social and structural factors which influence 1) career choices in IT; 2) career persistence in IT; and, 3) career advancement in IT. These are the dependent variables of ultimate interest both

in general and in this paper. More acutely, mentoring holds promise as a key ingredient from which both social and structural factors may be addressed.

This paper outlines an initiative to address this problem of underrepresentation of women in IT and computing fields in the design of a female-based, student-alumni mentoring program. This program has been developed for the female students in a Computer Information Systems program at a mid-sized, ABET-accredited university in the Southwestern region of the United States. This paper presents an evaluation of the mentoring program and identifies the affordances and the constraints of the program so that the necessary improvements can be implemented for the following years as the program expands.

To tell our story, the paper is presented in the following sections: a discussion of key literature salient to women in IT and computing; some discussion on the value of mentoring in career selection, matriculation and advancement; a description of the program at our university; an explication of progressing the role of mentee to mentor; prospects for mentor-focused solutions to address the underrepresentation of women in IT.

## 2. UNDERREPRESENTATION OF WOMEN IN IT AND COMPUTING

Ahuja (2002) presents a model of the social and structural determinants for women's careers in IT that is compelling to our focus here (Figure 1).

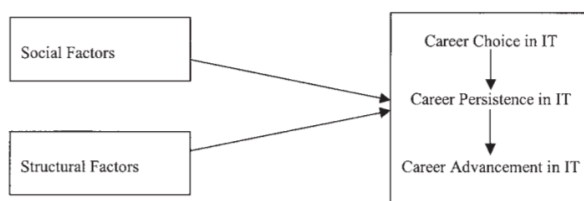


Figure 1. Social and Structural Determinants (Ahuja, 2002)

The aims of Ahuja's model can be well integrated for our purposes here: we simply desire to see a greater representation of women in computing to offset acute gender imbalance. We hold that it behooves a wide range of constituents and stakeholders in the computing disciplines to redress this imbalance to the benefit of society, the discipline, and computing practitioners (Cukier et al., 2002). Further, it is

While we do not adopt a decidedly feminist approach to the issue, some have called for "technofeminism" as a means of pointedly altering social and structural aspects that perhaps keep IT decidedly male in nature (Wajcman, 2007). In this regard, we acknowledge and adopt a perspective that technology increasingly manifests itself culturally (Wajcman, 2010). Culture can be socio-technically shaped and culture can be both inclusive and exclusive. For instance, news headlines alone reveal some patterns of sexism and misogyny in bastions of Information Technology such as California's "Silicon Valley." Thus, it has been suggested that the IT culture may, at times, border on promulgating bullying and harassment (Lawler and Molluzzo, 2016). While we do not make any empirical observations on misogyny or antisocial behavior in the discipline, the fact of underrepresentation of women juxtaposes interestingly with technofeminist theory that holds that technology is culture (Wajcman, 2010). Put from another theoretical perspective, as technology is socially shaped as it is economically shaped, some degree of emancipation from the ills in that shaping is possible (Williams and Edge, 1996). The issue is somewhat situated in place as well as culture as representation of women in IT is not globally imbalanced (Wajcman, 2010). Thus, we clarify that the focus of this paper is particularly for computing programs in higher education in North America as well as the industry and discipline as it manifests in North America.

We further explore social and structural factors with an idea that technology itself, having been socially shaped is gendered (Wajcman, 2010). This notion is rooted also in social shaping in that, being male-dominated, technology is somewhat imbued with that male dominance. Against this backdrop, we acknowledge that women are indeed embedded within the fabric of IT and, furthermore, women may be just as varied in personality and proclivities as any individual. Rather, we aim to understand the basis of the roles that have historically been cast for women vis-à-vis the IT profession.

In Ahuja's (2002) model, social factors include social expectations in gender roles and work-family conflict (often manifested in child care concerns). Structurally, Ahuja (2002) highlights organizational culture (again, reference recent headlines regarding gender issues (Mundy, 2017; Simonds, 2017)) and a lack of role models. Thus, we focus here in this paper on developing role models via mentoring. Propositionally, Ahuja (2002) asserts that a lack of role models

negatively influences the selection of IT as a career and further negatively influences persistence in such a career. Thus, a program related to mentoring women, particularly who, once past the unlikelihood and odds against selecting an educational path towards an IT career, would establish the informal networks that would lead to a change in the culture of IT itself. Thus, we appeal to another of Ahuja's (2002) propositions in that a lack of female-friendly informal networks will negatively influence women's advancement in computing and IT.

Assuming the tenets of the body of theory regarding the social shaping of technology, the degree to which the structures of IT can be influenced positively regarding the inclusion of women, a focus on organizational matters would bear fruit. Primary among them, holding great benefit regardless of gender, is mentoring. Thus, we further concur with Ahuja's (2002) proposition that a lack of mentors will negatively influence women's career advancement within the field.

### **3. THE CISTERS MENTORING PROGRAM**

The CISTers Mentoring Program is a collaborative effort between the faculty, undergraduate students, and alumni to foster meaningful professional relationships between current students and alumni mentors. The mentoring program pilot began in Spring 2017. At the time, there were 22 female students enrolled in the program. Out of 22, 15 students participated in the program. Five mentors participated in the program. Each mentor was paired with two or three mentees. The underlying concept of the CISTers is to provide mentees with female role models in the field as the mentees work on personal and professional development, and career and network building. Research has found that role models and mentors have a positive impact on female students (Holmes, Redmond, Thomas, & High, 2012; Weber, 2011). The program aimed to provide this type of mentorship to inspire the mentees so that they can expand their vision of what is possible for them based on what they see from alumni who were in their shoes as students and promote successful participation, networking, and facilitate success in their future professional careers. Furthermore, the program aimed to have mentees create personally and professionally relevant and meaningful relationships with their mentors.

The development of the mentoring program involved significant ground work at different stages. The first step was to identify alumni, find

their contact information, reach out to them, and inform them about the program and the requirements. The second step was to contact all the CIS female students and encourage them to participate. Once the alumni and the students were identified, the next step was training the mentors and the mentees on the expectations of the program. The mentees and mentors were sent an online survey to fill out. The goal of these surveys was to learn more about the participants' interests and where guidance could be offered, which would guide the matching process. Both the mentor and mentee surveys included questions on background information, contact information, communication preferences, areas they can provide or need guidance and mentorship, and any information that would be helpful for the matching process. The mentor surveys also included questions on current position and job title and descriptions of job responsibilities. The questions on the areas to either provide guidance or identify mentorship needs included networking strategies, job search skills, resume/CV advice, interviewing skills, job shadowing, internship opportunities, and volunteering opportunities. The third step was to pair the mentees with their mentors and introduce everybody to each other at the kickoff event. As an ice-breaker activity, mentees were given sample questions to ask their mentors to start conversations. Some of these guiding questions included: Discuss your current job responsibilities; explain how you got into the profession; share your feelings on the importance of networking and continued professional development; what types of obstacles did you have to overcome? what is the most meaningful thing you have learned related to your career goals while at the university? After this activity, mentees were given a questionnaire to identify one professional and academic goal for this academic year, actions to achieve these goals, and a plan with their mentors to achieve their goals. Mentors were encouraged to communicate or meet with their mentees at least once a month throughout the semester for motivation and to meet goals.

The mentees participated in two types of activities. The first type was designed by the mentoring program faculty advisor and included only the mentees. Through the Career Services at the university, the faculty advisor arranged workshops on CVs, job searching, and networking skills, a field trip to a local company, and monthly emails that included encouraging videos or articles related to women in technology. The second group of activities centered on both mentors and mentees. These activities were

based on the mentees needs and their personal and professional goals. Both mentors and mentees were expected to facilitate communication at least once a month via email, phone, Skype, FaceTime, or in person. Each month, the faculty advisor sent out a survey to gather input from the mentors to communicate progress on personal and professional goals, questions, or concerns. At the end of the semester, the CISTers had an end-of-the-semester gathering where mentees filled out a survey to reflect on their experiences, and identified ways to improve the program for the following academic year. Table 1 shows the results of the survey.

Table 1: Mentees’ experience with the mentoring program

	excellent	very good	good	poor
How would you rate the mentoring program?	46.7%	40%	13.3%	0%
How would you describe the quality of your experience as a participant in the program?	46.7%	26.7%	26.7%	0%
How would you rate your relationship with your mentor?	27.3%	9.1%	45.5%	18.2%

**Selected Mentee Comments**

“I learned that if you don’t know the specific programming language that a company uses, it is okay. If you understand the logic behind the code, learning the language will come with experience. She also taught me to be persistent when it comes to applying for jobs. Always follow-up and keep your resume up to date. Even if the company you applied for does not have any openings now, if you keep in touch, your name might come up when they are hiring.”

“My mentor gave us a unique insight of her experiences within the military and within her workplace.”

“I had an opportunity to go the field trip. It was a great learning experience and learned what’s it’s like to work in the technology field as a woman. During the visit, I knew about the internship opportunity and after the interview I was offered the summer intern position. I am very excited about the opportunity and looking forward to learn and gain valuable experience.”

“It was a great way for females to get together and learn and build confidence in the CIS field.”

“I liked being in the same group with women doing the same major like me.”

**4. THE SUMMER CODING CAMP**

With the overall goal of retaining and encouraging more females in the areas of CIS, three faculty had an opportunity to collaborate with 23 junior-high students from surrounding schools through a summer coding camp. This camp was a collaborative effort between the CIS program faculty and students in the Upward Bound and Upward Bound Math and Science programs. The focus of the camp was to help students with their coding skills as well as their attitudes and beliefs about their coding skills. During the three-week camp in June 2017, these middle-schoolers learned the basics of coding, GameMaker Studio, and app development. Through a foundation grant, faculty members received funding which allowed them to employ three mentees from the CISTers mentoring group. Even though the summer camp included both boys and girls, the faculty purposely hired female CIS students to work with girls who were part of the coding camp to provide female role models and hopefully spark and strengthen their interest in computing. This was also done to promote self-esteem, provide encouragement, and develop positive computing identities, attitudes, beliefs, and skills throughout the camp. Through this type of exposure, it was hoped that the girls would leave the summer camp with more positive attitudes and a belief in their coding skills. Their interest in computing was encouraged in anticipation that they will eventually pursue a career in computing.

**CISter Volunteer One**

“Seeing a female mentor as a role model had affect my attitudes and beliefs about my coding skill by knowing that females have the ability to code. Some things I’ve learned from this experience is that our mentor also went through what we’re going through right now, and seeing where they’re currently at right now is engaging

and encouraging me to strive to have a good career like them.

Seeing a female mentor as a role model affected my image as a future IT professional because it showed me that a female has the power to be a coder and to be employed in a technology field where it is majority of males. Some things I've learned from this experience was the many career choices in a CIS field.

I believe my presence affected the girls' beliefs and attitude by letting them realize that females also have the ability to code besides males. I was able to transfer the knowledge I had gained from the mentoring program, by helping and engaging the girls to the coding world. I think having a role model to work with is helpful to be prepared to become an IT professional. It is nice to have someone to look up to, and to ask questions if you have any."

#### **CISter Volunteer Two**

"There has always been a gender gap in the field of technology. Most of the people think girls cannot code and to have a female mentor who is in the field of technology always motivates female students. By looking at the ability of the female mentors, we believe in ourselves and inspire us to learn valuable coding skills. From the mentoring program, I learned: It's never too late when it comes to the matter of learning. Never give up on your dreams no matter what.

Female mentors promoted aspirations to pursue degrees in information technology. If I see someone like you (female I.T mentors) then I have a feeling that, 'If she can do it than I can. Gender im-balance in technology has been a major challenge for most of the girls and seeing someone working in such environment helps to inspire and motive towards the goal we have. Most of the girls have a perspective that coding is only for boys and seeing us helping them in coding camp definitely changed their perspective to some extent. There were few girls who dint like to code but having an attitude of finishing the task on time helped them to get it done and were later interested on it.

I never had a chance to have a mentor from mentoring program, but yes helping the girls and motivating them to complete the coding task that were assigned to them was a whole lot of different feeling and experience. To be a part of someone's motivation gave me some more inspiration to

reach my goal. Role model always inspire people to achieve their goal."

#### **CISter Volunteer Three**

"As a role model, I believe that my mentor gave me inspiration to keep learning. She has shown me to never give up and I can do anything I put my mind to. I learned networking is very important. I learned to continually challenge myself and improve my skills. I felt proud of the women and want to help the next generation feel the same way. I learned I like to teach and that you learn more when you are teaching someone else.

I believe the girls were more comfortable asking questions and showing their work because there were more women there. They may have felt intimidated if there weren't any women present. I think they were inspired and more comfortable asking questions. They could see first-hand what they could do with a little bit of coding knowledge and imagine the possibilities if they learned more. Showing them the different careers they could choose from becoming a reality.

I believe role models are very helpful. My mentor has been an amazing help and has shown me genuine caring and professionalism. She has taught me how to look and speak more professional. She helped me prepare a resume and introduced me to an organization that is helping me find an internship."

### **5. THE IMPORTANCE OF MENTORS AND ROLE MODELS**

Consistent with Ahuja's (2002) study on women in the IT profession, our approach to raising engagement was to consider both social and structural determinants of women's selection and matriculation through a CIS program. Our focus on mentoring and role models is consistent with research on the topic.

Structurally, social expectations are augmented for the mentees in that they can see a place for themselves in CIS. Further, the summer code camp allowed both young boys and girls and opportunity to explore technology together, potentially reducing any biased conceptions regarding gender appropriateness. And, directly, we address the acute issue of role models for women with the CISTers program.

### **6. CONCLUSION**

We have presented a mentoring program for young women at a mid-sized public university in the southwest. Further, we provided these

women with opportunities to extend their own mentee experience by volunteering to assist in a summer camp for young boys and girls. We position these programs not as an unique innovation, but rather as a reminder that it requires a community effort between practitioners, the academy, public institutions, and society in general, to encourage young women to consider Information Technology as a career choice. The CISsters program has provided both contact with an occupational culture where women can see a future for themselves in the experiences of the mentors. Further, we provided a means of carrying this message forward with our summer coding camp project. Taken together, these programs are positive steps towards addressing Ahuja's (2002) characterization of the factors most important to creating a professional setting that will attract and retain women such that both the profession and the women will flourish.

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