

Gender Rationales in Selecting a Major in Information Technology at the Undergraduate Level of a University Program: A Focus Group Approach

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ABSTRACT

Previous research studies of women applying to, enrolling and completing computing degrees at the undergraduate collegiate level suggest a significant underrepresentation of females in the Information Technology domain in the past decade. This study employs a focus group approach to the gender gap that encompasses forays into the qualitative perceptions and rationales of women in technology in an attempt to disclose the underlying factors that have led to the loss of a significant resource in the Information Technology workforce, that of the female contingent.

Keywords: Women in computing, focus group, qualitative study, strategies for recruitment, mentoring

INTRODUCTION

Despite expanding opportunities, substantial financial incentives and increased emphasis on STEM disciplines, women are significantly underrepresented at both the collegiate and professional levels of the Information Sciences. Yet, recent statistics (Armstrong, 2009) report that women earn nearly 60% of university degrees in the United States, are slightly more than half of the workforce, and still account for only 18% of graduates in the Information Technology field. In order to uncover and categorize the underlying problems of female non-participation in IT, we need to look beyond the common and persistent perception that women suffer from "intimidation" and "anxiety" when compared with their male counterparts (Freeman, 2010). Between 2000 and 2008, there was a 79% decline in the number of incoming undergraduate women interested in majoring in computer science. In 2009, 57% of students graduating from college were women, yet only 18% of the students graduating with a computer science degree were female (WIT.org, 2013). As a result, the percentage of professional women in the computer science workforce has been declining over the past decade from a high of 30% in 2000 to less than 22% in 2009. This is an issue that is growing exponentially and has negative implications for our future. In addition to careers directly in the IT field, the use of technology as an organizational infrastructural mechanism to conduct business today in the industries such as banking, retail and insurance is creating a greater implicit demand for more technologically savvy consumers in many industries. The multitude of factors that manifest the female experience in collegiate selection, retention, graduation and placement within the IT major are as diverse and compelling as the universe of Information Technology itself. Gender gaps in usage, prior experience at the K-12 level, attitudinal shifts that were engendered by the emergence of the social media phenomenon and the general pervasive nature of the Internet experience are certainly factors that need to be explored in relation to the culture and how it relates to women.

A primary goal in a research paper of this nature is to find the structure of the collegiate experience that will ultimately enable the IT educators to spark a new generation of female students who are capable, articulate, technically skilled, and infused with the confidence and professionalism required for success in the

Information Technology sphere. In the culminating analysis, the authors of this research paper engage the female university student in examining the challenges, barriers, rewards and perceptions of the Information Technology experience. While we are not able to redesign the culture of the IT community, we can perhaps alter the student's perception of her place in its fold. What do women want? We will try to know by asking them. The study was conducted at a medium size north eastern university in the United States. The study used focus groups of currently attending women with majors in information technology. The participating students ranged from freshmen to seniors. The research questions used for this study are:

Research Question 1: What are the perceptions of women concerning an information technology/information sciences degree?

Research Question 2: What are the perception of women concerning an IS/IT degree at Robert Morris University?

Research Question 3: What are the perceptions of women concerning a successful career in IS/IT field?

The paper is organized in the following way. The section following the introduction presents a critical review of research literature in the domain of women in computing. The literature review section is followed by the methodology design. This section discusses the focus groups method of research and its use in information systems. It presents the details of the results obtained from focus groups. The implications of results obtained are presented in the discussion section. The implications are presented along with future research directions and conclusions.

LITERATURE REVIEW

Female enrollment in computing degrees and thereafter in professional positions is in decline. The computing industry has been traditionally viewed as a male dominated profession. To understand the perception of women and the challenges of this field, a thorough evaluation of the available research literature was performed. McInerney and DiDonato (2008) conducted focus group interviews of information technology students and found that the major influences in choosing a computing major were positive experiences in high school, an aptitude for math, perceived job prestige, encouragement of family members and key teacher input. Students did not have the more negative stereotypes and

attitudes toward the field. A female student enrolled in a computing degree is greatly influenced by her reliance on strong interactions with female high school computer teachers/role models for female students (Beyer, 2008).

Female students have viewed a career in computing as a "nerdy" choice. Women expect this field to be dominated with mathematics and programming requirements and consider themselves unfit for a career in this field. Freeman (2010) argues that female college students feel a lack of confidence with computer skills because they had learned less and practiced less with computers than male students, thus becoming more anxious and distanced when using computer technology. Bright (2007) postulated that promising IT students need basic analytical skills, and concentrated interests in science, technology and math, and that computer technology encompassing the K-12 level is a necessary component.

The question arises concerning what can be done to reduce the anxiety of women who are considering college major choices and are uncomfortable about computing due to limitations in their own perceptions. Caputo and Kohun (2002) suggest that curricular innovation was the key element in increasing the enrollment and retention of female students in Computer Information Systems studies. It stemmed from the female student perception of anxiety when confronted with computer technology, particularly in the area of computer programming. On similar ground, Shade and Woszczyński (2010), after conducting in-depth interviews with female CIS majors, suggest strategies for improving the representation of women in all aspects of the IT realm. According to these authors, the major factors in the ultimate perception of the field were better recruiting and retention strategies, the development of mentors, and changes in the presentation of the information-based body of studies.

It has also been argued that women depend on their prior computing experience in making a choice for a major in their educational endeavor. Myrick and Heo (2009), in a study of a small group of female high school students in a specialized computer environment study group determined that pre-collegiate experience and training at an earlier age may cause a noticeable shift in gender equity among CS majors. Adequate training and ease of use with

computers does have a major influence on the freshmen perception of computing majors. Vllie et al (2005) propose a strong moderation effect of gender between perceptions of relative advantage, ease of use, visibility, and result demonstrability when using a computer-based communication technology. The curricular implications that would enhance the female IT experience were explored in relation to women's perceptions of the relative value of holistic skills prevalent in certain areas of Information Technology, such as Health Care and Informatics (Caputo, Kohun, 2005). Changes at this level tend to increase retention in the major as well as original matriculation among designated tracks within the general IT major.

Koch and Kayworth (2009) propose that the major factors of recruiting IS majors, retaining them throughout the undergraduate cycle, and placement upon graduation is the prescribed overall strategy that enhances female opportunities in the IT realm. Caputo (2010) studied the differences between male and female university students in the Computer Information Systems major as to the perceived value of the importance of technological skills necessary for job success in the prescribed discipline, and the acceptance of those criteria by the female student. Along similar lines, Guthrie (2009) argues that the success of women in the IT industry revolves around the critical support areas of mentoring women in the collegiate IT environment. Roach (2009) states that some important influences on the choice of computer majors were: a clear interest in technology, monetary compensation, and input from college instructors, and friends. Of primary importance to the selection of an IT major among women is, not surprisingly, personal and professional contacts and experiential connections. Thus emerges the core engagements of family members, key individuals such as high school teachers, professors, work associates, clergy, female mentors and role models, and on-line respondents (Heo, 2009).

A thorough review of available research in this area suggests an apparent gap in literature. This gap lies in addressing the profound issues determining low female enrollment in computing degrees and subsequent low representation of women in computing professions. The academic community's response to the issue of diversity on age, gender and ethnicity in Information Technology has not been addressed toward a meaningful conclusion (Moody and Woszczyński, 2003). Even though the situation is improving

and the gender gap in attitude toward the usage of computers are lessening over an extended period (Rainier and Astone, 2003), this issue

METHODOLOGY

Data collection

The methodology used for data collection for this research was a focus group encounter. An invitation was sent out to freshmen computer information systems (CIS) female majors at the site of this research, a medium size university in the north eastern United States. The first focus group gathering was sent out only to freshmen students (10) and 5 of these students participated. To avoid any factor of intimidation, the focus group was conducted by a female professor in the department of information systems and another female researcher with a doctorate in information systems. In the second meeting, senior IS majors were invited (8) out of which 4 participated. These focus groups were conducted by the same researchers who supervised the freshman meeting. The third and the final focus group sessions were conducted by two senior male professors in information systems department. In this group, 5 students participated who were at sophomore or junior level in the program. Each of these sessions was of 45 minutes in duration. The sessions were recorded (audio) with the permission of the participants. Each participant was given the opportunity to respond to each question, as well as to interact conversationally within the group. Each focus group session was recorded and transcribed.

The researchers developed a list of pointers to gain a better understanding of the perception of female students in three areas. The perception of women concerning IT/IS degrees in general, the perception of women concerning IS/IT degrees at RMU, and the perception of women concerning success factors in an IS/IT career. The role of the faculty member was limited to ask a probing question whenever there was a general pause in the discussion. The participation in the focus group was voluntary; students were told the purpose of the research and only the students who chose to participate showed up on the particular day at the prescribed time. The results of these focus groups were summarized to identify the underlying themes. Considering the researcher is the instrument of data collection and analysis in qualitative methods such as focus groups, caution was exercised to include a researcher

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Data Analysis

Patterns within the focus group results were identified after tabulation of all major points emerging from the three participating groups. The results of the focus group are presented under the broad research questions that were used for the data collection process. Researchers were divided into three groups of two each. These groups transcribed the data and identified the themes individually. Then the research entire team came together to triangulate the themes that were identified and, after much deliberation and discussion, final themes under each research question were established.

Research question 1: Perceptions of women concerning an information technology/ information sciences degree

The women as a group perceive information technology to be a male-dominated field, but they all feel they have the necessary abilities to succeed in an information technology career. Some of the older students assumed gender bias in the career but did not take this issue seriously. The prospect of competing with males increased their desire to enter the field. Interestingly, many of those women who anticipated the competitive nature of the business had competed in athletics at the secondary education level.

When asked why they chose to major in CIS, several of the women indicated they were mentored by a family member or friend in the field. The family was the primary reason for major choice. In addition to encouragement from family, these students were supported in their decision by friends and teachers. Parental attitude articulated career success in the IT field and the opportunity for employment out of college.

Computer programming is a major part of the high school curriculum in IT. Interestingly, females were more attracted to the newer technologies in IT including web development, web design and cyber forensics that enticed

them toward the college major. Computer programming had a negative effect on all of the participants in the focus groups. Somewhat surprisingly, all were adamant that they have no interest in a career in programming, and several indicated that they find programming to be very difficult. In addition, they expect to have many employment opportunities with good pay, and to "help people, not just languish behind a desk."

"I would feel more useful if I wasn't programming. I know programming is a really good thing to do, and I guess you really are helping people, but it's really difficult. You have to pull things out of thin air, and there's always more than one way to do it... I did enjoy it because it was a nice challenge, but I don't think I want to do it for the rest of my life."

Many participants expressed a strong interest in the area of cyber forensics. The participants agreed that their common interest in cyber forensics most likely originated from television shows such as CSI, and that this sparked their desire to work in the technology field. One of the women made a point of acknowledging that the television representation is not entirely accurate:

"I watch a lot of NCIS and Law and Order, so naturally, when I got here, I thought it would be a lot like that, and it's not. I learned that things are actually very different from what you see on TV."

All of the participants see technology as a rapidly growing field with many job possibilities, including mobile computing, and others and application development.

Several women mentioned that they feel challenged and unique by being a female in what is still considered a male-dominated major and career field. One woman said "It puzzles me every day why I'm the only female in three out of my five classes." Only a few of the women had high school course experience with IS/IT. One of the women built a computer for her high school project, others mentioned having experience with HTML and Microsoft products (Office, Word, Excel).

In summary, teacher and counselor advice was less effective than advice from family and friends. In fact, most feel that counselors recommended other majors more female

friendly like nursing and education. For many, the student's mother was the critical factor in their decision.

RQ2: What are the perceptions of women concerning IS/IT degrees at their current University?

These students had a positive perception of their current university from friends and family who were attending or who completed their studies at this institution. Pre-admission meetings with faculty and enrollment personnel were very encouraging when developing career prospects for women in the IT field.

One female student who was deciding on college entrance in the IT field at a local university was actually discouraged from the computer field. Their recommendation was to "study nursing." This attitude was never extended in any admission interviews at this institution. When asked why they choose to come to this institution, the respondents indicated that it offered "more" in the way of encouraging women in IS/IT degree programs. One woman said that this institution has the "best CIS department for encouraging women." Other reasons given included: 1) It is a small school and the advisors and teachers know the students by name and are available to answer questions about course material and give advice about career planning, 2) They often see "familiar faces" in different classes, and 3) their family members went to this institution. Two of the women transferred to this school specifically because of the technology curriculum options available here. Several women mentioned that the admissions departments at other schools seemed to discourage them from majoring in IS/IT and in many cases, nursing was suggested to them as an alternative. One woman was relieved to find that this institution encouraged her choice of majors:

"When I came to [this institution to major in CIS], they almost jumped on me like, 'wow, you're a woman!' That helped me decide that [this institution] was right for me because when I looked at other schools, they almost told me NOT to go for it... as if saying 'you shouldn't be considering this [CIS]... you should be in nursing like all the other women'"

Some of the new major areas in the IT field at this institution were also an attractive area for enrollment. New disciplines recently incorporated in the curriculum, such as cyber

forensics, was an incentive for enrollment. For these participants, this institution offered the entire positive package for enrollment. From the matriculation process that encouraged women to enter the field and through the meetings with IT faculty, the computing major was welcoming and encouraging.

In summary, the perception of the institution being "women friendly" helped these students in making their decision. Additionally, the environment of collegiality and encouragement from fellow students, faculty and administrative offices reinforced their choice of the major.

RQ3: What are the perceptions of women concerning a successful career in IS/IT field?

When the women were asked what they believe is required to succeed in an IS/IT career, many mentioned determination and attention to detail as critical factors to success. These women had a positive perspective on their success in the IT field. Competing with males in the education setting gave them added incentive to welcome competition in the career field. They feel that their strengths, especially in their ability to communicate more effectively, work harder, and compete mentally with males were more than enough to succeed.

They also feel that women, in general, have better communication skills than their male counterparts, and that being a minority could work to their benefit. They feel they may have to work harder to prove themselves in their field, but they are willing to do so. All of the participants agreed that they prefer working with males because a) "girls are too catty" and b) they (the women) can easily become "one of the boys." Overall, the participants feel that they can not only work through the gender bias, but they can also use it to their advantage by offering a different perspective, and providing leadership and organization and relevant skills critical to team success. These women did have some difficult situations dealing with males in the classroom. They feel the males were condescending and many did show a bias against females. In order to achieve success the more advanced female students encouraged determination and aggressiveness in competing with the males.

While they all feel confident of their success in the IT fields and were not in any way hesitant because of their gender, they all prefer working with males rather than females. One participant

cogently summarized the overall sentiments expressed by the focus group participants:

"I think because women have the dream to do something, they're probably more likely to do something that's 'easy' or what society thinks they should be doing. If all my friends are nurses, I should probably be a nurse. But I don't think that should stop you, if you have other dreams that other people don't have, or if someone tells you that you shouldn't do something."

In summary, these women feel that even though IT is a male dominated field they did not seem worried about being successful in their chosen career. These women seemed determined, focused and well aware of challenges lying ahead in their chosen professional lives due to their gender, but they seemed well prepared to deal with these challenges.

DISCUSSIONS

Our data from focus groups suggests that women require more mentoring or close guidance from a person who can influence theory decisions about college majors. The chosen few who opt for a degree in computing are aware of valuable employment opportunities and believe that there are areas in computing that provide them with more opportunities to interact with people. Almost all of these women had previous experience in computing courses during their K-12 tenure. Research suggests that providing children with a range of computing activities when they are young will help encourage students to study (Camp, 2012). Girls have a limited perception of IT and computing fields which needs to be broadened and the best place to do this is schools. This fact is emphasized in the results of a 2005 survey. In this treatise, 836 high school students from nine schools in California and Arizona were asked what a computer scientist major might learn in college. Approximately 80% of the students in the survey said they have "no idea", and 15% of the students in the survey said "programming" (Carter, 2006). This suggests opportunities for educators or parents who want women to enter in computing fields. Several implications can be drawn from the results of our study. Educators need to encourage mentoring programs in universities or even at lower school levels to provide counseling and reassurance about women being a "fit" in the computing careers (see Table 1 in

Appendix 1). The National Science Foundation has funded summer camps in computing that encourage female faculty members in IT to be role models to their students and leaders in academia. Many universities provide female faculty role models and mentors. Grants and scholarship programs promoting women are available through universities and organizations (Camp,2012). **[Insert Table 1 here]**. All the contributions of this study are represented as implications in Table 1 above. These contributions are for both theory and practitioners. This study suggests that positive impression of the university (due to past association or through friends and families) plays an important role for women in making a decision about her major. An admission department which encourages and answers women's queries about computing degrees is held in high regards compared to the ones that try to overwhelm students due to their interest in "unconventional" majors. There is a general agreement today about the low enrollment trend of women in computing degree programs, particularly at the undergraduate level. It is surprising as there is an overall rise in computing degree enrollments in the USA and increasing women population in colleges (Camp, 2012; Outlay et al, 2012). Computing degree programs have also recognized the need to overcome the perceptual barriers that keep women away from their programs and have undertaken intervention strategies to improve female enrollments (Outlay et al, 2012). Educators have to be creative in strategizing about recruiting and retaining women in computing programs. Some strategies that we suggest are to foster and nurture a positive reputation of encouraging women to pursue their major of choice, encourage faculty to be more interactive with women students and engage them through the process, to create specializations that appear holistic with more opportunities to interact socially, particularly in "cool" technologies such as cyber forensics, health care technology or technology auditing.

Finally, this study also accounts that women in computing degrees acknowledge the fact that it is a male dominated profession where they have to constantly prove themselves and improve themselves by being focused, determined and adaptable, in greater measures than their male counterparts. These findings imply that educators should encourage close alumni bonding such that women graduates can create support groups and initiate networks

with other women in the field. The major limitation of this study is the bias that comes with single sources of data for research. All the participants were from one particular university and hence the results might not be representative of multiple perspectives. In future pursuits we need to collect data from different types of schools across the nation, and engage the perceptions of women who do not choose computing as a major.

CONCLUSION

This study explores the perception of women who choose to pursue a degree in computing and understand their view of information systems degrees, their current university status where they are pursuing a degree, and a theoretical understanding of career challenges in information systems studies. Three focus groups were conducted with women at different levels in undergraduate computing programs. The most prevalent and far-reaching results suggest that women need mentoring, close guidance, more exposure to computers in schools at an early stage and specializations that allow them to be more sociable. Implications were drawn and limitations presented. Future research stemming from this work is also discussed.

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Appendix 1

Table 1: Emergent Themes and Implications

Research Questions	Emergent Themes	Implications for Educators
Perceptions of women about an information technology/information sciences degree?	<ul style="list-style-type: none"> Mentoring by a close person Good employment opportunities Identified areas that provide avenues for more socialization Preliminary exposure to IS/IT concepts in high school 	<ul style="list-style-type: none"> Create and encourage mentoring programs Advertise better job opportunities Educate high and middle schools about IS/IT exposure at an early stage
Perception of women about IS/IT degrees at the current university?	<ul style="list-style-type: none"> Positive impression of the university due to family/friends Encourages women to follow their interest Small size of the department and classes More faculty interaction/intervention Promote exciting areas of specialization that makes the major look "cool" 	<ul style="list-style-type: none"> Foster a positive reputation in alumni Emphasize and encourage women pursuing degrees in technology Promote better interactive relationships between students and faculty Create interesting specialization options in IT with focus on women
Perception of women about success factors in IS/IT career?	<ul style="list-style-type: none"> Heavily Male dominated It is interesting to work with more men than women Determination and hard work as vital factor in competition with others Need to establish their "value" in the eyes of the others in the team 	<ul style="list-style-type: none"> Encourage alumni bonding and networking Encourage support groups during and after the program Foster positive work ethics Females faculty needed to encourage by example