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COLLEGE OF INFORMATION SCIENCES AND TECHNOLOGY

A QUALITATIVE ANALYSIS OF THE UNDERREPRESENTATION OF WOMEN
ENROLLED IN THE COLLEGE OF INFORMATION SCIENCES AND TECHNOLOGY

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ABSTRACT

Information Technology is one of the fastest growing fields in the country, which means that the demand for college graduates with related degrees is on the rise. With so many job opportunities at present and on the horizon, why is it that the gender gap in technology persists so strongly in universities across the country? This paper aims to gain a better understanding of the factors that affect the underrepresentation of women enrolled in Penn State's College of Information Sciences and Technology's undergraduate programs, and what insights these observations can provide in terms of creating effective initiatives to balance the gender demographic in the future. To do this, the paper discusses prior research and literature on the underrepresentation of women in information technology, and uses these factors to assist in the analysis of themes observed in interviews conducted with women enrolled in the college.

Key terms: IST, INFORMATION SCIENCES AND TECHNOLOGY, WOMEN IN TECHNOLOGY, GENDER GAP, INFORMATION TECHNOLOGY, UNDERREPRESENTATION

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Chapter 1: Introduction

The U.S. Bureau of Labor Statistics predicts that by 2024, the Information Technology sector will add about 1.1 million job openings to the U.S. job market (NCWIT, 2016). While this increase in opportunity is hardly an issue, filling the positions may prove problematic. The National Center for Women and Information Technology (NCWIT) estimates that upwards of two-thirds of these new openings may not be filled due to the lack of qualified candidates pursuing computing-related degrees and programs (NCWIT, 2016). This issue is pressing enough to gain national attention and elicit responses from K-12 schools, institutions of higher education, and even the White House. President Barack Obama allocated $2.9 billion in his 2015 Budget specifically for use in Federal STEM education programs, emphasizing the need to increase Science, Technology, Engineering, and Math (STEM) education in K-12 and higher education (United States).

Despite these efforts there's a group that makes up approximately one half of the country's population that remains significantly underrepresented in the field: women. In fact, the percentage of women graduating with technical undergraduate degrees has actually decreased in recent years; from 2002 to 2012, the percentage fell from 30 to 19 percent (DuBow, 2014). Additionally, in the technological workplace, only 26 percent of U.S. employees are female (DuBow, 2014). Given the incredible need for graduates with degrees in Information Technology and related fields, this decrease and imbalance in the field is particularly disturbing. As a college

specializing in information technology degrees, it's logical for the College of Information Sciences and Technology (IST) to assess its female enrollment against national trends.

The College of Information Sciences and Technology Undergraduate Program

Based upon the College of IST's Student Gender Summary from Fall 1999 to Fall 2014, in 2014, 19.80 percent of the student's enrolled in the college's University Park location were female. Statistics on gender composition at non-University Park locations is only documented from Fall 1999 to Fall 2010, at which time female students comprised only 12.24 percent of those enrolled. Following national trends, both of these percentages are lower than they were when the college first opened for enrollment in 1999, at which time females made up 30.77 percent of University Park IST students and 26.05 percent of IST students at other Penn State campuses.

As a female studying technology and pursuing two degrees within the College of IST, I have found all of the aforementioned statistics troubling. When I entered the College, I was well aware that I was entering a male-dominated field of study, and I've always been passionate about advocating for the entrance of other young women into the field. For this reason, the purpose of this thesis is to analyze and understand the experiences of undergraduate women in the College of IST based upon prior research and semi-structured interviews with women enrolled in the College. By analyzing the experiences of these women who are pursing education in a field where they are woefully underrepresented—despite outnumbering men in U.S. college enrollment for at least 35 years—this study will provide insights that help administrators and

faculty to better understand the lack of women pursuing IST degrees at Penn State, and offer

suitable recommendations to improve the gender landscape in the college's future (Anderson,

2014).

Chapter 2: Literature Review

To gain a better understanding of the factors contributing to the paucity of women in the College of IST, I approached the topic in three steps. First, I conducted a literature review of studies and papers written on the factors that have been documented as deterrents or barriers to women entering the Information Technology field. Second, based upon these factors, I identified those that I believed could be applicable within the College of IST and drafted questions to outline a semi-structured interview script. These interview questions primarily focus on the team experience, a hallmark of the IST educational experience. Third, over the course of two weeks, I interviewed thirteen female students who volunteered to discuss their experiences within the college with me. I used these interviews to identify common themes that were specifically observed in the College of IST, and followed up on each theme with additional research that could help to explain them. The themes that I have identified are discussed, along with representative quotes from the interviews, and are followed by recommendations to account for and overcome their effects on women enrolling in the college.

In my review of existing literature related to the gender gap in technology and its many causes, I noticed some reoccurring themes: women's need for role models, mentors and support systems within the field; concerns about stereotypes and identity incongruities in technology; women expressing a lack of self-confidence in their technical capabilities; and the benefits of gender neutral settings in the Information Technology sector. The articles included in my review

ranged from scholarly articles published in technical magazines to academic journals chronicling studies conducted to help explain the persisting gender gap phenomenon.

The oldest article included in my literature review was Katz's (1982) analysis of the factors contributing to the retention of women in technology programs. Although the article is somewhat dated in the manner it discusses increasing the number of women in technical fields, it provides insight into just how difficult it has been to provide women with equal opportunities and to adequately communicate their potential for success in the field. In order to increase retention, Katz recommends active recruitment and the use of support systems for women entering the field. She also mentions some common themes that I'd noted when reviewing other articles, such as confidence as a driver for women in technology. The article provides insight into the discrimination women faced as they entered a male-dominated workforce and helped me contextualize the history of women in technology and the progress that has been made in the field.

Martin's (1999) scholarly article takes a broader, more societal approach to assessing what drives women into technical fields. Her article looks at cultural norms and cites them as main impediments to women entering technical fields. Martin explains that because these fields are traditionally branded as masculine, they can be threatening to femininity; moreover, men can be resistant to allow women into the field, since they may change the field's identity. She points out that there is likely some quality that women who do persist in technology have in common that differentiates them from those who do not defy cultural norms, but fails to identify what this quality might be. Additionally, Martin points out that women's successes in these fields should receive greater attention than their failures to enter into the area, or no women will be inspired to pursue careers in technology. According to this article, for there to be true change in the number

of women in technology, there needs to be an overall cultural shift and not just a program geared toward recruiting.

In a related study, Thom, Pickering, and Thompson (2002) describe which factors prevent women from displaying greater interest in technical programs and from responding to technical recruiting efforts by universities. To conduct the study, women in technical clubs and courses at Purdue and other universities were asked to complete a survey intended to assess their perceptions of, and motivations in, technology. The survey was open-ended and had been designed to align with questions asked during in-person, follow-up interviews. The study showed that women and men do not share the same perceptions and motivations when choosing career paths. Specifically, women valued opportunities and personal growth most highly when considering careers in technology, whereas men were primarily motivated by promises of adventure and honor. Thom, Pickering, and Thompson also found that additional common motivators included supportiveness, communication, and professionalism in the workplace. Women expressed concerned about the workplace environment (swearing, sexual misconduct, etc.), as well as with some stereotypes associated with the field. The women surveyed reported concerns related to compromising their feminine identity, and sought more interpersonal support and mentors in their technical careers.

In their paper analyzing the factors at play when it comes to the attraction, development, and retention of women and minorities in Information Technology, Tapia, Kvasny, and Trauth (2004) discuss a number of theories that might be preventing women from pursuing degrees and careers in technology. The researchers cite a number of perceptions that affect women's interest in the field, including the belief that the Information Technology industry can't provide them with what they seek in a career, that jobs within the field are "difficult, isolated, lacking

necessary social interaction, and lacking work family balance," and the belief in stereotypes attributed to the industry being male and "geeky." Additionally, Tapia Kvasny, and Trauth mention that both women not being perceived as technically skilled by society and women not perceiving themselves as being technically skilled deters women from entering the field.

Trauth, Joshi, Kvasny, Chong, Kulturel, and Mahar's (2010) study aims to gain a better understanding of how the perceptions of skills associated with Information Technology have changed over time, and specifically how they are viewed by college-age Millennials who have grown up surrounded by technology. Their study revealed that skills like communication, working in teams, ethics, global and cultural awareness, and openness to new experiences were perceived as feminine, while more technical skills like computer programming, database, and networking were perceived as masculine. This aligns with stereotypes perpetuated by the concept of hegemonic masculinity, which is discussed in the researchers' paper and refers to the dominance of men over a field, and which has applied to the Information Technology landscape in years past. The study also revealed, however, that other skills that had been documented as being perceived to be masculine in the past, such as initiative, ability to work under pressure, critical thinking, and problem solving, were perceived by Millennials as being gender neutral. Trauth, Joshi, Kvasny, Chong, Kulturel, and Mahar point out that although the most technical skills associated with Information Technology were still stereotyped as masculine, the transition of some skills from masculine to gender neutral may indicate that the field is opening to women and becoming less characterized by hegemonic masculinity.

A more recent article written by Wendy DuBow (2014), a senior research scientist at the National Center for Women and Information Technology who has contributed substantial research to the field, chronicles the trends associated with women in technology, as well as the

aforementioned statistics on the decline in the percentage of women pursing the field. DuBow's main recommendations for improving the landscape and attracting undergraduate women all aim to engage women in technology education. She also suggests offering inclusive and more creative classes with gender-neutral décor, promoting equal encouragement of male and female students, and marketing the benefits and versatility associated with a career in technology while diminishing the stereotypes that are presented. DuBow addresses the issue of women leaving the field after they enter it, and attributes the phenomenon to work environments that are not female-friendly or gender-neutral, the scarcity of role models for women in technology, and a lack of support and equal treatment in the workplace. Several other studies pointed to the importance of mentors and role models in encouraging women to pursue degrees and careers in Information Technology as well (Allbritton, Aronis, Katz, Soffa, Wilson, 2006, Blanchard, Ellis, Guzman, Sharif, and Stanton 2005).

In a study similar to Thom, Pickering, and Thompson's, DuBow and James-Hawkins (2015) report on the preliminary findings of an ongoing study that aims to explore the factors that prevent young women from exploring an interest in technology. The study was conducted using a combination of interviews and surveys that were completed by 1,451 young women who were interested in the NCWIT's Aspirations in Computing Award. Of the women surveyed, 691 were awardees and 760 were non-awardees. The study found that awardees demonstrated greater indications of self-confidence and feelings of validation than non-awardees, and that awardees were significantly more interested in pursuing technical degrees in the future. DuBow and James-Hawkins claim that both sets of subjects seemed to experience the "impostor syndrome"—a term coined in the 1970s by Suzanne Imes, PhD and Pauline Rose Clance, PhD to describe the inability of affected individuals to internalize their successes—and found that

participants' feelings of inadequacy were either confirmed or contradicted by the outcome of the award process (Weir, 2013). The study also revealed that both awardees and non-awardees had had experiences in which they believed men had been perceived as more knowledgeable and had expressed more confidence in their computer skills from an early age. Another interesting finding that arose in this study was the idea that working on male-dominated teams actually made women feel that they weren't as capable of excelling independently because they felt less ownership over the outcome of team projects. This point struck me as particularly relevant to IST, where team projects are considered a crucial part of the college's curriculum.

Chapter 3: Methodology

The intent of conducting interviews with female students enrolled in the College of IST was to gauge how applicable the themes presented in the literature review were to the College and its students, and how these themes could be contributing to the persistence of a significant male majority in enrollment.

Based upon the significance of team dynamics expressed in DuBow and Hawkins' (2015) study, I chose to focus heavily on the team component of the College of IST's curriculum, as it permeates nearly every course offered to students pursuing either of the school's degrees, and comprises a significant portion of the time and work students dedicate to completing their degrees. Group work within the College of IST also exposes women in the college to experiences in which they may be underrepresented and encounter attributes of the other themes identified in existing literature. Interview questions focused on the students' team experiences, leadership roles, encounters with micro-aggressions, as well as their perceptions of other women enrolled in IST, sense of community, and their ideas on how other males and females might perceive them in different settings within the College. Each interview concluded with a request for their opinions and recommendations on potential improvements that the College of IST might pursue to help bridge the existing gender gap.

The interviews were semi-structured to allow for conversation intermixed with prompts, and the questions included in the initial interview script were derived from the themes identified in the previously conducted literature review. The thirteen interviews were completed over the course of two weeks, and were scheduled on a volunteer basis. Each interview was recorded with the interviewee's permission and lasted between 10 and 30 minutes. All interviewees were

pursuing Bachelor of Science degrees in either Security and Risk Analysis (SRA) or IST, had

varying levels of involvement within the College of IST, and were asked the originally

conceived questions in addition to follow-up questions that occurred throughout each

conversation. Although the majority of the students interviewed were seniors, all the

interviewees had varied semesters of experience enrolled in IST, and three were remaining in the

College for a fifth year. All of the women interviewed where between the ages of 17 and 22, and

are therefore considered millennials, who have also been described as "digital natives" (Trauth,

Joshi, Kvasny, Kulturel, and Mahar, 2010). Of the thirteen interviewees, four were majoring in

IST, eight were majoring in SRA, and one was a dual-major.

     While completing my initial literature review, I created a running list of factors that were

identified as being linked to the underrepresentation of women in Information Technology.

Based upon recurring factors revealed in the literature review, I deduced an initial interview

guide composed of questions addressing the aforementioned topics. As the data collected for this

thesis is qualitative in nature, the data analysis began as soon as I began my research. This

research approach is typical in cases of qualitative data analysis (Burnard, Gill, Stewart,

Treasure, and Chadwick, 2008). For this reason, as I began to pick up on similarities between

interviewees' responses, I adopted follow-up questions that were not part of the original

interview script, but had come up conversationally in early interviews. These emergent questions

were added to the interview script and I consistently asked them in subsequent interviews. A

complete transcript of the interview guide can be referenced in Appendix A.

     After conducting and recording the interviews, I transcribed them to allow for simplified

comparison of responses to assess the common themes. When reviewing the transcribed

interviews, I used two techniques for theme identification: repetition and constant comparison

(Ryan and Bernard, 2003). First, I went through the interview transcripts using a similar approach to that applied in my literature review. I noted repeating topics in interviewee responses. I then returned to the interviews and compared the different responses given to the same questions across interviews, asking myself what they had in common, where they differed, and how I could relate to them. The results of these analysis methods led me to identify three prevalent, recurring themes that closely aligned with those I had discovered in my literature review, and which are discussed in-depth in the following chapter.

Chapter 4: Findings

After transcribing and reviewing the thirteen interviews, I determined that there were three recurring themes on which the women commented and shared common thoughts and observations, most of which reflected the prevalent themes in prior research. The three themes I have identified are as follows:

1. the type of women that opt to enroll in the College of IST;

2. the existence of and appreciation for a sense of community among the women in the college; and

3. the preference for and perceived benefits of teams composed of a balanced gender ratio.

These themes, along with representative quotes from the interview, will be presented in the following sections.

Theme 1: The IST Woman

Somewhere out there in this cultural maelstrom, women are succeeding. Some very few of them are able to swim against the strong cultural norms for their gender…We don't know how or why they do it. What marks these women as different? How do they manage when others do not? Is their psychological makeup different? (Martin, 1999).

This concept came up in conversation by my second interview, and by the fourth I couldn't help but pick up on the pattern. After interviewing thirteen women—women of different ethnicities, women with different backgrounds, women with different experiences, career interests, and

motivations—I found that I had uncovered one, distinctive picture of a woman in the College of IST.

The IST Woman is a leader; she is confident and comfortable in her own skin. The IST Woman does not shy away from responsibility; she knows what she needs to accomplish to succeed and how she wants to do it. The IST Woman speaks her mind; she is assertive and outspoken. The IST Woman also believes that she is, at times, misunderstood by a number of her peers. She has been labeled "aggressive," "intimidating," "bossy," "sassy," and even "bitchy."

The women enrolled in the College of IST are indubitably individuals, but they are also strikingly similar. They consistently assume leadership roles in groups regardless of the gender ratio, they're comfortable working alongside men in teams even if they're the only female, and they frequently describe themselves as "assertive" when discussing their roles and the perceptions they believe others may have of them. A number of them are aware of these commonalities and admitted to them when asked, sometimes offering explanations as to why they might exist. "We're all kind of alike in that way. I think most of us kind of have that personality anyway since we're in a male-dominated field," one interviewee responded when asked about the trend. Another explained, "I think it's because of the type of girls that enter IST, that we're always a little more Type A, and a little more organized, and a little more forward pushing." Based solely on the interview responses, it's unclear as to whether this theme stems from the fact that more assertive women choose to enroll in the College of IST or if women in the College are encouraged to be more assertive by the nature of the male-dominated field. Another reoccurring comment was that women in IST—the interviewees included—are driven to succeed in part due to the challenge that being a minority in the field presents.

While Martin (1999) was able to delve into some of the patterns and barriers affecting women and preventing them from entering the technical workforce in greater numbers, she was unable to provide any significant insight into the characteristics of women who challenged cultural norms and persisted in technology. Little research has examined the personality traits associated with women who pursue degrees in Information Technology since the publication of her study in 1999, and even less has successfully attributed an inclination toward technology to any specific traits.

When considering why this theme that emerged from the interviews might persist in the College of IST, I found myself comparing it against two different studies from my literature review. The first was DuBow and James-Hawkins' (2015) study of NCWIT award and non-award recipients. One of the key objectives of this ongoing study is to analyze confidence and how it effects young women's interest in the Information Technology. In the preliminary results of the NCWIT study, those women who had received the award displayed greater confidence in their technological abilities, as well as greater interest in persisting in computing in the future. The researchers predict that "individual characteristics, such as stubbornness, desire to prove others wrong, or a wish to be unique will ultimately emerge as most influential in explaining female persistence in male-dominated fields." The link between confidence and a desire to persist in the technical field, coupled with the characteristics that DuBow and James-Hawkins believe participants may exhibit as the study progresses, is demonstrated in the interviews with females in IST. This supports the theme that certain characteristics are common among women willing to pursue a career or degree in a male-dominated field.

Capretz's (2002) research on prevalent personality types in software engineering, however, reveals that there are certain personalities that appear to be more drawn to technical

pursuits. His analysis uses the Myers-Briggs Type Indicator (MBTI) to compare personalities of

100 different software professionals, both male and female, and found that the personality types

of software engineers typically included STs, TJs, and NTs in their overall four-letter

designation. The common factor in these results is the "T," which indicates "Thinking" over

"Feeling." The five most common MBTI for women include an "F" and account for 66 percent

of the female population. Furthermore, while 51 percent of the male population have these

combinations in their MBTI results, only 22.7 percent of women have them in their personality

types ("Personality Types," 2016). This supports my observation that a certain type of female,

perhaps one whose personality traits are less common among members of her sex, may be more

likely to enter into a technical field.

Thom, Pickering, and Thompson's (2002) related study touches on the issues of self-

confidence that DuBow and James-Hawkins cover, and goes on to discuss another barrier to

women considering a career in technology: "fear of be[ing] de-feminized." When I originally

read this, I found myself wondering if the thought of compromising my femininity had ever

crossed my mind when I began my transition into the College of IST, and I shared this anecdote

with the majority of the women I interviewed when it came up in conversation. Each one

expressed similar sentiments, and several mentioned that they had always gotten along well with

men, describing themselves as "laid back." Thom, Pickering, and Thompson's (2002)

observation indicates that the more closely women view femininity as aligning with their

identities, which is technically termed "gender role congruity," the less inclined they are to

consider a career path that they believe may compromise it. Based on my personal experiences

and those shared with me by the interviewees, this strong identification with the general concept

of femininity does not appear to be a common trait, which may lend to the similarities in the

women who are enrolled in the College.

Theme 2: The Balanced Team

Although the women of IST report being generally unbothered by the frequent necessity to work in groups in which they are the only female and by the underrepresentation of female students in the classroom, they all acknowledged that they desired to work with other females when given the opportunity to do so. When asked what gender ratio they most preferred to work with on a team within the College, however, the responses were the same: an even split, or close to it. The rationales differed from person to person. Justifications for mixed gender teams included an appreciation for balance in a group, benefits of diverse perspectives and thought processes, and the comfort of having at least one other person that will likely be easier to talk with and relate to. One interviewee described the simple pleasures of having another girl on a team with an anecdote:

> I do like working with guys, they don't really bother me, but it's nice to have a girl on a team only because, when you're working on a team out of class, sometimes it's good to talk about something more than just cars, or sports. I know that sounds so stereotypical and very middle school-esque in a way...but I really like talking about recipes and guys look at me like, 'Oh, I had a hamburger,' and you're like, 'Okay...' I don't know, that's a very gender role stereotype, but I'm gonna say I like small talk with girls on occasion.

A number of the women I interviewed expressed that they were more comfortable when there were other women on teams, that they felt excited to work with women on teams, and that they felt as though they could more easily connect with other women on a team. Additionally, three of the women interviewed claimed that in instances where they worked with groups of

balanced teams, they consistently ended up being some of the best team experiences they had

had within the College of IST.

Research supports the gender ratio preferences conveyed by the interviewees when it

comes to promoting retention of females in technical fields and creating a neutral work

environment. In Rosser's (1998) review of group dynamics, she sites a study done at Harvard

that showed that women are more likely to drop out of groups in technical studies if they are the

only female in the group. Rosser goes on to explain that studies have shown that it is better to

have groups that are not representative of the classroom demographic as a whole in order to have

groups with at least two girls on them, even if this results in other groups of all male students,

because it decreases isolation and therefore decreases the chance a woman will drop out.

Conversely, a number of women I interviewed mentioned that they would also not prefer

a team composed of all female students. Some stated that they simply preferred the diversity of

thought that a mixed-gender team affords; others believed they would be less productive with all

girls or might "butt heads" over group decisions with the strong female personalities IST tends to

attract.

Koppel, Cano, Heyman, and Kimmel (2003) discuss the arguments for and against

single-gender versus coeducation programs in their study on the difference in the two. The

researchers point out that arguments for single-gender programs cite benefits such as fewer

classroom distractions, greater comfort in asking questions, and a reduced fear of making

mistakes. On the other side of the argument, researchers assert that there is no evidence that

supports the arguments for single-gender programs. At the conclusion of Koppel, Cano, Heyman,

and Kimmel's study, which compares test scores of students involved in single-gendered

programs to those not involved and supplements them with survey data, the researchers conclude

that there was no significant difference in performance between the two groups and that overall, single-gendered programs did not benefit students in any measurable way.

These articles support the coeducation practices of the College of IST and support the notion that the preferences that interviewees expressed are likely the most conducive to the success of their groups.

Theme 3: Community and Mentorship

Research indicates that, more than having a diverse team, it's important for women pursuing technical degrees to experience a sense of community and to identify with strong, supportive mentors. In Cohoon's (2001) study of factors that increase female retention in computer science, two of the departmental factors she identified as leveling male and female retention rates were the employment of at least one female faculty member who worked closely with students and served as a mentor, and the presence of other female students that supported one another. Other studies have revealed similar findings when it comes to the power of having a support system in a technical college like the College of IST.

> In a survey of 1,434 undergraduates, researchers found that encouragement was the driving factor in how likely female students were to complete a computing major/minor and choose a computing career—more important than young women's confidence in and perceptions of their ability. (DuBow and James-Hawkins, 2015)

Throughout my interviews, I noticed that these findings manifested themselves in number of the responses I received, even when they weren't what I was seeking answers to. In terms of mentorship, I was initially surprised by the number of women who mentioned that their fathers,

mothers, or sisters had either served as driving forces in convincing them to pursue a degree in

the College of IST, or had previously pursued similar degrees of their own and were therefore

able to impart knowledge of the challenges these young women might face in a technical, male-

dominated field. In fact, without any prompting, almost half of the interviewees mentioned that

they had close relatives who had computer science or similar degrees. This aligns with research

conducted by Blanchard, Guzman, Ellis, Sharif, and Stanton (2005) that identifies having a close

hero or mentor as one of the main factors in attracting women to the Information Technology

field.

       The most telling comment about the influence female mentorship has within the College

of IST came from a freshman who spoke with me about her Accepted Students' day at the

College.

> I think one of the things that really helped, I mean I was the only female at accepted
>
> students' day program, and they had a female come and talk to us and I think that really
>
> helped. And females ran the program… I think that just showing the passion with which
>
> females have within it, that would really help and open up IST to other girls… It's really
>
> cool to see that other girls are in this and they're so empowered and able to do everything
>
> that guy can do and better if they want.

Viewing other women within the College as "empowering" or "inspiring" was common

theme in many of the interviews. In general, the females enrolled in IST are not only comfortable

and excited when working together in a group setting—they communicate a genuine respect for

one another. Although female mentors may be more difficult to identify in a college that is

predominantly male—faculty included, which is 70% male—the women of IST provide each

other with a support system that, for the most part, they appear to be aware of. When asked if

they believed there was a sense of community among the females in the College, every interviewee affirmed that she believed there was. Many of them even stated that they felt that most of the females in the major became friends with each other because of the common bond they shared as minorities in a male-dominated college, and mentioned that they would typically get to know each other through group projects and would continue to strengthen their relationships from there.

Having a network of females, whether they are fellow students or older mentors, helps to provide women in IST with the encouragement and support system that DuBow and James-Hawkins found integral to women's success in technology. One of the greatest concerns with the College of IST is that, although there is a well-recognized network of women in the College at present, the network is still limited in size by the females enrolling in IST. Without more women to attract new students interested in pursuing degrees in IST and SRA, the community of females remains limited, as does its outreach potential. For this reason, it's necessary to ask what the College of IST can do now in order to change the gender demographics for the future.

Chapter 5: Changing for the Future

On the opposite side of the country, approximately 2,500 miles away from the IST Building, a small private college nestled away in the city of Claremont, California is changing the way undergraduate women view technical degrees. Over the course of five years, Harvey Mudd College increased the percentage of women graduating from its Computer Science program from 12 percent to about 40 percent ("New Report," 2015). The NCWIT attributes the College's dramatic success at increasing female enrollment in its technical program to the main steps it undertook to begin revamping the program in 2006.

The change began with a redesigned Computer Science program, which a number of faculty members collaborated on to rebrand and initiate. The new curriculum requires all incoming freshmen to enroll in one computer course upon their arrival. The section of enrollment in the introductory course is determined by the new student's previous computing experience, so as not to discourage students unfamiliar with the subject mater or to hinder those whose skills may already be more advanced. To supplement the course, Harvey Mudd's faculty hold weekly labs for students to receive more personal help in the subject. In addition, assignments have been designed to be useful beyond the classroom and to cater to the student's interests (Cohoon, 2010). Additionally, Harvey Mudd has taken steps to promote female interest in the technical field by sending students to the Grace Hopper Conference, the world's largest technical conference for women in computing, which is held annually by the Anita Borg Institute for Women in Technology ("About - Grace Hopper," 2016). The conference unites successful

female technologists to network, present on their achievements, and call attention to the successes of women in technology.

I concluded my interviews with women in IST by requesting recommendations: What could IST do to increase the number of women enrolling in the College? What could IST do to make women feel more welcome, to recruit more efficiently, and to promote the College to the underrepresented half of the population? A number of the responses I received are not only directly tied to the themes I've identified in this thesis, but are also reflected in the initiatives that served as catalysts for Harvey Mudd's dramatic increase in female enrollment in Computer Science.

Two women in particular stated that, due to the current pervasiveness of technology in most careers, exposing women to technical courses early on should be encouraged, and possibly even required at Penn State, much like it is at Harvey Mudd. A common theme in the responses was the notion that most women either believe the College of IST is something that it isn't, or that they aren't even aware that it exists as an option that's available to them. "I think, for the most part, that you kind of have to show that it's not computer science, it's not coding. Because I think that's what would make females shrink away from it because they would think 'Oh I would be building a computer, or I would be staring at ten pages of code, and that doesn't appeal to me,'" one interviewee explained.

Other women echoed this perception of the school, and some even stated that, prior to exploring the College of IST more thoroughly, they shared misconceptions about what it meant to pursue a major in the College. "Even me when I started IST I was like, '… this is just gonna be like so much coding, it's going to be overwhelming. Will I be ready for something like this when I really have never done anything like it before in my life?'" All of them went on to clarify that

IST and its curriculum are comprised of considerably more than coding, and that part of its

appeal lies in the versatility of its courses and applications.

Just as Harvey Mudd restructured its courses and assignments to align more closely with

students' interests, interviewees suggested that the College of IST communicate more effectively

the career opportunities available to graduates. "Everything that you're interested in can be

supplemented by technology. Everything," explained one of the seniors while reflecting on what

paths she could pursue after graduation. Another interviewee, who had elected to add a bachelor

of science in IST to her academic plan in addition to the Marketing major she was already

pursuing, expressed similar sentiments and believed that, if more women across the university

were made aware of the applicability of IST courses to their fields of interest, they too might be

interested in dual-majoring across colleges. A similar suggestion posed by a senior SRA major

pointed out that the College could even advertise the prevalence and pertinence of technology in

more stereotypically-feminine fields, such as fashion and design or public relations. She cited an

experience she had when touring Microsoft's headquarters in which the visiting females were

shown an application that enabled them to virtually try on different styles of wedding dresses as

an example. While not all examples of Information Technology's applicability to these fields

need be so overtly focused on appealing to female stereotypes, this does represent an instance in

which technology was distanced from its masculine typecast in an attempt to highlight its

versatility.

In addition to increasing general female interest in the College of IST and its majors,

these advertising and recruiting techniques could also help to diversify the female population that

currently exists in the College. As explained in Chapter 4's section on the IST Woman,

interviews indicate that the women opting to enroll in IST share common personality traits and

interests, which may cause females with markedly different personalities and interests to feel intimidated or out of place in the College A large part of increasing the number of women interested in the College includes expanding the pool of females from which IST can recruit, and I believe this can be accomplished by appealing to more diverse feminine interests.

Another common recommendation that aligns with Harvey Mudd's initiatives and the themes I've identified was to increase the visibility of females within the College of IST and at its recruiting events. One student suggested that IST hold a career or technology expo specifically geared toward undergraduate females and run by women to help promote the College's degree programs to these students, to offer networking opportunities, and to empower and inspire them to explore the field by providing them with an opportunity to connect with strong female role models and potential mentors. This proposal aligns with the goals of the Grace Hopper Conference and ties back to the importance of encouraging a female community within the College.

Other, related ideas that interviewees shared with me were the creation of a mentorship program either independent of, or in conjunction with, the Women of IST club that could serve as a resource to young women entering IST who might have unanswered questions and concerns that they'd feel more comfortable addressing to a fellow, seasoned IST female than to the College's administration. Another proposal called for the creation of a women's caucus that could represent the interests of women within the College and enable them to converse and work directly with other students as well as female faculty members. Increased engagement and mentorship opportunities reinforce the sense of community between the female population of IST, which, as discussed in Chapter 4, is frequently cited as a principal factor in making women feel welcome and comfortable both in the interviews I conducted and in academic literature.

Chapter 6: **Conclusion**

In the process of preparing this thesis, I identified and agreed with most of what was published and said to me on the topic of women in technology and in IST. I say "most," because there was one conclusion brought up by a handful of academic journals and interviewees alike that I struggled to support:

"But as far as like getting more girls to IST, it's kind of a cultural thing, you know? I feel like, I think that all girls should be STEM majors…but society doesn't always think that." While society's beliefs are likely a factor in whether or not women feel comfortable pursuing these majors—and while it's not reasonable or realistic to want *all* women to enter the field—they are not reason enough that women should remain underrepresented in Information Technology.

Results like those documented at Harvey Mudd College serve not only as inspiration for technical institutions and programs across the country looking to align their demographics with those of the country's population, but also as reminders that it is possible to narrow the gender gap in technology with realistic changes. Nationally, in 2014 only 12 percent of computer-related bachelors' degrees were awarded to women (Yoder, 2014). The College of IST's female enrollment of nearly 25 percent that same year serves as evidence that the College is already capable of defying trends that negatively impact female enrollment in similar technical programs across the country. Although it may seem impossible to close the gender gap in the Information Technology landscape on a large, national scale without significant societal and cultural changes, well-designed interventions to reduce potential deterrents affecting the women of Penn State can help the College of IST balance its enrollment demographics and foster the future female leaders in Information Technology.

Chapter 7: References

About - Grace Hopper. (2016). Retrieved March 25, 2016, from http://ghc.anitaborg.org/about/

Allbritton, D., Aronis, J.M., Katz, S., Soffa, M.L., & Wilson, C.. (2006). Gender, achievement, and persistence in an undergraduate computer science program. *DATA BASE, 37*, 42-57.

Anderson, N. (2014, March 26). The gender factor in college admissions: Do men or women have an edge? *The Washington Post*. Retrieved April 5, 2016, from https://www.washingtonpost.com/local/education/the-gender-factor-in-college-admissions/2014/03/26/4996e988-b4e6-11e3-8020-b2d790b3c9e1_story.html

Blanchard, T.J., Ellis, G.S., Guzman, I.R., Sharif, R., & Stanton, J.M.. (2005). What Attracts Women to the IT Field? The First Process of Occupational Socialization. *AMCIS*.

Burnard, P., Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Analysing and presenting qualitative data. *British Dental Journal, 204*, 429-432. Retrieved April 6, 2016, from http://www.nature.com/bdj/journal/v204/n8/full/sj.bdj.2008.292.html

Capretz, L.F.. (2003). Personality types in software engineering. *Int. J. Hum.-Comput. Stud., 58*, 207-214.

Cohoon, J. M. (2010). *Promising Practices* (Rep.). Retrieved March 29, 2016, from National Center for Women and Information Technology website: https://www.ncwit.org/sites/default/files/resources/harveymuddcollege_successfulsystemicapproach.pdf

Cohoon, J. M. (2001). Toward Improving Female Retention in the Computer Science Major. *Communications of the ACM, 44*(5), 108-114. Retrieved March 30, 2016, from

http://cacm.acm.org.ezaccess.libraries.psu.edu/magazines/2001/5/7354-toward-
improving-female-retention-in-the-computer-science-major/fulltext

DuBow, W. (2014). Attracting and Retaining Women in Computing. *IEEE Computer Society,*
90-93. Retrieved February 10, 2016.

DuBow, W. M., & James-Hawkins, L. (2015). What Influences Female Interest and Persistence
in Computing. *IEEE*. Retrieved February 10, 2016.

Katz, P. S. (1982). Retention of Women in Technology Programs. *IEEE Transactions on
Education, E-25*(1), 15-18. Retrieved February 10, 2016.

Koppel, N. B., Cano, R. M., Heyman, S. B., & Kimmel, H. (2003). Single gender programs: Do
they make a difference? *Frontiers in Education, 1*, T4D-12-16. Retrieved March 30,
2016.

Martin, S. (1999). Gender, Technology and Work: Understanding Patterns in Women's
Employment in Science and Technology Occupations. *IEEE,* 118-129. Retrieved
February 10, 2016.

New Report on Women in STEM Features Harvey Mudd's CS Program. (2015, March 26).
Retrieved March 29, 2016, from https://www.hmc.edu/about-hmc/2015/03/26/new-
report-on-women-in-stem-features-harvey-mudds-cs-program/

NCWIT Fact Sheet. (n.d.). Retrieved March 27, 2016, from https://www.ncwit.org/ncwit-fact-
sheet.

Personality Types in the Population by Gender. (2016). Retrieved April 6, 2016, from
http://www.careerplanner.com/MB2/TypeInPopulation-Males-Females.cfm

Rosser, S. V. (1998). Group work in science, engineering, and mathematics. *College Teaching,
46*(3), 82.

Ryan, G. W., & Bernard, H. R. (2003). Techniques to Identify Themes. *Field Methods, 15*(1),

    85-109. Retrieved April 6, 2016, from http://crlte.engin.umich.edu/wp-

    content/uploads/sites/7/2013/06/Ryan-and-Bernard-Techniques-to-Identify-Themes.pdf

Tapia, A. H. (2004). Is There a Retention Gap for Women and Minorities? The Case for Moving

    In Versus Moving Up. *Idea Group, Inc.,* 143-164. Retrieved April 5, 2016, from

    https://faculty.ist.psu.edu/lyarger/RetentionChapter.pdf

Thom, M., Pickering, M., & Thompson, R. E. (2002). Understanding the Barriers to Recruiting

    Women in Engineering and Technology Programs. *ASEE/IEEE Frontiers in Education

    Conference,* F4C-1-F4C-6. Retrieved February 10, 2016.

Trauth, E. M., Joshi, K. D., Kvasny, L., J. C., Kulturel, S., & Mahar, J. (2010). Millennials and

    Masculinity: A Shifting Tide of Gender Typing of ICT? *16th Americas Conference on

    Information Systems*. Retrieved April 5, 2016, from

    https://faculty.ist.psu.edu/lyarger/Amcis2010-Millenials.pdf

Trauth, E. M., Cain, C., Joshi, K. D., Kvasny, L., & Booth, K. (2015). The Influence of Gender-

    Ethnic Intersectionality on Gender Stereotypes about IT Skills and Knowledge. *The Data

    Base for Advances in Information Systems*. Retrieved April 5, 2016, from

    https://faculty.ist.psu.edu/lyarger/DB-TrauthCainJoshiKvasnyBooth.pdf

United States, White House Office of Science and Technology Policy. (2014, March). *Preparing

    Americans with 21st Century Skills, Science, Technology, Engineering, and Mathematics

    (STEM) Education in the 2015 Budget*. Retrieved March 27, 2016, from

    https://www.whitehouse.gov/sites/default/files/microsites/ostp/fy_2015_stem_ed.pdf

Weir, K. (2013, November). Feel like a fraud? Retrieved April 05, 2016, from

    http://www.apa.org/gradpsych/2013/11/fraud.aspx

Yoder, B. L., Ph.D. (2014). *Engineering by the Numbers* [Scholarly project]. In *American Society for Engineering Education*. Retrieved March 30, 2016, from

https://www.asee.org/papers-and-publications/publications/14_11-47.pdf

Appendix A: Interview Transcript

What is your major and option in IST?

Are you pursuing a minor in IST?

What kind of degree are you pursuing?

What semester standing are you?

In how many semesters have you enrolled in IST courses?

How did you find/enroll in IST?

What, if any, involvements do you have in the College of IST?

What is your primary career goal or plan post-graduation?

Have you worked in teams in any IST courses?

What did you find made teams the most effective in your experiences in IST?

What did you find made teams the least effective in your experiences in IST?

Have you been on a team with all male students? Can you tell me about that?

Have you been on a team with all female students? Can you tell me about that?

Do you have a preference for a certain gender makeup of a team? Can you explain your

reasoning?

Would you say you feel more comfortable when there's a girl on a team, or is there a feeling of

excitement or relief when you see there's at least one other girl on a team?

Have you noticed a difference in the team dynamic based on the ratio of males and females on

the team? Can you explain or give an example?

Have you noticed that you take on different roles based upon the gender makeup of a team?

Have you found that as you've gotten higher up in classes that there are more or fewer women?

How do you believe male IST students perceive you on a team?

How do you believe male IST students perceive you in a general classroom setting?

How do you believe female IST students perceive you on a team?

How do you believe female IST students perceive you in a general classroom setting?

Do you think that IST attracts a certain kind of woman to the college?

Do you think there's kind of a sense of community within the women of IST?

Is there anything that you believe the College of IST could do to improve, to recruit more women, to make women more comfortable in the classroom setting?

Appendix B: Interview Responses in Support of Themes

Theme 1: The IST Woman

"I never really thought about it being because of gender, but it's definitely easier for me to take on a leadership role when there are more girls on the team, I think. Because I have more of an assertive personality. When there's guys, I think there are more people who will step up, but sometimes I still—it's not that I'm a dictator and have to be in charge, but, I'm not always the first to step up if there's more guys, I guess."

"I think because I take an assertive role, they think I have more value—I do think about these things a lot—I think if I was more submissive they probably wouldn't task me with as many things because that's kind of the stereotype of helpless, you know, like cute, just sit there and be like 'oh, just tell me what to do.' But I think the assertiveness gets me more respect from my peers in teams."

"Yes, I think you would get overlooked, otherwise. I think you're given less responsibility and your opinions are just overlooked. It's not even that you're taking a backseat role because you're a girl, it just might be your personality. It just doesn't help that you're a girl."

"Probably a similar way, because I will raise my hand a decent amount, depending on the class. I probably still come across as slightly assertive. I get that a lot, it's just the general people who don't know me, I'll meet them and they'll be like 'oh, I was really scared of you at first,' and I'm like, 'why?'"

"Yeah, because it's always been like, 'you're a woman in technology, there's not very many of them.' People will tell you that you can't do that thing. So I feel like the girls that are in these fields are the ones who are like, 'I'm going to do it, this is what I want to do.'"

"I get that I'm intimidating a lot, and I'm just like, well I just carry myself confidently and I should be able to do that. Just because I'm a girl I don't need to be sweet. So I definitely get that a lot. Especially from guys. Girls don't—like none of my friends have ever told me I was assertive, but a lot of guys will."

"The first is that I think that women in science, even though there have been women in science since the beginning of science, women in science as early adopters, or early majority adopters of studying science, I think we're still in that first or second wave of women in STEM, or computer science, or those kinds of fields. So, I think naturally, the women who are trying to do that are going to be more assertive. And then the second thing I think is that maybe because you are a more assertive get things done type of person, perhaps the people that you know in the college share qualities with you."

"I mean I think so. I think that kind of has to deal with the whole STEM area anyways. It's going to be a lot of females that are more drive just because it's so male dominated. I think that's just the kind of way it is."

"I mean I think that's just kind of the way it is in a sense. Sometimes I think that especially at this age, females are more mature than males. So, when you get that combined with the fact that we're in a field that's male-dominated, you're going to kind of get the females that are more empowered and more driven and assertive in that sense. I mean I know some females in the major that aren't quite as aggressive in a sense than I am. But, I think that probably it does attract more of an assertive type of female."

"I would say so. I think it takes a lot of courage to go into a field like IST where it's predominantly male, and to go in as a girl and think, 'I can compete in this.'"

"Yeah, maybe they do self-select for this sort of thing. I think that any girl who wants to take on technology has a little bit of...courage? Maybe a little bit of a backbone to her, a little bit? So yeah, maybe? Yeah, I could see that being a thing. I never thought about that one before, but I could see it. Yeah, because I haven't really met anybody who wasn't...I haven't met very many introverted people. I've met a lot of go-getters, sort of, as far as girls are concerned."

"There's definitely moments when I've felt like, 'ok I just need to assert myself, but not really.'"

"I don't think that being in IST makes you any less feminine, I do think that it takes a certain kind of person to come into a field that's male-dominated, and I don't think you think about it. But I think that you would leave if you didn't feel perfectly comfortable in what you're doing."

"But again, I think it's because of the type of girls that enter IST, that we're always a little more Type A, and a little more organized, and a little more forward pushing."

"So when I switched to SRA, and my ActSci classes as well, they were mostly guys, so I think I'm kind of used to it, and if anything it's kind of like a challenge, you know, to prove that you're, I don't know, that you're just as good, if not better. I kind of look at it more as like a challenge. I don't really think much of it."

"I would certainly probably think that a male might find me a little bit bossy?"

"It's interesting. I usually end up being the leader of a group, which kind of happens even if there are other females in the group. That's just my personality…I'm not really much for drama so I usually hang around guys more, so it's not unusual for me but, so far, so good. Hopefully that doesn't change."

"I'm sure that I come off as a little bitchy because of just, I just take charge and I do it. I'm sure I seem uptight about it too, but at the same time, I also try and be more laid back in a sense, just with my language and my mannerisms, so while I'm saying, "okay guys, we actually need to sit down and do this." I'm not you know they straight up and on top, I'm not snapping at them for that. It's more of I'm telling them what to do, but letting them within their actions have more freedom. I'm sure that I seem a little anal about it, but I try to be cool about it. So I think that I probably come off as just more organized, but a down to earth person, I guess. I hope, I hope that's how I come off. I really hope I don't come off as a complete bitch."

"Usually it has to do with if there's a conflict or if I'm trying to get my way, I'm a very confident person, so I'm not afraid to step up and take what i want, which I think has to do with why people find that intimidating. But, that's not when I first meet people. It's only when I'm trying to achieve a goal in that sense."

"I don't know. I guess at some point, it takes a stronger person to do it. I know my roommates could never do it. I think they have a little bit of a different personality, but not in a bad way."

"No, I'm usually just the team leader, but that's more just my personality type than because I'm a girl."

"I mean, personally, I think I take on the leadership role a lot. And I don't know if it's because I'm trying to prove something, or if it's just my personality. But I do take on leadership roles a lot."

"Yes. Only because I think that the college of IST is very unique, so I think the girls who are maybe more introverted and strictly want to focus on computers would go to computer science or computer engineering. I think that people in the MIS field more so than strictly than the college of IST want to very social and are looking for more of the business end. So I think that the girls

are in the college of IST are the drivers of the comp sci side of it. They're more social but they really want to get things done so that they go to IST because they can't make it all the way to the business side because it's not technical because that's where I find myself as well."

Theme 2: The Balanced Team

"I actually kind of like being the only female in that sense, just because then it's easier for me to step up. One or two other females would be fine. I don't have a big preference. If I were in a group of all girls that would be fine too. I think it might be a little messier. I think that females tend to complicate, but I also think it would be more efficient because I think females tend to be more efficient. So, I mean there are pros and cons to both. I think personally I would prefer more males in the group, and I'd be fine if it were heavy female as well."

"Yes. I would prefer...well if the team is 5, including myself, I would prefer to have 2 other girls or one other girl. Having three other girls and one guy, which would make four girls and one guy, is too much and then he doesn't know how it handle it, so he needs to have at least one pairing of another guy with him. Three is fine, but I find that it's better to bounce ideas off of different people. And both sides are more versatile if they have someone they can associate with."

"Right now I'm working on a team in my capstone class that is three guys, three girls, and I don't think it's the gender difference that's working, but I do think that it's the best team I've been on. So I don't think there's any correlation, but I do think that when it's mixed...when there's at least two girls I think it works because you can kind of get that different perspective, and I think it's easier to bounce ideas off of each other, because everyone has different experiences. I just think

it's good to have different experiences and I think that two girls is better because sometimes girls are more timid around guys, so it's hard to bring up topics, so when you have a partner almost, it's easier to bring up ideas and work toward the common goal."

"I feel like it's easier to be heard, if you're not as extroverted as I am, especially. So, other girls that are on teams that are by themselves, definitely need someone else there. I just kind of go for it either way, but I definitely find that the experience is more enjoyable when there's another girl in the group."

"Not particularly. It's always nice when there's another girl on the team. But I don't mind being on a group of all guys. It used to, like freshman year, it used to be kind of weird, I suppose, because I was still getting used to college and all my friends from back home were girls. So it was strange being in a group with all guys. But I think, over the years I got used to it and it's not really an issue anymore."

"I do like working with guys, they don't really bother me, but it's nice to have a girl on a team only because, when you're working on a team out of class, sometimes it's good to talk about something more than just cars, or sports. I know that sounds so stereotypical and very middle school-esque in a way...but I really like talking about recipes and guys look at me like, 'Oh, I had a hamburger,' and you're like, 'Okay...' I don't know, that's a very gender role stereotype, but I'm gonna say I like small talk with girls on occasion."

"Yeah, I'd say that, actually. I'd agree with that statement. It's almost like you have someone that you can commiserate with, or someone that you can be on the same page with. I'm not saying that I get along with every girl that I talk to, but I do think there's something to be said for two people who kind of understand each other. I don't know if it's a biological thing, I don't know. But I do think there's something about having a girl on a team that's kind of comforting. I'm not

saying that I can't make it work if there's all guys, but having another girl is something that's kind of like, 'Ok, she gets it. She knows that when I eye roll, it's me, saying under my breath all these things.' You know what I mean? I don't know why, but I feel like when there's another girl it's just a little bit easier."

"It is nice having another female on the team. It's easier to talk to sometimes, but I don't really care."

"I don't think I have a preference. I think balance is good, just to bring different perspectives, but I don't know that I would prefer one way necessarily."

"I think it would be good to be mixed, especially since I think that for females, it's a lot harder to work in a male-dominated industry, so I think we work a little harder, just to kind of prove that we deserve to be here—at least I know that's how I feel sometimes."

"I feel like a good mix is two girls and three guys. I feel like when you have mostly girls, everyone's butting heads. Girls are sassy and, you know. But when you have two of them, I feel like it's easier for them to agree on one thing. I don't know, people say 'three's a crowd' and it's harder to come up with one idea when there's three strong-minded people. I feel like most girls that I've had interactions with within IST classes are stronger-minded people, stick to their guns, have strong opinions. So I feel like that's why I'm wanting 2 girls and 3 guys, because I feel like the guys I've had experiences with in IST are more laid back and don't try to force you to go with their idea."

"I don't think so, because what I've observed is that men and women have different strengths when it comes to projects, and I'm not saying that men are the only ones who can be coders, but I find that in general, women are much more detail oriented on certain things and they're willing to put in a little bit more time than men are, and then at the same time, men maybe have more skills

or different skills than women do. So I think that the best experiences--like, right now I'm in a team in my IST 440W class and it is literally the best team I've ever worked on and we have 3 girls and 3 boys. And actually, I wouldn't say that the boys are more technically skilled than the girls, but I do think that the skills the boys have don't overlap with with girls so it's a really good synergy type situation where everyone's bringing something different to the table. So, I think that in my experience, having a balance is really, really nice."

Theme 3: Community and Mentorship

"I like it. The meetings can be a little boring sometimes, because it's mostly presentations. I think WIST could do a little better with getting the community of females together. I know that at the start of the semester, they had a dinner at one of the restaurants downtown. I wasn't able to go to it, I had another commitment that I had to go to. But, maybe doing, we're all going to go get froyo on a Thursday night, if you want to come, we'll be there for an hour. That might be nice. When I go to the meetings, I'll sit by myself and no one really approaches me and tries to engage me in conversation. So I think that to build a sense of community and come up and "Hey, I'm so and so, what's your major? What are you doing? Do you want to come sit over here with us?" That might be better."

Do you feel that there's kind of a sense of community between the women of IST?

"Definitely."

"Actually, yeah. I would say that there probably is a little bit a sense of community. At least, I feel like the girls kind of band together a little bit--I'm not saying all the time, but whenever you

see another girl in your class, you kind of tend to sit near them, just because you're almost like a

lone wolf in the sea of guys. That sounds like I'm being...obviously, over-dramatic,

but...sometimes it's nice just to sit next to them, talk about it, whatever."

"Oh, definitely. I mean, the girls that I'm friends with in IST, I'll see them in a class next

semester, and we're good friends. You definitely, when you have a girl on your team, you'll

probably be teammates with them later in another class and stuff."

"Yeah, definitely. I mean, especially now, I feel like I only sit with my friends that I'm friends

with even outside of class. But yeah, it's nice to have someone you know going into class,

because they're mostly team projects, so it's nice to have a friend you can talk to."

"If anything, it would just...I don't know, in my opinion when I see another girl, I'm kind of like,

'oh, cool, someone I can instantly talk to, bond with.' So, yeah, I would assume seeing another

girl in IST they get excited. Someone else who's going to do some good work."

"I think it'd be interesting if there was almost like a mentoring program just so that--because I do

think, coming in it is intimidating for girls, especially for people who might not be used to being

in a male-dominated environment. It's intimidating, it's scary, especially if you have to work in a

group that's all guys who might be older than you, that's intimidating. So I think if there could be

some sort of mentoring program. I know there's Women in IST, but I think Women in IST could

set up, like setting up a senior with a freshman, or a junior with a freshman, kind of like a buddy

within IST, who you can go to for questions about the major, for questions about issues, or about

classes, or even if you're having an issue, so you have someone who's still more on your level to

talk to about it, rather than having to go through administration."

"I started college wanting to go to medical school and I realized that I didn't like chemistry, like I didn't want to go to school for 8 more years. Also, kind of having ties to here, my parents made me kind of switch to SRA."

"My mom even, who was in the marine core, she's tried to play that balance too. She's been like, 'you might want to wear your hair up so they have to look at your face…We're playing some game."

"I know my mom worked in a very male-dominated field, and I'm used to that kind of setting—I have a brother and stuff, so I don't know if that has anything to do with it or if it's coincidental, but I do find that I don't think a lot of people are that bothered by how many males are in the class, unless they get unwanted advances and then it gets annoying."

"I don't think it bothered me. It was almost like a challenge. My sister graduated 4 years ago in CompSci, so it was pretty much the exact same thing. So she would always tell me about that."

"I'm very analytical, so that's kind of what pushed me toward it. Coming into college, I kind of didn't know what I wanted to do. My mom actually graduated in comp sci a long time ago. It was kind of cool that -- I kind of got to see it through her. She was like, "Why don't you look at it?" And that was kind of how I ended up here. So, yeah. I like it. I'm glad that IST is here."

"Well I started in CompSci, and didn't like the physics or calc that went along with it, so my mom set up job shadowing for me for winter break after my first semester with computer security guys in her business and they told me to look into College of IST and see if they had a security option, because I liked what they were doing, and I stumbled upon it really."

"So, my dad actually works in IT--he works for Behr, like Behr aspirin. So I started taking computer programming classes in high school just to see if I liked because I was good at the information sciences classes where you just work on word and powerpoint and the other design

things and then I got into programming, but I was the only girl in my programming class. So I thought that was really interesting because I was kind of like an alien in the class."

"I mean I fell in love on my accepted students' day. I think one of the things that really helped, I mean I was the only female at accepted students' day program, and they had a female come and talk to us and I think that really helped. And females ran the program. And I asked "What is the ratio?" I was just asking because I was curious, and they stood up and defended IST and everything. I think that just showing the passion with which females have within it, that would really help and open up IST to other girls. Because that, when I asked that question…she went off on a four-minute speech about females and technology and the field and that sort of stuff. And I went, "Oh, that's really interesting." It's really cool to see that other girls are in this and they're so empowered and able to do everything that guy can do and better if they want. "

BIBLIOGRAPHY

About - Grace Hopper. (2016). Retrieved March 25, 2016, from http://ghc.anitaborg.org/about/

Allbritton, D., Aronis, J.M., Katz, S., Soffa, M.L., & Wilson, C.. (2006). Gender, achievement, and persistence in an undergraduate computer science program. *DATA BASE, 37*, 42-57.

Allen, A., & Thomas, T.. (2006). Gender Differences in Students' Perceptions of Information Technology as a Career. *JITE, 5*, 165-178.

Anderson, N. (2014, March 26). The gender factor in college admissions: Do men or women have an edge? *The Washington Post*. Retrieved April 5, 2016, from https://www.washingtonpost.com/local/education/the-gender-factor-in-college-admissions/2014/03/26/4996e988-b4e6-11e3-8020-b2d790b3c9e1_story.html

Beyer, S., Haller, S.M., & Rynes, K.. (2004). Deterrents to women taking computer science courses. *IEEE Technol. Soc. Mag., 23*, 21-28.

Blanchard, T.J., Ellis, G.S., Guzman, I.R., Sharif, R., & Stanton, J.M.. (2005). What Attracts Women to the IT Field? The First Process of Occupational Socialization. *AMCIS*.

Burnard, P., Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Analysing and presenting qualitative data. *British Dental Journal, 204*, 429-432. Retrieved April 6, 2016, from http://www.nature.com/bdj/journal/v204/n8/full/sj.bdj.2008.292.html

Capretz, L.F.. (2003). Personality types in software engineering. *Int. J. Hum.-Comput. Stud., 58*, 207-214.

Chow, A., Iyer, L., Tate, S.R., & Zhao, X.. (2011). Computer Science and Information

  Technology (CSIT) Identity: An Integrative Theory to Explain Gender Gap in IT. *ICIS*.

Cohoon, J. M. (2010). *Promising Practices* (Rep.). Retrieved March 29, 2016, from National

  Center for Women and Information Technology website:

  https://www.ncwit.org/sites/default/files/resources/harveymuddcollege_successfulsystemi

  capproach.pdf

Cohoon, J. M. (2001). Toward Improving Female Retention in the Computer Science Major.

  Communications of the ACM, 44(5), 108-114. Retrieved March 30, 2016, from

  http://cacm.acm.org.ezaccess.libraries.psu.edu/magazines/2001/5/7354-toward-

  improving-female-retention-in-the-computer-science-major/fulltext

DuBow, W. (2014). Attracting and Retaining Women in Computing. *IEEE Computer Society,*

  90-93. Retrieved February 10, 2016.

DuBow, W. M., & James-Hawkins, L. (2015). What Influences Female Interest and Persistence

  in Computing. *IEEE*. Retrieved February 10, 2016.

Gender and Competition. (2016). BizEd, 15(2), 16.

Guzdial, M., Perry, H., & Rich, L.. (2004). A CS1 course designed to address interests of

  women. *SIGCSE*.

Hankins, J.A., Iriarte-Gross, J.M., Perhac, D.G., Parker, B.C., Pettey, C.C., & Rowell, G.H..

  (2003). Computer-related gender differences. *SIGCSE*.

Henwood, F. (1998). Engineering Difference: Discourses on Gender, Sexuality, and Work in a

  College of Technology. *Gender & Education, 10*(1), 35-49. doi:

  10.1080/09540259821087

Joshi, K.D., & Kuhn, K.M.. (2001). Gender differences in IS career choice: examine the role of attitudes and social norms in selecting IS profession. *SIGCPR.*

Katz, P. S. (1982). Retention of Women in Technology Programs. *IEEE Transactions on Education, E-25*(1), 15-18. Retrieved February 10, 2016.

Koppel, N. B., Cano, R. M., Heyman, S. B., & Kimmel, H. (2003). Single gender programs: Do they make a difference? *Frontiers in Education, 1*, T4D-12-16. Retrieved March 30, 2016.

Kranov, A. A., DeBoer, J., & Abu-Lail, N. (2014). Factors Affecting the Educational and Occupational Trajectories of Women in Engineering in Five Comparative National Settings. *International Conference on Interactive Collaborative Learning,* 21-28. Retrieved February 10, 2016.

Martin, S. (1999). Gender, Technology and Work: Understanding Patterns in Women's Employment in Science and Technology Occupations. *IEEE,* 118-129. Retrieved February 10, 2016.

Meyer, M., Cimpian, A., & Leslie, S. (2015). Women are underrepresented in fields where success is believed to require brilliance. *Frontiers In Psychology,* 61-12. Doi:10.3389/fpsyg.2015.00235.

New Report on Women in STEM Features Harvey Mudd's CS Program. (2015, March 26). Retrieved March 29, 2016, from https://www.hmc.edu/about-hmc/2015/03/26/new-report-on-women-in-stem-features-harvey-mudds-cs-program/

NCWIT Fact Sheet. (n.d.). Retrieved March 27, 2016, from https://www.ncwit.org/ncwit-fact-sheet.

Personality Types in the Population by Gender. (2016). Retrieved April 6, 2016, from

    http://www.careerplanner.com/MB2/TypeInPopulation-Males-Females.cfm

Rosser, S. V. (1998). Group work in science, engineering, and mathematics. *College Teaching,*

    46(3), 82.

Ryan, G. W., & Bernard, H. R. (2003). Techniques to Identify Themes. *Field Methods, 15*(1),

    85-109. Retrieved April 6, 2016, from http://crlte.engin.umich.edu/wp-

    content/uploads/sites/7/2013/06/Ryan-and-Bernard-Techniques-to-Identify-Themes.pdf

Tapia, A. H. (2004). Is There a Retention Gap for Women and Minorities? The Case for Moving

    In Versus Moving Up. *Idea Group, Inc.,* 143-164. Retrieved April 5, 2016, from

    https://faculty.ist.psu.edu/lyarger/RetentionChapter.pdf

Thom, M., Pickering, M., & Thompson, R. E. (2002). Understanding the Barriers to Recruiting

    Women in Engineering and Technology Programs. *ASEE/IEEE Frontiers in Education*

    Conference, F4C-1-F4C-6. Retrieved February 10, 2016.

Trauth, E. M., Joshi, K. D., Kvasny, L., J. C., Kulturel, S., & Mahar, J. (2010). Millennials and

    Masculinity: A Shifting Tide of Gender Typing of ICT? *16th Americas Conference on*

    Information Systems. Retrieved April 5, 2016, from

    https://faculty.ist.psu.edu/lyarger/Amcis2010-Millenials.pdf

Trauth, E. M., Cain, C., Joshi, K. D., Kvasny, L., & Booth, K. (2015). The Influence of Gender-

    Ethnic Intersectionality on Gender Stereotypes about IT Skills and Knowledge. *The Data*

    Base for Advances in Information Systems. Retrieved April 5, 2016, from

    https://faculty.ist.psu.edu/lyarger/DB-TrauthCainJoshiKvasnyBooth.pdf

United States, White House Office of Science and Technology Policy. (2014, March). *Preparing*

    Americans with 21st Century Skills, Science, Technology, Engineering, and Mathematics

(STEM) Education in the 2015 Budget. Retrieved March 27, 2016, from

https://www.whitehouse.gov/sites/default/files/microsites/ostp/fy_2015_stem_ed.pdf

Weir, K. (2013, November). Feel like a fraud? Retrieved April 05, 2016, from

http://www.apa.org/gradpsych/2013/11/fraud.aspx

Yoder, B. L., Ph.D. (2014). *Engineering by the Numbers* [Scholarly project]. In *American*

Society for Engineering Education. Retrieved March 30, 2016, from

https://www.asee.org/papers-and-publications/publications/14_11-47.pdf

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The Vanguard Group, Malvern, PA   May—August 2015
College2Corporate IT Intern – Chief Technology Office
- Technological consultant and researcher for Vanguard's internal divisions on the Innovation and Research team
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The Pennsylvania State University   January—May 2014
Learning Assistant – SRA 211: Threat of Terrorism and Crime
Sea World Parks and Entertainment, Busch Gardens Williamsburg, VA   May—August 2013
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Pomerado Hospital, Poway, CA   September 2010—April 2012
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