

**EXPANDING HORIZONS OF COMPUTING PEDAGOGY  
THROUGH THE WORDS AND EXPERIENCES OF FEMALE  
INFORMATION SCIENCE UNDERGRADUATES**

By

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There is a persistent absence of women in undergraduate Computer Science programs in colleges throughout the United States. However, Information Science programs, which train students in programming, statistics, and a variety of computing concepts, consistently boast higher rates of women's participation than mainstream Computer Science degrees. This paper seeks to understand why: first, by analyzing selected research from the last thirty years regarding the relationships between culture and women in computing, and then by presenting an ethnographic picture of five women enjoying and excelling at computing at the University of Arizona School of Information. Catalyzed by my own experiences, and expanded and bolstered by the stories my colleagues have shared, this paper reports on a range of unique women who feel welcomed, supported, and challenged by their educational and computing community. In the interest of unpacking this phenomenon and expanding the potential of Information Science, I relay the themes between my interviews and compare them to other successfully inclusive undergraduate programs, supporting existing initiatives and presenting concrete steps forward for Information Science and Computer Science programs nationwide.

## **Introduction: Project goals and motivation**

For almost thirty years, professors, administrators, and educational researchers have attempted to understand and remedy the gender gap in enrollment in undergraduate computing. However, it has persisted. In 2015, 16.1% of Bachelor's Degrees in a Computing major were awarded to women (Zweben & Bizot, 2016). However, there are significant differences in participation within a subset of computing majors: Information Science. Nationally, 21.7% of all Information Science Bachelor's degrees are awarded to women (Zweben & Bizot, 2016). At a local level, these numbers are even more encouraging. At the University of Arizona School of Information, women's enrollment rate in 2016 almost the almost doubled that of women in computing degrees nationally, at 30% (School of Information, 2017). These numbers offer an important insight into the factors that either encourage or dampen a young woman's motivation to pursue a computing major. I used a variety of methods in order to understand the factors that are leading a much higher percentage of women to pursue a Bachelor's degree at the UA iSchool than in any other Computer Science major nationally. My research adds to an existing body of work that describes the educational strategies and culture of institutions where women are participating at heightened levels in undergraduate computing majors.

To provide context for this local ethnography, I have assessed and summarized existing research regarding the persistent and increasing dearth of women in undergraduate computing programs, focusing specifically on the complex and evolving sociocultural concerns that coalesce to negatively impact female students' educational identities as they decide to enroll in and pursue computing at an academic level. These realities are complicated and significant, however, because they result from cultural ideations and structures, and are evolving by nature, as evidenced by both international and local computing environments where women participate at rates equal to men.

Bearing in mind how national and departmental culture influences many women's choices to pursue computing academically, I compiled and assessed relevant elements of the curriculum, pedagogy, and general department culture at the UA iSchool. My methods include document analysis of course content and departmental demographic data provided from two different School of Information reports, my own participant observations throughout my time in the program, semi-structured informal interviews, and comparisons to other successfully inclusive undergraduate computing programs. Through these methods, I formalize and categorize the ways in which the UA iSchool actively supports and encourages undergraduate women in pursuing coding and careers in computing. I seek to present this segment of experiences at one university as a starting point and a call to iSchools nationwide to expand upon the existing strengths of their courses of study to advocate for the presence of women in computing.

### **Demographic snapshot of women in the computer science pipeline**

The significant majority of degrees awarded in Computer Science are awarded to men. According to the Computer Research Organization's Taulbee survey, there were 21,880 Bachelor's degrees awarded for Computer Science in 2015. 83.7% of these degrees were awarded to men, while 16.3% were awarded to women (Zweben & Bizot, 2016). These numbers are historically low. Furthermore, the ratios that they described are echoed in tech spaces from high school computer science classes to tech company boardrooms. Even before college starts, young women are less likely to be engaged in programming and academic computing, as reflected by participation in the Advanced Placement Computer Science A Test. According to the College Board (2016), 76.6% of those who took the AP Computer Science test were boys, compared to the 23.3% that were girls. In total, there were 57,937 test-takers. Not surprisingly, markers of dampened participation continue past high school and college and into women's professional lives. The National Center for Women in Information Technology reported that in

2014 women left computing at “twice the rate of their male peers” (NCWIT, 2014). Furthermore, NCWIT reports that 56% of those who leave tech companies do so after about 10 to 20 years, at the midpoint in their career. This especially high and often delayed quit rate has intuitive negative ramifications for the advancement and lifetime earning potential of these women, because they are not achieving the highest potential of professional influence and salary that they would have received if they had stayed.

These individual statistics are surprising and disheartening in the context of longitudinal trends in both men and women’s participation in computer science. Women’s participation has been steadily declining since 1984, when 37% of all computing degrees were awarded to women. Contrastingly, in 2015, 16% of all computing degrees were awarded to women (Zweben & Bizot, 2016). Women’s declining participation is a stark contrast to the rise in popularity of computer science undergraduate degrees since the early 2010s (Zweben & Bizot, 2016). Women’s participation is running directly against men’s participation.

### **Representation is both a moral and pragmatic imperative**

Computing professions are widely regarded as stable, lucrative, and growing (Snider, 2016). Employees have opportunities to contribute to widely-used technologies and work in flexible and challenging environments, usually accompanied by a comfortable salary. Given America’s history of gendered and racialized divisions of labor, and future of increasing automation by manufacturing companies, computing offers one among many avenues for women to gain and control of their economic futures.

If fewer women are considering computing and are instead choosing other professions, tech and other companies are losing out on a potentially world-changing talent pool. Throughout history, women have contributed significant discoveries to science and technology, regardless of discriminatory and exclusive educational and social norms. Computing must continue to break

down barriers to participation if we want to continue pushing forward as a field. Until we have equitable representation, we are wasting our potential for greatness. This has been proved on a macro level as well. A significant body of research shows that the presence of women in the workplace means better economic outcomes for everyone. A 2012 study of venture-backed companies found that “a company’s odds of success increase with female executives at the VP and director levels” (Canning et. al, 2012). These findings have been echoed in both micro and macroeconomic research (e.g., Carroll and Shabana, 2010; Deloitte, 2011; McKinsey & Company, Inc., 2014, 2012; Quesenberry and Trauth, 2012; Trauth et al., 2006).

It has been previously noted that company performance is not directly related to having a certain portion of women on the board, or any other statistical measures of demographic diversity. Rather, the presence of a varied group of employees often represents a company with more inclusive rules of engagement, and institutional understanding of the value of a variety of different perspectives, facilitating the innovation and collaboration that lead to success (Bohnet, 2016).

## **Literature Review**

### **Overview**

The gap in women's participation in computing fields has been resistant to intervention for many years, and has in fact gotten bigger. Caroline Hayes (2010) pointed out "If this trend were to continue at the rate experienced from 1986 to 2006, there will be no women bachelor's degree graduates in computer science by 2032." This gap is not for lack of research regarding the multidimensional factors that contribute to this trend, nor for the deployment of various perspectives to explain its root causes. Essentially since women's enrollment in undergraduate computing peaked in 1984, researchers have hypothesized and theorized about why computing is unattractive to many women and how to change this reality. This literature review informs the study by summarizing the evolving and varied perspectives and explanations deployed by researchers over the past 35 years. Furthermore, through this literature review, I hope to present a sociocultural framework of bias that explains and underscores many of the issues investigated by researchers in this field.

### **Heuristics and bias**

In order to interpret the world around us, human beings use heuristics, or rules of thumb. These mental shortcuts allow us to quickly understand a complicated and dangerous world, but they also, in many cases, inhibit us from making completely rational decisions. One example of the shortcomings of heuristics is unconscious bias. Unconscious bias is the natural cognitive application of stereotypes, which is often unknown to the person who holds the bias. In the case of gender, prescriptive stereotypes require women to be communally and socially minded, as well as nurturing, kind and understanding (Burgess & Borgida, 1999; Eagly & Karau, 2002; Heilman, 2001; Rudman & Glick, 2001). When women break these stereotypes, they are often socially penalized. Striking proof of this is found in Madeline Heilman's research: in one

experiment, she asked undergraduate students to rate the likability of a series of incoming managers, including two that were described identically except one was male and one was female. The researchers found that “women are decidedly more disliked and interpersonally derogated than identically described men and, in addition, that they are found to be less desirable as bosses” (Heilman & Okimoto, 2007).

### **Computing specific stereotypes**

Culturally, there are very strong stereotypes about the differences between men and women’s mathematical and computing abilities, as well as intellect. While theories that once attributed the computing gender gap to inherent biological differences between men and women have been widely dismissed (Blickenstaff, 2006), and researchers have found no significant evidence of differences between mathematical and general intellectual ability between men and woman (Hyde, 1996), both men and women believe that men are smarter, especially in mathematics and science. These stereotypes impact children early, and researchers have found that five-year-old children will identify characters of their own gender as “really, really smart.” However, once girls turn 6, they will overwhelmingly identify men as being “really, really smart” (Bian et. al, 2017).

These gendered stereotypes have specifically constricted permutations when it comes to computing and technology. Since the 1990s, popular culture has painted computer scientists as “hackers” and “geeks” (Cheryan, Plaut, Handron, & Hudson, 2013; Sele, 2012). Jane Margolis (2002) found that the female students in Carnegie Melon’s undergraduate program felt like they weren’t as single mindedly obsessed with machines, and felt left out from constant conversations about the details of computers. In some ways, gendered conceptions of technology professionals have evolved since the 1990s with tech giants like the casually geeky Mark Zuckerberg, and sitcoms that explore the cutthroat and masculinized culture of *Silicon Valley*. However, these



permutations have introduced the idea of the entrepreneurial “brogrammer,” which in some ways is more masculine and intimidating than the quiet computer nerd. This new reality does very little to shift gendered stereotypes and their accompanying norms.

Furthermore, stereotypes and unconscious biases can play a large part in the creation of the “chilly climate” that many women have described and experienced in undergraduate computing. Young men, who are acting in societally-mandated ways, may often discount the perspectives or intellect of their peers, and engage in macroaggressions such as speaking over fellow students, or regulating them to tasks of visual design during group projects.

### **Addressing 25 years of stagnation: new directions in computing education**

In the late 1980’s, the National Science Institute characterized their desire to recruit and train a broader pool of women and people of color as “a pipeline.” Much of the research in the intervening years has sought to understand why young women do not persist throughout this process, or enter the pipeline in the future. In recent years, however, scholars have sought to challenge the paradigms that this business-based model engenders (Vitores & Gil-Juares, 2016). Recruiting, encouraging, and valuing women is not simply to increase the profits of corporations, but instead an effort to include all people in envisioning and benefiting from technological advancements, especially people who are currently and historically marginalized.

Furthermore, the pipeline analogy and resulting interventions often puts the impetus on marginalized groups to assimilate and ingratiate themselves into chilly climates. This can result in interventions that attempt to assist women in assimilating to masculinized environments, or (more specifically) environments that have been shown to be suspicious of or hostile towards women, for instance by providing women with mentors.

Finally, this pipeline metaphor assumes that everyone interacts with computing technology linearly through the academic process. “Such a conception not only may hide the complexity of

the situation (Hayes, 2010) but also may foster a narrow definition of both computing and ICT in general (Clegg & Trayhurn, 2000).” (Vitores & Gil-Juares , 2016) Many students engage in much more complex interactions with their schooling and career choices and do not advance in the strictly linear way that the pipeline metaphor assumes. A traditional path seems to occur only in a social vacuum (Bartol & Aspray, 2006; Castaño & Webster, 2011; Jesse, 2006; Leventman, 2007; Metcalf, 2010; Soe & Yakura, 2008).

### **The Information Science perspective**

Thus far, I have assessed and described trends and realities in undergraduate computing programs broadly. However, the Computing Research Association separates computing degrees into three categories: Computer Science, Computer Engineering, and Information Science. Each of these fields requires students to understand and interact with computers and information technology, however there are significant curricular differences between each field. Computer science is the most popular and well-known of the disciplines, and requires students to learn various computer programming languages, as well as learn about the theoretical aspects of algorithms and data structures. According to the National Coordination Office for Networking and Information Technology Research (1995), Computer Science is defined as:

“The systematic study of computing systems and computation. The body of knowledge resulting from this discipline contains theories for understanding computing systems and methods; design methodology, algorithms, and tools; methods for the testing of concepts; methods of analysis and verification; and knowledge representation and implementation.”

Computer Engineering is defined as “Computer engineering refers to the study that integrates electronic engineering with computer sciences to design and develop computer systems and other technological devices” (Techopedia.com, 2015). Computer Engineering requires its students to learn computer code for hardware applications.

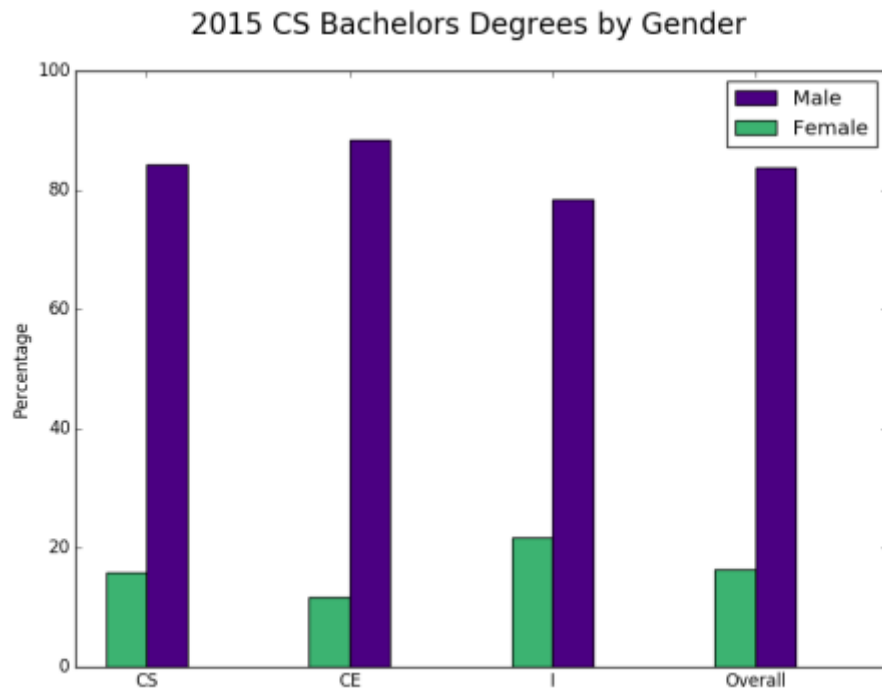
Finally, there is Information Science. Information programs often differ in name depending on their institution, a point of confusion addressed by the Taulbee survey: “Information programs included here are Information Science, Information Systems, Information Technology, Informatics, and related disciplines with a strong computing component.” Information Science, specifically, is defined by the *Dictionary for Library and Information Science* as the “systematic study and analysis of the sources, development, collection, organization, dissemination, evaluation, use, and management of information in all its forms, including the channels (formal and informal) and technology used in its communication” (Zweben & Bizot, 2016). Information programs are significantly less developed and popular than Computer Science and Computer Engineering programs. The Taulbee Survey included 147 public and private universities in their assessment of Computer Science degrees, and they only included 14 universities in their assessment of Information degrees (Zweben & Bizot, 2016). Information Scientists are required to learn code, but usually for statistical and other analytic applications. Often associated with Library Sciences, Information Science often asks their students to use technology for socially scientific applications.

Information Science programs represent an emerging academic movement in the field of Computer Science. Just this year, the School of Information at the University of Arizona was inducted to the iSchools organization. The iSchools organization was founded in 2005 and chartered as a nonprofit in 2016. According to their website (2014), the iSchools organization is a:

“consortium of Information Schools dedicated to advancing the information field. These schools, colleges, and departments have been newly created or are evolving from programs formerly focused on specific tracks such as information technology, library science, informatics, information science, and more.”

These schools challenge all computer scientists to think about the ramifications of what they build. Fundamentally, the program is about interpreting data and creating information that

people can interact with and understand. Context and ramifications are placed on the same level as brute technological strength. Because of this, Information Science schools stand at a unique position in the fight to create undergraduate programs that value and support women, from both an intellectual and demographic perspective. According to the 2015 Taulbee Survey, 11.6% of the Computer Engineering graduates in 2015 were women, as opposed to the 21.7% of women Information Science graduates, as visualized in Table 1.1.



### **Defining the role of culture**

There are many facets and expressions of both national and local culture that have real ramifications for how students enact their college and career goals. Cultural expectations and their external and internal effects are often large and complex factors that dampen women's participation in computing fields, particularly coding. In the context of gender, our culture defines the traits that we value in men and women. These expectations are clearly reflected in the

expectations and stereotypes that almost all Americans hold about gender and computing efficacy.

Culture is the lens and guide through which we understand our social world. Culture refers to the norms, histories, practices, and beliefs that bind groups of people, either visibly or invisibly. Carol Frieze describes scholarly views of culture being “dynamic; shaping and being shaped by those who occupy it, in a synergistic diffusive process. When Williams refers to the ‘ordinariness’ of culture he was claiming it for us all, as part of the lived experiences of ordinary as well as extra-ordinary people” (Frieze, 2015). Culture is formed and reformed daily by the people in it: our actions, thoughts, and relationships with others are all informed by and continuously informing what our collective culture sees as valuable and correct. The inherent flexibility and constant evolution of culture is hopeful in the context of women in computing: both individuals and institutions have power to challenge and shift cultural expectations. By actively and carefully enacting institutional and personal change, educators and students can collaboratively change the structured and restrictive views that many hold about efficacy and ability differences in gender when it comes to computer science. In enacting these cultural shifts, an institution will not only improve outcomes for female students, but also make the atmosphere better for all students.

### **Uber: Closed culture is indicative of deeper problems**

A potent example of the impact of a toxic company culture comes recently from the ride-sharing company Uber. In February 2017, Susan J. Fowler, a former Uber employee, published a personal narrative detailing “One very, very strange year at Uber,” in which she described a variety of discouraging interactions and company practices that she experienced as a female engineer for the company, including sexual advances from her direct supervisor. She described how the company’s human resources defended and excused the actions of her manager, citing his

performance as prohibitive to serious disciplinary action, even after she submitted documented evidence of his advances (Fowler, 2017). These instances reflect a company culture that prioritizes profits over people. Uber is an undoubtedly profitable and revolutionary company, however these allegations show a dysfunctional company culture, to say the least. This has also been reflected in a series of public relations fiascos that Uber has undergone throughout 2016 and 2017, including high profile privacy violations, a politically motivated boycott to delete the app, and recent resignations of many top executives, including president Jim Jones (Bowman, 2017). From an outside perspective, it would seem that many of these problems are symptomatic of the poorly organized and often hostile environment that Fowler described. Uber's public relations problems are all rooted in a dysfunctional company culture, which results in their blasé and unprofessional handling of sexual harassment and other Human Resources complaints.

### **Examples of inclusive culture: historically, internationally, and at home**

There are also examples of cultural practices that welcome and support women in computing. This collection of historical, international, and local perspectives flies in the face of currently dominant western conceptions of how each gender should engage in computing, and further demonstrate the significance of external culture in women's participation in academic and professional computing. In the United States, women have contributed to advancements in programming and its applications since the advent of computer in the 1950s. Rear Admiral Grace Hopper invented the compiler, which allows the English-adjacent syntax of computer code to be translated into something that the computer can read. During the space race in the 1960s, NASA employed women and people of color as "human computers." These computers were hired to calculate by hand the equations that were meant to send astronauts into space. However, there were also women who, through their own abilities and willpower, moved up the ranks and worked on significant projects as mathematicians and programmers. Three of these women were

Katherine Johnson, Dorothy Vaughan, and Mary Jackson, and were recently immortalized in the novel *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race* and the accompanying 2016 film. These women, and many more, have made significant contributions in these fields, and are an important part of America's computing history. These contributions not only showcase the technological talents of women from a variety of different backgrounds, but also present an alternative narrative about the relevance of gender in computing fields.

This problem is not universal or international. Studies in countries from Afghanistan (Hoffmann, 2010), to Mauritius (Adams, Bauer, & Baichoo, 2003), to Armenia (Gharibyan & Gunsaulus, 2006) have shown women studying and working in computing fields at similar rates as men. The most substantial examples of this have taken place in India and Malaysia. In India, women are increasingly earning bachelor's degrees in computer science. Computing is seen as "women-friendly" (Varma, 2010a). Researchers have found that computing jobs are considered safe and civilized, because they take place in an office and do not involve outdoor or menial labor (Varma, 2010b). Furthermore, they afford significant earning potential, leading parents to encourage their daughters to consider careers in information technology (Gupta, 2012).

In Malaysia, women's participation is sometimes outpacing men's in computing credentialing and the resulting professions (Lagesen, 2008 ; Mellström, 2009). While one of the factors that contribute to this is likely race-based quotas in the Malaysian education system, computing has also been accepted and touted as an appropriate career path for women. Researchers note that social rules that link women's work to offices and indoor spaces precede any "gender codification of technology" (Mellström, 2009).

In the United States, there are a handful of academic programs that recruit and retain women at comparable rates to men. These institutions are concrete examples of how Computer Science programs can effectively create a local culture that is more shielded from the dominant

computing stereotypes that currently influence American culture. One especially hopeful guide Carnegie Mellon School of Computer Science, which made up of only 8% women in 1995. However, the leadership of the college was committed to changing this, and commissioned a report on the reasons for women's dampened participation from educational researcher Jane Margolis. As result of their findings, the Carnegie Mellon expanded their admissions criteria to deemphasize prior coding experience and created introductory classes to accommodate novice coders, as well as hosting targeted recruitment-oriented outreach programs for high school teachers to learn about computer science and the importance of diversity. These and other initiatives have worked: Carnegie Mellon's undergraduate program was 37% women in 1999 (Frieze, 2015). While this number has fluctuated over the almost 20 years since the program, it has remained high. In fact, women made up 48% of the first year entrants into the program in 2016 (Carnegie Mellon, 2016).

In 2015, Carol Frieze published *Kicking Butt in Computer Science: Women in Computing at Carnegie Mellon University*, a comprehensive look at the evolution of the Carnegie Mellon School of Computer Science as it has welcomed and maintained women in their student body. Through a series of case studies, the university has a longitudinal record of the cultural shifts that have resulted from a commitment to a diverse and representative student body. In the late 1990's, Jane Margolis found that many student's academic pursuits and identities often broke out on gendered lines. She originally recorded that male students were often obsessed with understanding and manipulating the comfortingly static and pliant systems within computers and software, while female students more frequently expressed that they were interested how computing could help people or other interdisciplinary applications (Margolis, 2002). However, after admissions and curricular interventions changed the makeup of the program, faculty and researchers realized that students began to express and explore a much broader range of interests, regardless of gender. This increased balance had a positive social impact on the School of



Computer Science as well. Professor Peter Lee, noted in 2002 that the, “faculty is beginning to understand that having a mix of men and women makes our program better. It’s become a source of pride and enthusiasm” (Frieze, 2015). These interventions have remained in place for almost twenty years at Carnegie Mellon, and provide a roadmap and point of reference for other universities and departments that wish to change their demographics and undergraduate experiences in computing.

## **Methods**

### **Overview**

This paper brings the nationwide conversation about women in computing to the local context of the School of Information at the University of Arizona. For this project, I synthesized a variety of different research methods in order to answer my research questions:

*R1: Why do 5% more women nationwide graduate from Information Science programs than any other computing field?*

*R2: What are the specific factors that lead the women in the School of Information at the University of Arizona to enter and remain in the program?*

My main research methods were document analysis of demographic reports and course content, participant observations gained from personally experiencing the program, and semi-structured qualitative interviews.

### **Document Analysis**

I analyzed program materials from both the School of Information and the Computer Science departments at the University of Arizona, using program plans and the University's course catalog to relay a contextualized comparison of the two academic programs. I also analyzed and interpreted two different reports from the School of Information which shed light on both past and present demographic realities in our major. I simplified and visualized these numbers with the hope of categorizing just how inclusive the major is, and also how far we still need to go towards full gender parity.

## **Participant Observation**

I documented my own critical experiences in the School of Information from January 2015 to April 2017. These are short narratives of assignments or interactions that seemed to shed particular light on the relationship between the iSchool culture and the women within it. The bulk of these experiences have taken place in classes, however I also have included more abstract and interpersonal narratives as well. I have included relevant class materials in the appendix.

## **Semi-Structured Interviews**

The bulk of my data comes from semi-structured that I conducted with four undergraduate women in the School of Information at the University of Arizona. These interviews lasted between 15 and 30 minutes. I recruited my interview participants through individual emails to women in my information Science classes, as well as a recruitment message presented to Dr. Diana Daly's ESOC 211- Collaborating in Online Communities. I asked all of my interviewees questions (see Appendix A) designed to record their relationship with programming and computing before entering college, their decision to enter the school of information, and their feelings towards the program and specific experiences that have contributed to those feelings and their career goals. My interviewees were at a variety of different points in the program: one is a senior who is graduating in May 2017, one a senior who is graduating in December 2017, the third is a third year student, and the fourth is in her first year in the program.

## **Researcher Positionality**

This research question is inspired directly by my own pathway through the University of Arizona, which has been heavily influenced and enhanced by my experiences and studies in the School of Information. My own relationship with information technologies and programming has

evolved from one of cautious non-engagement to being an experienced problem solver and mentor to other burgeoning programmers. While I still have much to learn, I am extremely grateful to the professors and administrators of the School of Information. This program has given me a chance to learn to code at an academic level, and to supplement and expand my existing passion for data-based educational practices and policy. I do believe that this would not have been possible in any other computing major, especially given the deterring factors that kept me from wanting to pursue computer science. I have reflected on my own experiences as part of the iSchool community and further examined and examined various national and university-level statistics, and these combined understandings lead me to investigate and categorize the reasons that women seem more likely to enroll in and pursue Information Sciences.

Like many people, my life experiences have informed my values. I consider myself an advocate for inclusivity in pedagogy because it has had such a positive impact on my own life. I have chosen to share my experiences in order to evaluate them critically and combine their power with the stories that my peers have been so gracious to share. Together, our narratives and experiences combine to illustrate a group of women with diverse interests and backgrounds, but whom all have found meaning and sense of place in the School of Information. These stories demonstrate the potential that iSchools are already realizing to create welcoming communities for women in information technology. I add my own story to lend credence to so many similar experiences.

## Results

### Comparing Computer Science and Information Science core classes

The tables below, compiled from departmental websites and the University of Arizona Course Catalogue, include the course titles and catalogue descriptions of the core classes required for degrees from the School of Information and Computer Science, respectively.

#### School of Information

The School of Information at the University of Arizona is housed in the Social and Behavioral Sciences Department. The school offers three undergraduate degrees: a Bachelor of Arts in Information Science and the Arts, a Bachelor of Arts in Information Science and eSociety, and a Bachelor of Science in Information Science and Technology. All course descriptions can be found on the University of Arizona Course Catalog.

Table 1.1 - Required Courses in the Undergraduate Information Science Program at the University of Arizona

Foundations Class Titles	Foundations Class Descriptions
ISTA 100 – Great Ideas of the Information Age	“Important ideas and applications of information science and technology in the sciences, humanities and arts. Information, entropy, coding; grammar and parsing; syntax and semantics; networks and relational representations; decision theory, game theory; and other great ideas form the intellectual motifs of the Information Age and are explored through applications such as robotic soccer, chess-playing programs, web search, population genetics among others.”

<p>ISTA 116- Statistical Foundations for the Information Age</p>	<p>“Understanding uncertainty and variation in modern data: data summarization and description, rules of counting and basic probability, data visualization, graphical data summaries, working with large data sets, prediction of stochastic outputs from quantitative inputs. Operations with statistical computer packages such as R.”</p>
<p>ISTA 130 – Computational Thinking and Doing</p>	<p>“An introduction to computational techniques and using a modern programming language to solve current problems drawn from science, technology, and the arts. Topics include control structures, elementary data structures, and effective program design and implementation techniques. Weekly laboratory.” Programming in Python</p>
<p>ISTA 131 – Dealing with Data</p>	<p>“At the core of Information Science lies the digital data that is the object of study. This course aims to introduce the tools, techniques, and issues involved with the handling of this data: where it comes from, how to store and retrieve it, how to extract knowledge from the data via analysis, and the social, ethical, and legal issues involved in its use. Throughout the course, students will be given hands-on experience with actual datasets from a variety of sources including social media and citizen science projects, as well as experience with common tools for analysis and visualization. Students will also examine topical case studies involving legal and ethical issues surrounding data.” Programming in Python</p>
<p>ISTA 161 – Ethics in a Digital World</p>	<p>“This course explores the social, legal, and cultural fallout from the exponential explosion in communication, storage, and increasing uses of data and data production. In this class, we emphasize the opposing potentials of information technologies to make knowledge widely available and to distort and restrict our</p>

	<p>perceptions. In a world of rapid technological change, topics include (but are not limited to): eavesdropping and secret communications, privacy; Internet censorship and filtering, cyberwarfare, computer ethics and ethical behavior, copyright protection and peer-to-peer networks, broadcast and telecommunications regulation, including net neutrality, data leakage, and the power and control of search engines.”</p>
<p>ESOC 302 – Quantitative Methods for the Digital Marketplace</p>	<p>“This course will explore broad research paradigms and theoretical approaches that inform contemporary social research, varying study designs, as well as the systematic methods utilized in differing types of data analyses. Though this course will introduce research processes across the academic spectrum, quantitative analysis of both small and large data sets will be emphasized. Therefore, students will learn about basic statistical analyses and will be introduced to the emerging worlds of data science and social media analytics. Students will also consider related topics such as data visualization or research presentations.”</p>

### **Computer Science Department**

The Computer Science Department at the University of Arizona is housed in the College of Science. Their undergraduate program offers two degrees: a Bachelor of Arts in Computer Science, and a Bachelor of Science in Computer Science. All course descriptions can be found on the University of Arizona Course Catalog.

Table 1.2 -- Required Courses in the Undergraduate Computer Science Program at the University of Arizona

Class Titles	Class Descriptions
<b>Pre-Major Courses</b>	<b>Students seeking a degree in Computer Science must pass these classes and achieve a GPA of 3.0 in CSC 120, CSC 245, and CSC 210 in order to be admitted to the major (“Pre-Major”, 2016)</b>
CSC 110* – Intro to Computer Programming I	“An introduction to programming with an emphasis on solving problems drawn from a variety of domains. Topics include basic control and data structures, problem solving strategies, and software development tools and techniques.”
CSC 120*– Intro to Computer Programming II	“Provides a continuing introduction to programming with an emphasis on problem solving. It considers problems drawn from a variety of domains (including Computer Science) and emphasizes both the broader applicability of the relevant data structures and programming concepts, as well as the implementation of those structures and concepts in software. Topics include arrays, lists, stacks, queues, trees, searching and sorting, and exceptions.”
CSC 210 – Software Development	“An introduction to the development of large scale software. Topics include modularization, design patterns, documentation, unit testing, source code control, build systems, debuggers, and performance tuning; all of the tools necessary for developing software as opposed to writing small programs.”
CSC 245(or MATH 243 or MATH 323)* – Intro to Discrete Structures	“An introduction to mathematical concepts for Computer Science. Topics include first-order logic and logical arguments, proof techniques with an emphasis on mathematical induction, sets, relations and functions, properties of integers, counting methods, probability, and recurrences. Weekly laboratory.”
<b>Foundation Courses</b>	<b>Courses required to fulfill the final major requirements once a student has passed the preliminary classes with a GPA of 3.0 or more.</b>



CSC 252 – Computer Organization	“Basic machine organization; elementary hardware concepts; CPU internals. Machine operations and instructions; assembly language concepts and programming.”
CSC 335 – Object-Oriented Programming and Design	“Fundamentals of object-oriented software development. Includes design principles, inheritance, polymorphism, Unified Modeling Language (UML), testing, event-driven programming with graphical user interfaces, applications of design patterns, and use of existing frameworks. Weekly laboratory.”
CSC 345 – Analysis of Discrete Structures	“Introduction to and analysis of algorithms and characteristics of discrete structures. Course topics include algorithm analysis techniques, recurrence relations, structural induction, hierarchical structures, graphs, hashing, and sorting.”
CSC 352 – Systems Programming & Unix	“Programming in C, including single and multi-dimensional arrays, lists, stacks, queues, trees, and bit manipulation. Unix topics, including debuggers, makefiles, shell programming, and other topics that support systems programming.”

### **Review of Existing Demographic Data**

I reviewed contemporary data measuring the gender ratios between men and women enrolled in the School of Information at the University of Arizona within core classes and the major as a whole.

The first report that I reviewed was entitled “University of Arizona CPATH II: Computational Thinking as a Foundation for Interdisciplinary Undergraduate Education.” This comprehensive report, released in 2013, used survey data from students in introductory core courses in Computer Science and Information Science courses at the University of Arizona in

order to assess the relative levels of familiarity with computational thinking concepts (Stiles, 2013). These surveys also measured the gender of their respondents.

In 2011 and 2012, the School of Information at the University of Arizona disseminated surveys in both ISTA 130 and CSC 127A, the introductory programming courses for the School of Information and the Computer Science department, respectively. In 2011, the gender ratio in survey respondents was the same in both classes: 71% of students who responded to the surveys in both classes were male, and 29% were female. In 2012, 83% of the students in CSC 127A were male, and 17% were female. In ISTA 130, however, 69% of students were male, and 31% of students were female.

**Table 2.1 – Gender Breakdown of ISTA 130 and CSC 127A, 2011**

Course	Male	Female	Total
ISTA 130	71%	29%	42
CSC 127A	71%	29%	42

**Table 2.1 – Gender Breakdown of ISTA 130 and CSC 127A, Spring 2012**

Course	Male	Female	Total Respondents
ISTA 130	69%	31%	55
CSC 127A	83%	17%	55

The rates of participation measured in 2012 were about the same in 2016, based on analysis of the Fall 2016 class list of ISTA 130 – Computational Thinking and Doing. 66.4 % of the students in ISTA 130 were male, and 30.6% were female. (The remaining 4% were not included because their names did not indicate their gender clearly.)

The second set of reports that I reviewed was generated by the administrative offices of the School of Information and described the ratio of men to women on a departmental level. This reports relayed data from the freshman class of Information Science majors at the University of Arizona in 2016. They show that 30% of incoming students are women, and 70% are men, as reflected in Table 2.3. #I am also waiting on more data from the school of information.

**Table 2.3 – Gender breakdown of freshman enrolled in Information Science, 2016**

<b>Gender</b>	<b>Enrollment</b>
Female	53 (30.6%)
Male	121 (66.4%)
Total:	174

### **Participant Observation**

My own experiences as an undergraduate at the University of Arizona inspired my investigation into this topic and have provided insight as I have reviewed and gathered stories from my peers in the School of Information. As I am a woman in the School of Information, I have included my own personal narrative, which informally addresses the questions that I asked during my interviews with four additional undergraduate women in the School of Information. Along with relaying my own academic path before and throughout the program, I will relay selected critical experiences that serve to shed light on the complex and multifaceted expressions of the UA iSchool's departmental culture and how it relates specifically to women in the program.

I did not code at all in high school or at all before entering college. The only coding that I even attempted was HTML on my Tumblr page. While I was sometimes able to edit a menu or change a color scheme, I was unsure of how the process worked. I remember an instance in which I attempted to edit the HTML of a “theme” written by another user, which left my page glitchy and fairly unreadable. I also did not see myself as a math or science person, even though I did AP Physics and AP Statistics in high school. My parents, while supportive of my mathematical abilities, did not encourage me to pursue coding. My understanding of coding and computer science was almost completely based on depictions that I read and watched in blockbuster movies. When I was in high school, my brother graduated from Arizona State University with a degree in Computer Science. My parents and I were impressed: it was at that point that I understood the economic benefits of having computing skills. When I left high school, I was intrigued by the internet and impressed by programming, however the process of coding was almost a complete mystery.

Even though the act of programming was fairly obscured to me, I was still very interested in the cultural and social potential of the internet. When I arrived at the University of Arizona as an undecided freshman, I quickly enrolled in eSociety classes focusing on online communication. During my sophomore year, I enrolled in CSC 127A, the introductory Java programming course offered by the Computer Science Department. I enjoyed the challenge of this course, but often felt scared or judged. I was one of few girls, and was hyperaware of that fact. I cannot claim to have learned much from that class. When the next class in the sequence did not fit easily into my schedule, I decided that Computer Science was not the major for me. A Computer Science advisor suggested that I look into majoring in Information Science, and after enrolling in my first ISTA class, I declared the major.

My experiences in the major have been challenging and rewarding. I have been surprised by what I am capable of. I have taken a variety of classes that have begun to train me as an

Information Scientist and a programmer. I have taken classes in Python for data analytics, the programming language R, HTML, and CSS. I have even worked as a Section Leader for the Information Science program, leading labs for ISTA 130 in the fall of 2018, and ISTA 350 in the spring of 2017. The atmosphere of my classes has varied significantly with each of my professors. In most cases, my professors have prioritized results and the real world applicability of the concepts that we are learning. In some of the larger introductory lectures, the atmosphere was more casual and the content felt less rigorous, which was frustrating at times. Most of my coding classes have been taught by Rich Thompson, who values routine and mastery of coding concepts, and demonstrates a commitment to inclusivity through his supplementary course materials, choice of section leaders, and concrete and subjective expectations for all students. I have made friends and feel a sense of community in my major, as I have maintained relationships developed through past group projects. A significant part of my personal community is the Section Leader program. I feel that the women in this program do go out of their way to support each other, and the presence of visible women in the program has normalized their participation.

## **Narratives**

Below are selected excerpts from semi-structured, informal interviews with four female students in the University of Arizona School of Information. These interviews took place during March and April in 2017, and are shared here in the same order that they were conducted. Each student was given a pseudonym in order to maintain anonymity as the results will be shared publicly. The full transcripts of each interview are available in Appendices B through E.

## **Samantha**

Samantha is one semester from graduating from the UA iSchool with her Bachelor of Science in Information Science and Technology. Since spring 2016, she has been a Section Leader in multiple classes within the School of Information, including ISTA 116 and ISTA 120 (which is now called ISTA 131 – Dealing with Data). She is a talented Information Scientist with expertise in Python and R, along with other informatics and illustration software. She has a contagious laugh and is quick with a joke and a smile, and is friends with many of the Section Leaders. We met for lunch at Paradise Café and chatted about her experiences in and perspectives about the UA iSchool. Our conversation covered her previous experiences with computing, her decision to enter the program, details of the community that she has felt in the School of Information, and how the skills she has learned have already helped her with her future plans.

### **Previous Experiences with Computing**

“I was always interested in computers from like a young age. I would always spend a lot of time on the internet and just doing dumb stuff, you know. Like our generation, we just know computers. But I just thought that, you know, maybe the extent of my computer knowledge was gonna be Excel. But even in business classes, I guess that's my first exposure to coding is, I loved Excel... And I guess I probably should have put two and two together, huh, that I loved Excel so much and deal with all that data!”

“I didn't know anything about coding. I really wish I had. Once I had my first coding class, I really fell in love with it and I really knew that this was for me.”

### **Recruitment and Entry into ISTA**

I had a “friend who majored in ISTA and I always really admired this friend. And I didn't even know that that was his major. So, you know, one day I kind of talked to him about, like

"Hey, what is this? What are you doing here?" And he ended up getting a really nice job as USAA and that's somewhere, you know, I'm really interested in working. My dad's a vet and all that stuff. So I kind of saw him as like a role model and like, "Hey, you know what he's doing, it looks fun. And you know what, I have other friends who are going into it too. So maybe I can do this."

"I knew I couldn't do Computer Science because I'm not really a strong math person and I know that computer science was a lot of math. And I didn't wanna put myself- I didn't want to basically set myself up to fail.... And I didn't ever know that there was actually like a technical field out there for me that was less intensive and where I could actually, you know, thrive. Especially as someone that doesn't feel like they're a strong math person."

### **Feelings Towards the Major:**

"So my ISTA experience has been an overall really positive one. I came basically from a boy's club, you know, business. Well, honestly that's not true. It's about 50/50. But I never felt welcomed in business classes."

"But in ISTA, pretty much day one of any of my classes, you know like talking about 116, 130, 100, I was never afraid to go up and talk to someone, and they were never afraid to talk back to me. It was really easy to make friends and that's what was, what drew me in so much."

"I'm just really excited to be in a major that I can be understood in and that I can thrive in and not have to worry about do I belong here, because I know I do. Because not only do I have the grades to prove it, but the people are just fantastic. And if I wasn't forming real connections, then yes I would leave. But that's not the case. And I think that the ISTA department is going go really, really far in the next 5 years."

### **Personal Efficacy**

So I think the biggest thing to remember about coding is to not be afraid of failure. That's how you learn. And plus it's no harm, no foul. Your computer isn't like, "Oh you made an error, you can't ever work on this program again. You get an F forever." No it's really just how you learn. So once you get that error, it's just you have to make a game plan. Go through the lecture slides. Go look online. Go pester your friends, "Hey can we work on this together? I'll help you if you help me!" That kind of thing. Which again goes back to that community type of thing. I always feel like I have someone to work on homework with."

### **Mentorship and the Section Leader Program**

"So I've never really had a professor where I can actually go and talk to about life experiences and stuff. And he has this warm personality that makes me feel heard and respected. It feels like he's talking to you like a friend. Like a mentor! I've always wanted a mentor, so it's really nice to have that kind of relationship."

### **Maintenance of Stereotypes**

"As a woman, I jump to that someone is treating me like that because I'm a woman a lot of the times. And I'll tell this to like, you know, my classmates who are male and they'll be like, "Well, I don't think it was a sexist thing. I think it was just you're memorable, or whatever." And I'm like, "I don't know." He singled out the two only girls in class and specifically called us out. I don't really know that's just because we're memorable. Or if it's, you know, rampant sexism. But either way, it's a little bit jarring. And my hope is to get ISTA to a place where no girl ever has to feel, "Is this sexist or is this just, you know, whatever."

"Last semester I was in a 400 level class. It was a ISTA 416 Human Computer Interaction, which turned out to be my favorite class I've ever taken at the U of A, but it was really intimidating and I wasn't sure of myself. And like "Oh, I've only had like one year of



coding, can I really do this?" But then I saw that my coworkers are in it too and they're both male and they weren't questioning themselves or their programming skills or anything. So I thought, why should I? You know, so it really is just about leaning on your supporters.

### **Career Goals**

[For my summer internship] "my job title's gonna be implementation intern. So what they do is they have this, um, this software called GENTEX and they lend it out to different businesses basically. So your job at FAST is just implement that software in a way that works for them. So basically you're just changing, it's all object-oriented. It's really interesting."

"I'm thinking that my dream position would be as a data scientist. I just think it's so interesting, data mining, you know. Finding patterns and just stacks of numbers. It's really interesting to me."

### **Julia**

Julia is a graduating senior in the School of Information, who is also doing an Honors Thesis. She has taken many of the upper-division programming courses that the iSchool offers, including ISTA 131, ISTA 350, and ISTA 400. She is conscientious and warm, and has always been very focused and effective at completing homework assignments on time. My conversation with Julia covered her experiences with programming before entering college and the major, her experiences in the iSchool and, specifically, how flexible course offerings and a variety of research opportunities have supported her in honing her skills in computer art and infographics, along with informatics visualizations and research.

### **Previous Experience with Coding**

A: Did do any coding in high school or did you come into college with any desire to do coding or information science?

J: Um, not really in high school, no. I didn't take any of the computer science classes or anything like that. I don't actually know if my first high school offered any. I'm sure my second high school did, I just didn't take them. So pretty much the only experience that I had was like when I was really, really little, maybe like 8 or something. Oh God- do you remember the website Neopets?

A: Yeah. [laughs]

J: Yeah [laughs] like trying to do the HTML and CSS for that. And then getting frustrated. It's horrible. That was pretty much it, so.

J: Mmm um, so my mom was actually- she was a computer scientist. E: And so it was funny- it was kind of both a double-edged sword in that it was like, "Oh yeah, I didn't have any of the like women in tech, that sort of stuff, because she had done it." But then at the same time I know that she got really bored at her job. Just cause she's actually super, super creative and she just got really bored. So I was like, "Oh, well you know, well maybe if I do computer science, I'll get bored." Or, I don't know. So I kind of didn't wanna do it- that. And then of course once I started thinking more about it- once I was in ISTA, it was like, "Oh, well maybe some Computer Science classes"

### **Recruitment and Entry into ISTA**

"I actually came in as an undecided major. And was undecided my entire freshman year. Then they're like "You have to declare!" And so I had like taken some business classes and then I declared business and I was like "No, God, I don't wanna do business." [laughs]

“I went to meet your major fair.... I saw the School of Information booth. So I picked up something from them and then I just kind of started looking up all the different classes and the different requirements, and seeing how it would work with the kind of odd assortment of classes I had already taken and what I would be able to take in it. I thought it sounded pretty cool, so now I'm here.”

### **Decided not to enter Computer Science**

“Yeah, well it was kind of- part of it too was that it was more intimidating, you know. When I was looking at the various majors I saw that for computer science, the way that they listed it on their website was like, "You are supposed to have come in as a freshman knowing that this is what you wanna do. You need to take these classes in this order." There were just so many requirements and so many- I don't know, something about it seemed like you should have already come in with experience from high school. And I definitely didn't have that. And so it definitely was one of those things where maybe you falsely think that everyone's already gonna know everything, but I definitely did have that with Computer Science.”

### **Feelings Towards the Major**

“I mean overall I really enjoyed most of them. I'd say most of my actual coding classes, I think have all been with Rich, so those have all been great. You know, Rich is always- it's always a really fun class.”

“I mean I guess I just appreciate how, I guess the a) that the ISTA program exists, cause without it I was kind of without a major. And then the flexibility, like I said, in terms of getting to take the classes that I actually find interesting. You know, I'm kind of an odd student in that I

don't necessarily find a lot of classes interesting. You know, I'm very happy to go to class and do everything, but I don't often find them interesting. And within ISTA, you know, you go, "It's like worthwhile!" I dunno."

### **Diverse Class Offerings**

"Overall I think I've enjoyed my classes and one thing that I really appreciated about ISTA is the flexibility in terms of substituting courses or finding courses that work from other majors, like the Library Information Science ones- I mean they're all kind of linked, but getting to use some of those. Or using ones from the art college. So that's been really nice."

### **Mentorship and Research Opportunities**

"I work as an undergraduate research assistant... the School of Sociology. I actually got to use Python this semester, so that's super exciting."

### **Interaction with Stereotypes**

"I definitely do notice in some of the computer science classes, and actually one of the ISTA classes, that Human and Computer Interaction one, it will be kind of odd when you realize- you're like, "Oh, I'm one of like 3 or 4 girls in the room." Um, but I don't know, it's just more of something you notice. I haven't specifically noticed it affecting me, just more of something where it's kind of like "Oh, well that's funny." And then you move on with your day."

### **Personal Efficacy**

"Definitely it's easier now in terms of that- just with the background knowledge of generally how things work. It's easier to trouble shoot in terms of try fixing things here, or just

rearranging things. And then also I know whenever I really get stuck on a problem, I always try the ‘Ok, put it away. Come back tomorrow.’ And then sometimes things- you just like fix one thing and it'll work. Just having the general background knowledge I would say.”

### **Career Goals**

“I really want to get into user experience design. Or user interface design. I think that would be just really cool. I wanna do that or something with like Information Graphics, just in terms of- so something to do with combining the information/coding side with the art side. And ISTA has definitely helped there I mean just in terms of obviously having any coding skills whatsoever, plus you know like I said getting to take some of the art classes.”

### **Alice**

Alice is a junior in the School of Information. She has been a Section Leader for ISTA 116 for the last three semesters (double check with her), and is also one of the student coordinators for the Section Leader program. She is friendly and smart, with a knack for mathematics and coding. Our conversation covered her previous coding experience and entry into the program, along with comparisons to her experience in the computer science department

### **Previous Experience with Coding**

“I had no experience whatsoever. I took ISTA- ISTA 116 was the first class that I took that had any programming background at all. I had taken statistics in high school, but I really hated it actually, which is kind of ironic given, you know, I now TA for a stats class.”

### **Recruitment and Entry into ISTA**

“I was a pre-nursing major... I took it as just a typical statistics requirement. Didn't really know what I was getting myself into and then found out, ‘Oh, hey we're doing a little bit of like really minor programming.’”

### **Positive feelings towards the Major**

“I'm in a CS class right now and it's one of their sort of fringe classes. It's web programming, which isn't actually a part of the major. And the atmosphere is very different in that class. And you can sort of- it's interesting to see, because it's not one of their core classes, so I don't know. It'd be interesting to see what the core classes look like. ISTA's been very friendly and very good to me. I really enjoy it and I feel like especially section leading and being a part of that- it feels like being a part of a community. It's not a very large major, so there's like- you get to know the people in your classes because you have more than one- more than one class with them.

“But, I think it's a very friendly and nurturing atmosphere. And there are- I've taken- I mean most of the classes I've taken have only been with like Rich and so. Which I really enjoy, because Rich is really a great guy! So my experience for the most part has been really awesome.”

### **Importance of the Section Leader Program**

“It's great! Be a section leader! [laughs] We'd love to have you! Yeah it's just been very positive and I think the section leader program, being in classes with section leaders, and being a section leader has been very, very positive. And I think it makes everyone feel very comfortable to know that you're working with people who are at the same level as you and have been through this exact thing too pretty recently. And I think ISTA with the integration of those classes with section leaders and the friendly environment is very welcoming.”

## **Career Goals**

“I’m getting a double degree currently in Communication and Information Science. So it would be interesting to find a job that was in the market for both of these places as far as maybe- as far as like marketing research or business development or things like that.... I think the possibilities overall are pretty endless. You can do whatever you set your mind to, you just have to find the right way- the right things to do to get there. And once I figure that out- it's a bit- there are possibilities here that I can go for and take.”

## **Kelsey**

Kelsey is a junior who entered both the University of Arizona and the School of Information in the fall of 2016. She had transferred from a school in Virginia where she had been doing the prerequisites for nursing, but when she arrived here, her credits did not transfer. She chose this program after completing her prerequisites at Pima Community College. She is currently enrolled in ISTA 130, along with ISTA 161, and ESOC 211. Kelsey is thoughtful, passionate, and motivated.

## **Previous Coding Experience**

“I always have been incredibly feminine, so I think I've never been steered in that direction. Like my mom always, you know, said that she was bad at math and I had trouble with picking up multiplication when I was 9. So therefore I was bad at math in her eyes. So like, they never really directed me to it. My step dad is actually a computer programmer. It was- I was never exposed to it, they never talked with me about it. And in media you never see women in it either, so it's never really something I thought about until I just got bored one summer and Googled it.”

## **Recruitment and Entry into ISTA**

“Information Science isn't very well advertised by the university. I actually found out about it from word of mouth from a girl in my calculus class at Pima... it was really just word of mouth. She recommended it and said it was like better.” She was really nice and I hadn't met any nice female programmers.

“I don't know, and it seemed like a great alternative and the job prospects were just as good as computer science. Like it might not be as heavily recruited, but that's probably just because they don't know about it.”

## **Negative Experiences with Computer Science**

[Describing previous programming class at the University of Arizona] “... all of the men were like very exclusive and it was very difficult to talk to them, whether they had terrible personalities, or they didn't wanna talk to women. Cause I had a few that just like blatantly lied to me. I don't know if they were trying to impress me, but it was like I can't form a relationship with somebody.”

“The reason why a lot of the guys succeed in Computer Science is not because they're smarter, it's cause they're better connected. They're more likely to be approached, more likely to be included in the group. Otherwise, like, I think that I'd have to either kind of like desexualize myself or just like, I don't know, be somebody's girlfriend. You know, that's not what I want. Like getting the group- to be a part of these study groups, it's really difficult.”

## **Feelings Towards the Major: The Role of Faculty Support**

“It's been wonderful. Like, my- I really love- Rich is amazing. He's my favorite professor, like, ever. Cause he's like extremely progressive and he sets it- rather than like- you



know how you hear a lot of people who are really, really passionate about social justice, but a lot of it is just, it's not communicated in the best way cause they're so passionate about it and they don't back it up with logical statistics and objective analysis. And I feel like Rich really did that, and I think he reached more people that way.”

### **Diverse Class Offerings**

“I think a lot of it is what you make of it. You can take three programming classes- that's an exaggeration. But like a really low amount and graduate. You might be able to get a job, but you are less likely to in software development, which is what I really, really want. And I want to get good at it, to increase job prospects.”

“It's what you make of it, it's like there's options. And a lot of people don't like programming as much and they might want to do something else with their degree. So it's a very flexible degree. That's what I like about it actually.”

### **Personal Efficacy**

“K: Yeah, I mostly solved it and then I went in for tutoring for two minutes just to sulk (?) so that was interesting.

A: You say you're not super proud of seeking for help, but you still will do it if you need it?

K: Yeah, definitely. That's how I've managed to- cause I'm not like the smartest person, but like a lot of the reason why I get good grades is cause I'm going to tutoring. I think a lot of people are much, much smarter than me, but they just don't care. And a lot of the stuff like professors don't communicate clearly, so you really have to go in for their office hours.”

### **Career Goals**

“Basically I wanna research. Like data science is pretty amazing. I mean like I'm really excited to learn R. I wanted to wait until I got- cause I just did Python last semester, so I wanted to knock out Python. And not overload my schedule too much. But yeah, just data science and software development, like it's all just really, really exciting.”

### **Critical Experiences with Gender**

In order to provide more context, I have included additional experiences and moments that relate specifically to treatment and discussion of women in computing and technology by the faculty of the UA iSchool.

In my third semester in the program, I took ISTA 100. During one of our first class periods, our professor presented a slide show called “The Founding Fathers of Computing.” By way of explanation, the professor made the comment that there weren't any women who had made a significant impact in the field. Later, he told the class that students had emailed him to deny that women have had no significant impact on the field. In order to remedy the error, he retitled the slide show “9 dudes and 2 Women.” Personally, I was glad that the professor had been open and willing to address criticism in this regard, but still felt somewhat dismissed and concerned that this was one of the first classes that many incoming Information Science majors take.

During this same semester, I took ISTA 350, which covers advanced Python for data analytics. For one of the first assignments, our professor (Rich Thompson) assigned and quizzed us on a graphic novel about Ada Lovelace (1815- 1842), who is considered by many to be the first programmer based on her writings on the potential calculating capabilities of the Analytic Engine, a calculating machine planned by inventor Charles Babbage. I had never heard of Lovelace before reading this comic. I was excited and proud to learn that one of the first icons of

computing was a woman, as well as comforted that my professor found her worthwhile enough to share with the class.

According to Kelsey, Dr. Thompson has since switched his curriculum to include the Lovelace reading in ISTA 130, the introductory programming class. He has also begun to include a recent study that found that women's code on Github was more likely to be approved than men's code if all authors' names were genderless, but more likely to be rejected than men's code if the names were gendered. This component of the class introduces novice programmers both to women's historical and foundational contributions to programming and information technology, as well as presenting concrete evidence of the gender biases that are still occurring today.

## **Discussion**

### **Themes**

Across all of my interviews, themes and common experiences emerged clearly. Some of these themes are reminiscent of or similar to existing successful interventions at Carnegie Mellon, which I have noted in my analysis.

### **No formal coding in high school**

None of the women that I interviewed had any academic or formal experience with coding before they entered college. Three of them had never coded until they took ISTA 130, the introductory course in the iSchool, and the fourth had begun learning Java online shortly before ISTA 130 started. As for myself, the only coding experience I had was from CSC 127A.

### **Broadened admissions requirements**

In their research at Carnegie Mellon, Jane Margolis and Alan Fisher (2003) found that high school coding experience was not a determining factor for a student's success in undergraduate Computer Science. As a result, the School of Computer Science decided to shift the existing admissions requirements from being focused on prior coding skills and SAT scores, towards SAT Scores, leadership ability, and community involvement (Frieze, 2015). The UA iSchool does not have any admissions requirements. All of the women that I spoke to are very effective programmers who derive a lot of joy and satisfaction from coding, and who plan to pursue software engineering or information science jobs after graduation. However, most of them only learned to code after entering the School of Information. In many cases, this meant they felt unwilling and sometimes unprepared to enter the Computer Science department, which does have admissions requirements.

When Carnegie Melon shifted their admission requirements, they also developed introductory classes that would accommodate their new, less experienced students as they entered the discipline. At the UA iSchool, ISTA 130 is taught in Python (widely considered to be a language that has very intuitive and clear syntax), and therefore serves as a place for novice programmers to start. It is also worthwhile to mention that the Computer Science Department has changed the language of their introductory programming language from Java to Python, as of Fall 2016.

### **The winding path to the iSchool**

None of the women that I interviewed entered college with the intention of declaring a major in Information Science, or majors in the computing field. All of them had declared other majors or started down other paths before they entered the program. Two of them were referred by friends, the third was taking ISTA 116 when she found out about the program, and the fourth found the iSchool through a pamphlet from the Meet Your Major Fair. I was referred to the program by a Computer Science advisor. Two of them had studied nursing, and the other two had studied business, however they all expressed feelings of uncertainty with their original programs, which led to them seeking other options.

### **Section Leader program builds confidence and supports women**

This program hires students for either credit hours or an hourly wage to lead a weekly two-hour lab, help students at weekly office hours, and grade and assist in other administrative tasks. Dr. Thompson is the faculty coordinator of this program, and makes it a priority to hire female students at the same rates as male students. All of the women that I interviewed had interacted in some way with the Section Leader program. Samantha is a Section Leader and soon to be Section Leader coordinator, Alice is the 2016-17 Section Leader coordinator, Julia was

asked to be a Section Leader but declined, and Kelsey was going through the interview process to become one at the time of my interview with her. I also work as a Section Leader. This program, while definitely not the only path that women in the UA iSchool take, instills confidence and builds a supportive community for many women as they make their way through the major. It also further credentials women in the major as expert coders as well as team members, thus helping with job prospects. The equal gender makeup of the program could have further potential impacts on incoming students who see that a large portion of the respected members of their learning and programming community are women, further normalizing and legitimizing the everyday inclusion of women in their learning and working communities.

### **Flexible course offerings with routes to good tech jobs**

Many of the women that I interviewed mentioned the benefits of having a flexible course schedule within their major, and that the iSchool allows students to make what they want of their experience. All of the women that I interviewed, however, had specifically chosen to take programming classes with the hopes of becoming information scientists, software engineers, or user interface designers. These women in the iSchool are seeking to use the courses offered to develop the skills it takes to succeed in technical careers very similar to the ones that graduates of traditional Computer Science programs pursue.

### **Positive interactions with iSchool culture and community**

Each of my subjects expressed that they felt comfortable and happy in the major, describing the atmosphere as “friendly”, “nurturing”, “wonderful,” and “very positive.” In some of my own critical experiences, I have cited feelings of inadequacy at some points, and I do not doubt that I am alone in sometimes feeling discouraged. However, all of the women that I spoke

to mentioned almost exclusively positive and encouraging experiences. Three of them spoke about having both male and female friends in the major to work with on the homework, along with going to office hours comfortably for assistance or emailing Dr. Thompson when they needed help. Beyond course materials, at least three of my interviewees mentioned how they had built relationships in the major and one said that it was “easy to make friends, and that’s what drew me in so much.”

### **Faculty commitment to inclusivity and mentorship opportunities**

Each of my interview participants mentioned Rich Thompson, who is the professor for ISTA 130, ISTA 120, and ISTA 350. Each of these classes train students in Python for Informatics applications, and so all students seeking to gain applicable and concrete coding skills interact with Dr. Thompson. Two of my interviewees mentioned specific actions that Dr. Thompson has taken which have helped them to feel respected and welcomed in the major, while the other two spoke of him as a great guy, whose classes were really enjoyable. My interviewees also mentioned faculty members, Karen Zimmerman, Diana Daly, Kay Mathiesen, and Brian Atkinson, as role models who have supported them through research opportunities, acted as mentors, and facilitated supportive and engaging classroom environments.

### **Women in Information Science are still aware of dominant cultural stereotypes about women in computing**

There is still evidence of cultural biases playing out in the School of Information. One of the women that I interviewed, Kelsey, expressly stated that she did not want to pursue Computer Science despite her love of programming because she had felt disconnected and disrespected in the Computer Science classes that she had taken before. Another interviewee, Julia, noted that her mother was a Computer Scientist, but that she found it boring. This, along with the rigorous

course schedule required by the Computer Science department, played a part in her decision not to pursue Computer Science. Information Science students are not failed Computer Science students, however, intertwining notions of the environment of the Computer Science department and the skills that it takes to succeed there definitely factor into many women's decision to pursue programming in a more welcoming and flexible environment.

Furthermore, once women are in the iSchool, they are still exposed to students and interactions that are based on stereotypes and other cultural conventions about the role of women in computing. Oftentimes, male Section Leaders are considered more capable and sought after for help, regardless of their experience level. In other instances, female Section Leaders have been sent letters and approached romantically or sexually by students or colleagues. However, when these things have happened, professors have intervened and expressed a zero tolerance policy for harassment of any kind.

For many female undergraduate students, the iSchool serves as a safe haven or a viable alternative from less welcoming computing environments. However, the fact that a safe haven is even necessary demonstrates the fact that unconscious bias and cultural norms do impact the experiences of women in computing fields. Furthermore, experiences described by my interviewees, along with the reality that women are still not participating at equal levels in Information Science programs, show that iSchools are not immune to the ramifications of cultural bias. iSchools still have a lot of work to do to make their communities truly welcoming and equitable for women.

## **Significance**

### **Questions of social and economic access**

Almost all Americans rely on the internet and a host of related technologies to mediate their transportation, banking, news, and social relationships. In fact, tech behemoths are



becoming the monopolies that they once sought to disrupt. According to the US Census (2014), “83.8 percent of the nation’s households have a computer (either desktop, laptop, tablet or smartphone),” and “74.4 percent have some form of Internet access at home.” The ramifications of the tech gender gap are increasingly pronounced and wide-reaching in both the company culture of tech companies and the ideologies that are foundational to the products that they bring to the market.

In 2015, 79% of Apple’s, 84% of Facebook’s, and 82% of Google’s technical employees were men (Heer, 2016). These findings indicate that technological innovation does not automatically engender social or cultural innovation. Rather, tech startups in recent years have often reproduced power dynamics characteristic of more entrenched gatekeeping institutions, including government, business, and media. These demographics have real ramifications for young women who are considering entering computing fields, and in some cases in the lives of the millions of consumers that depend on the internet for news, entertainment, relationship building, and more.

### **The responsibility and promise of undergraduate institutions**

Undergraduate computer science is one of the main points of contact for budding computer scientists, and has the potential to provide an educational blueprint for supportive and inspired environments in the workplace and beyond. By intentionally encouraging and supporting students from marginalized groups, universities both live up to the spirit of their mission and concretely improve departmental experiences, as well as retention and enrollment rates. Furthermore, curricular and atmospheric initiatives and innovations serve to demonstrate the benefits of representative and respectful team environments, as well as the results and products they engender, to all students.

College provides young people with many opportunities to expand their social, cultural, and intellectual horizons. Often, college students find that they leave college with a more expanded worldview than when they entered as eighteen year olds. Undergraduate programs can not only take advantage of these existing realities, but can work to design curriculum that challenges their students to interact with perspectives and realities different from their own and teaches them increasingly vital interpersonal skills and an understanding of the historical and social contexts of their everyday lives. There is real opportunity here, as many institutions have proven through concerted efforts to improve their curriculum.

Intentional curricular and cultural adjustments at many American universities have shown that thoughtful and concerted efforts improve not only overall enrollment statistics but the culture of the learning and working environment for everyone involved (Frieze, 2015). These research-based strategies can serve as a blueprint for other universities who are hoping to expand their computing programs and change the way that computing and technology are stereotypically viewed in a college context.

### **Conclusion and Next Steps**

While much of the data and research regarding the experiences of women in undergraduate computing paints a bleak picture, there are also many women who are excelling in and enjoying computing. As Carol Frieze and her colleagues noticed at Carnegie Mellon (2015), academic computing departments with inclusive practices and reasonable gender parity engender more positive social environments, and empower students to explore a variety of computing interests and projects, regardless of gender. The stories that my colleagues in the UA iSchool have shared describe a community in which many female students feel expressly welcomed and supported, and where they are excelling both at computing and leadership in their department community. The UA iSchool is already providing female students with multiple viable paths

towards careers in computing, web development, software engineering, information science, graphics and visualization, and more. Our college must acknowledge and maintain the programs and structures that are already helping women succeed in our program. We must also seek to expand our outreach efforts, and to directly support more women as they enter the program by training Section Leaders and staff about the symptoms and impacts of unconscious bias. Furthermore, we must formalize our existing support structures in order to give even more female access to mentorship, research, and career opportunities. iSchools nationwide must continue to take the mantle of examining and improving the participation of women in tech fields.

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## Appendix A- Interview Questions

1. Did you learn anything about coding or information technology while in high school?  
What were you planning when you came into school?
2. What year at the UA were you when you declared ISTA? Do you remember when you learned about? Who told you? What enticed you about it? Why did you choose ISTA instead of CS?
3. How do you feel about your experiences in ISTA overall? How would you describe the atmosphere of your classes? Are there any standout moments or amazing classes? Any classes that you hated?
4. What do you do when you are in a coding class and you encounter something difficult that will not work? What next steps do you take? How do you feel? Do you feel teachers support you?
5. Have you planned your career goals? What's your dream job? In what ways would you say that this major has prepared you for your future?
6. Demographically, there are more men than women in ISTA and computer science fields overall. Are there any specific moments during your college experience where you have really thought about or felt strongly about a situation because of your gender (positive or negative)? How do you feel ISTA professors address this?
7. Anything else...?

## Appendix B – Samantha Interview

A: Amelia

D: Samantha

(?): Unknown word

Transcribed by Lili Steffen

04/23/17

### Samantha Interview

A: Ok so this is Samantha.

D: Hi, I'm Samantha!

A: Samantha, I'm sorry.

D: Oh it's ok, really. It's Sam for short, so.

A: This is Sam and we're doing this interview. So did you know anything about coding or math or anything in high school?

D: No, I didn't know anything about coding. I really wish I had. Once I had my first coding class, I really fell in love with it and I really knew that this was for me. But my high school was like a state of the art- like it was built 5 years before. I was there for 4 years and those were it's first 5 years.

A: Oh wow, so-

D: There were lot of computers, there was a lot of iPads, there was a lot of technology, but there wasn't anything about coding!

A: There was no actual classes? So like when you came to college, I know you said you were thinking about business. Was that your original intention in college?

D: Yeah, I did business because my dad did business and I really didn't know what else I wanted to do. I knew I couldn't do computer science because I'm not really a strong math person and I know that computer science was a lot of math. And I didn't wanna put myself- I didn't want to basically set myself up to fail. So that, you know, that feeling was cemented when I started making friends with people in computer science and being like, "Wow, they really have a lot to do. Just like a lot." And I didn't ever know that there was actually like a technical field out there for me that was less intensive and where I could actually, you know, thrive. Especially as someone that doesn't feel like they're a strong math person.

01:34

A: Yeah, so that was the big reason was because of the math stuff. Like in high school, did you do math at all?

D: No, I didn't- did I do math?

A: Yeah.

D: No, I was really bad at my pre-calculus class just because like- well I believe that everyone requires a different kind of learning, right. In high school math they really teach it to you one way, right. It's lecture, homework, then test. That doesn't work for me. It just doesn't.

A: Yeah.

D: So as a result, I always thought that I was, you know, like dumb or whatever. But you're not dumb just because one teaching style doesn't work for you.

A: Yeah, just cause you can't follow that same path. So you took 116 and you've taken some other math classes in high school- or in college. Like those have-

D: Mhm.

A: Been able to round it out more? Cause like college had it changing or like a different way of teaching math? Or just because you had to take them?

D: Definitely. I think cause um in high school your tutoring options are so limited that I was able to go to Pima and get to the help I needed. Like I was able to sit in tutoring all the time and actually sit with other students who were like, "Hey I know this is hard, but this is how I would approach it." And you know, so that made me feel a lot more confident in my skills. And especially going into this major, and you know, acing every class. [laughs] That really does a lot of creating confidence too.

02:43

A: Yeah, really. [laughs] So my next question is about what enticed you into Information Science versus computer science, so you pretty much already answered that.

D: I could talk about how I heard of-

A: Yeah, I'd love to hear about how you heard of it, what that process was like for you, the decision process.

D: Oh yeah, sure.

A: Like who you talked to

D: Like I said, I have friends in computer science and I thought that what they were doing was really, really cool and I would ask like, "Hey is there a class I could take? Hey is there something I could do here or here?" You know, even pick up a minor. But as I said, it's just so intensive. So what I did actually come across is a friend who majored in ISTA and I always really admired this friend. And I didn't even know that that was his major. So, you know, one day I kind of talked to him about, like "Hey, what is this? What are you doing here?" And he ended up getting a really nice job as USAA (?) and that's somewhere, you know, I'm really interested in working. My dad's a vet and all that stuff. So I kind of saw him as like a role model and like, "Hey, you know what he's doing, it looks fun. And you know what, I have other friends who are going into it too. So maybe I can do this."

03:45

A: So seeing that role model was really why?

D: Mhm.

A: Talking with him. Did you look at his code and stuff before you started the classes? Or was your ISTA 130 your first coding class?

D: Yeah, no, ISTA 130 was- like the first day of that class was the first day I'd ever seen any kind of coding at all. Like I hadn't even opened a book about it, because I was just like, I didn't know I could- I didn't think I could teach myself. And then I walk in to class and it all just suddenly clicks, you know?

A: Yeah, so you had the interest in it, but you didn't feel like you wanted-

D: I didn't know how to get into to.

A: What was your interest like? Why were you interested in coding? Because it was such a good job, or computers in general were interesting?

D: No, I was always interested in computers from like a young age. I would always spend a lot of time on the internet and just doing dumb stuff, you know. Like our generation, we just know computers. But I just thought that, you know, maybe the extent of my computer knowledge was gonna be Excel. But even in business classes, I guess that's my first exposure to coding is, I loved Excel. You know, there's formulas. It's very set out, it's blan- it's very cool, you get to work with data. And I guess I probably should have put two and two together, huh, that I loved Excel so much and deal with all that data!

A: Oh wow, so you were in your MIS classes and you really enjoyed thatD:

D: Mhm. I always had said that, like, when I was applying to business school to be in MIS, that all I really cared about was the IS part of MIS. And I really didn't wanna deal with management.

A: Oh, so you're perfect.

D: Yeah, so I just dropped the M. Got a TA on the end and now I'm ISTA, so. [laughs]

A: Just popped it on.

D: Yep!

A: I totally feel the same way, that I was so interested in computers, but I just didn't know where to start. I felt like there was no way I could ever know this.

D: It's really intimidating.

A: Really? Yeah, like esoteric. Or not esoteric, but yeah intimidating is the right word.

D: Yeah.

A: So now you're in ISTA, you're living the life.

D: Love it!

A: Loving it. I know that you like ISTA, but I just wanted to ask you how do you feel about your experiences overall in ISTA? Atmosphere wise, how would you describe the atmosphere of your classes overall? And then we can talk about specifics, maybe classes that you liked or didn't like.

05:59

D: Sure! Yeah, totally. So my ISTA experience has been an overall really positive one. I came basically from a boy's club, you know, business. Well, honestly that's not true. It's about 50/50. But I never felt welcomed in business classes. Like you would kind of like look around and you would try and talk to someone who sat next to you and they wouldn't be interested, they'd be watching Netflix or doing their own stuff. But in ISTA, pretty much day one of any of my classes, you know like talking about 116, 130, 100, I was never afraid to go up and talk to someone, and they were never afraid to talk back to me. It was really easy to make friends and that's what was, what drew me in so much. In addition to the material being really interesting, and my professors always being there for me. It was- it's awesome to have a little community of- and we all of the same interests. We all had that love for computers at a young age. We all spent

a lot of time on the internet looking at memes and stuff. And you know, we're all open about our nerdy-ness and I really love that"

06:53

A: Yeah, the nerdy-ness and the friendliness mixed together-

D: Mhm.

A: Also that really makes the atmosphere. Are there any specific instances where you can talk about a class where the atmosphere was particularly community-like or good?

D: Let me think about that one for a second. ... Well, as you know, 116 is a very challenging class. And that- that class definitely feels like a we're all in it together type thing, because statistics is a really hard topic. They don't even teach it in computer science. Like I would show some of my friends what I was doing and they'd be like, "What is that? I haven't ever had to do," like, "standard deviation or anything before. It's all just a bunch of math!" And it's hard! But you know, you find friends, you get through it, and in the end I still have my friends that I talk to today from that class. And it just feels like we've been through so much together. [laughs] We got through it, we're here now, we're living. And then I section led the class the next semester and it was a great experience. It was awesome.

07:53

A: I'd love to ask a little bit more about section leading as a community builder. Do you feel like that has helped you to make- I feel like it has helped us build a little community. But ok, both in terms of making friends but also in terms of mastery of the concepts, do you think that-like that really has helped me to master things.

D: Oh for sure, yeah no, I realized that, that I'd only scratch the surface of statistics when I was actually taking 116. It's really when you actually start to teach it, is when you really like learn the subject. And that's what I kind of learned like helping out my friends with homework in 116 when I was just a student. Because I was explaining it to people and I was realizing like, "Oh you know what, this is actually really helpful for me too." It's actually when I say it, it becomes real instead of just doing homework, turning it in. And that's it.

08:40

A: Yeah, like how that's the same amount of feedback.

D: But talking about section leading as a community, too, that's a really interesting point. Cause I've always wanted to make a group of friends that prides themselves not only on the quality of their work, but being good people as well, you know. And that's what I found in being a section leader.

A: Yeah, it sounds like I hear 2 really interesting themes of both being really good at something and then also having the support around it.

D: Yeah, definitely.

A: It's almost like a microcosm of ISTA overall for me.

D: Definitely. I mean I happen to think we're ISTA's best and brightest. But you know, whatever. [laughs]

A: That's a topic for another time. [laughs]

D: And it's really nice to be friends with your professor as well, so. [laughs]

A: Yeah, it makes it a lot easier.

D: Yeah.

A: Then going back to atmosphere, do you feel like professors have- I guess there are certain professors that have a hand in making that a really good experience.

D: Uhuh. Yeah, no it's just like any other major, there are good and bad professors. And that's not because of the ISTA department as a whole, but it's maybe just because the bad professors are gonna be bad professors no matter what. But luckily we're able to find some really, really good gems. And I had asked Rich Thompson like, "I've been to 130, can I be a section leader? Are you gonna have any spots?" And he was like, "I don't know. I'll have to go check." And then a week later he comes running up the stairs and he was like, "We are gonna need people!" all excited. Oh it was so cute, I loved it.

10:10

A: So that experience was really cool, cause you felt like wow he really-

D: He really like values me as a student and sees my worth and isn't gonna write me off because I'm a girl or a person of color, any of that stuff. He's just seeing a really good student who wants to help other people learn.

A: Yeah are there any other ways you could talk about Rich supporting you in that way?

D: Oh sure, yeah. So I've never really had a professor where I can actually go and talk to about life experiences and stuff. And he has this warm personality that makes me feel heard and respected. And when you tell some other people stories about your day or your past, they'll just write it off or be like, "Oh, well I'm sorry. That sucks." Rich will bring it back to himself and he'll tell you, "Look, like, this stuff happened and you're gonna get through it because everyone gets through it." And it doesn't make you feel like he's just trying to get you out of his office to



go back to work. It feels like he's talking to you like a friend. Like a mentor! I've always wanted a mentor, so it's really nice to have that kind of relationship.

11:15

A: Do you feel like him telling you in 130, "We have spots for you," do you think that was one of the reasons that you did so well in 130? I know that you were already on a good track to do well and already have the capability for it, but do you think that that like-

D: Oh yeah.

A: Supported you in developing confidence?

D: Absolutely. Like I mean it's always that voice in the back of your head that's like, "Oh I wanna impress the person who wants to give me a job. I can't get anything less than a 90 on this test or else he's not gonna hire me!" Not at all. But there's that little fire in the back of your head saying, "Gotta do good."

A: Yeah, that keeps you motivated.

D: Mhm.

A: Totally. So if you are in that coding situation in any of these coding classes that you've taken and you do run into a problem in the code, what steps do you take to solve it? And how does that make you feel if you run into a problem? And also maybe, can you tell me as an evolution. Maybe in the beginning how did you feel about it, has your feelings changed about making mistakes when you're coding?

12:23

D: I'm a kinetic kind of learning, or kinesthetic, which means that you have to actually do it to actually learn. I'm a combination of that and visual. So what'll happen is I'll go to lecture and I'll listen to him, to Rich lecture, and I'll understand the concepts, but it really doesn't come together until- for me, until I see that error over and over and over. And then by like the 5th time you're really starting to remember it. So I think the biggest thing to remember about coding is to not be afraid of failure. That's how you learn. And plus it's no harm, no foul. Your computer isn't like, "Oh you made an error, you can't ever work on this program again. You get an F forever." No it's really just how you learn. So once you get that error, it's just you have to make a game plan. Go through the lecture slides. Go look online. Go pester your friends, "Hey can we work on this together? I'll help you if you help me!" That kind of thing. Which again goes back to that community type of thing. I always feel like I have someone to work on homework with.

13:19

A: Yeah, definitely. In the beginning of your experience, did you feel- have you always felt like "Oh, it'll just be easy." Did you always feel like it was easy or has it changed at all?

D: Easy, no. But I always knew that I could get through it, because there's so many resources. Like my favorite thing to do when I was a beginner was to go those Thursday night office hours, where, you know, there'd be a little coding party and everyone's kind of in the same boat. "We all need to get to that 100, guys! We also want the SLs to go home and enjoy their Thursday night!" You know? So yeah I've always just felt like you're setting yourself up for success, basically.

A: Yeah, having those resources-

D: Mhm.

A: And also the confidence in yourself. That's awesome. I was going to say, do you feel teachers support you, but I think that you do.

D: [laughs] And even if you feel like a certain teacher doesn't support you, there's always the support of your students, so. You can- like even if it's a particularly rough or hard class, there's always people you can talk to around like, "Hey, did you do this assignment?" "No I didn't, let's work on it together," you know?

14:21

A: Yeah, having that community is really helpful.

D: Yeah.

A: So I know that you have your internship and your job, with Fast (?) Enterprises.

D: Yes. Yeah, thank you for the plug. The best place to work on Last Door (?). [laughs]

A: What is your dream job? What do you see yourself doing as a career? And what ways do you think ISTA has helped prepare you for that?

D: Yeah, I was just talking to someone about it this actually. So in this age of, you know, fake news and alternative facts and all of this stuff, like how are we to be sure that anything is real? You know, and this is what the major has taught me the most, is that, it's all about the data. It-we realize everything in the world relies on data, right. Social networks use it to basically track our movements and learn who we are. But in the future, and I hate to say it, we might be approaching a Black Mirror-like society- [laughs] no, no way toned down. But in the scenario I'm thinking that my dream position would be as a data scientist. I just think it's so interesting, data mining, you know. Finding patterns and just stacks of numbers. It's really interesting to me.

15:39

A: Like leveraging that overall, yeah.

D: Mhm. So I'm hoping to use my experience in ISTA to one day get to that point. But for right now, in my little internship with Fast (?) I'm very excited about. [laughs]

A: Do you know what you're going to be doing there?

D: Yeah so my job title's gonna be implementation intern. So what they do is they have this, um, this software called GENTEX (?) and they lend it out to different businesses basically. Like hospitals, or that kind of thing. And for each one of those businesses they have different needs for actual software. So your job at FAST is just implement that software in a way that works for them. So basically you're just changing, it's all object-oriented. It's really interesting.

A: Yeah. Well congrats on that! I mean I've told you that already.

D: [laughs]

16:39

A: So demographically speaking, there are more men than women in ISTA and in computer science on the whole. Do you feel- are there any specific moments in your college experience either before or during ISTA where you felt your gender very strongly? Any times or-

D: As a woman, I jump to that someone is treating me like that because I'm a woman a lot of the times. And I'll tell this to like, you know, my classmates who are male and they'll be like, "Well, I don't think it was a sexist thing. I think it was just you're memorable, or whatever." And I'm like, "I don't know." He singled out the two only girls in class and specifically called us out. I don't really know that's just because we're memorable. Or if it's, you know, rampant sexism. But either way, it's a little bit jarring. And my hope is to get ISTA to a place where no girl ever has to feel, "Is this sexist or is this just, you know, whatever."

17:35

A: Yeah, there's an instance in class- can you talk about that a little more?

D: Sure, yeah totally. So I just have a certain professor that kind of makes me feel like disrespected in class. He likes to talk about it as building a rapport or just making jokes or you know that kind of stuff. But to me, and my other female classmate, he makes us feel very uncomfortable. He calls us out for being absent and he doesn't call out our male friends. And you know this is the time when I mentioned to them like, "Hey, don't you think it's because we're women?" And he's like, "No, I don't think so. I think that's just him." So and then there was another instance of him actually talking to another lady friend of mine and using the word proposition, which is just not-

A: Like I'm gonna proposition you?

D: Yeah, he said to her, "I have a proposition for you." And as a male in like a male dominated field, I would feel that you should be definitely hyper-vigilant of the vocabulary you're using, because it made her very uncomfortable. And even the thing that he was asking for, she didn't wanna do it at all. She wasn't interested and he make it sound like it was, you know, just like disrespectful to her. And like he was talking down to her. And that's the thing that I hear the most from my girl friends is, "Oh, I went to my computer science professor's office hours and I felt talked down to because I'm a woman." And then when you tell men this later, they don't really understand. So that's the only thing that I would say. There hasn't been any like blatantly calling you out or sexual harassment or anything. And if there is, then I would know to immediately tell my professor, the one that I love. [laughs] But sometimes you just have to roll with the punches, and I really hope that one day this isn't a problem anymore.

19:19

A: Yeah, like how do you deal with it? You just roll- even if it wasn't someone calling out, I know I've had times when I felt maybe I shouldn't take this upper level class or I shouldn't continue on. Have you ever felt that way in a coding class, even though there is that supportive environment?

D: Oh for sure. Um, last semester I was in a- it's funny you should mention that. Last semester I was in a 400 level class. It was a ISTA 416 Human Computer Interaction, which turned out to be my favorite class I've ever taken at the U of A, but it was really intimidating and I wasn't sure of myself. And like "Oh, I've only had like one year of coding, can I really do this?" But then I saw that my coworkers are in it too and they're both male and they weren't questioning themselves or their programming skills or anything. So I thought, why should I? You know, so it really is just about leaning on your supporters. Leaning on your coworkers, your friends. For every male you have that writes off your sexism comments, you have another male friend who's there and saying, "Hey that was weird. You don't have to deal with that." You know?

20:21

A: Yeah for sure.

D: Yeah so I think it is just developing that confidence.

A: And that community.

D: Mhm.

A: I feel like a lot of the things you talked about is cause you have this support system-

D: I always thought that if I didn't have the community that I had, I probably wouldn't have stayed in ISTA.

A: Really?

D: But that's what I- that's what I love about the major. That's what's kept me coming back and that's what I think separates us from other majors.

A: Do you think that- so you wouldn't have stayed in ISTA because of- what would have made you leave?

D: If I let, it would probably be because I'm not very good at the classes. [laughs]

A: But you are good at the classes.

D: Seeing as I am good at the classes, I would say...probably just if I felt uncomfortable or if I didn't feel like it was something that I'd wanted to do for the rest of my life.

A: But you have like the community.

21:13

D: Yeah. But I like it. I like my friends. I really like the subjects and- so I'm not going anywhere! [laughs]

A: I would love to talk to you about- this is kind of an odd question, but I've been thinking about information. So there's data science and coding and then there's like more qualitative classes that we also have to take. Has your experience with that been- I kind of noticed that maybe there's more women in the eSociety classes versus the coding classes. Have you had that experience? Have you ever heard anyone talk about the differences between those parts of the major?

D: Very much so. This is a very hotly contested topic in ISTA because you'll walk into an eSociety class and you'll be able to tell who the ISTA majors are and who the eSociety majors are. That's not a dig, that's just we have very different ideas of what we wanna do in the future. eSociety students usually wanna do something in social media. That means they're going to be out there, they're going to be marketing, they're going to be out there in publications and stuff. But for us, ISTA nerds, we're here. We're coding. We're taking statistics courses and that's what we're interested in.

22:29

A: Yeah.

D: It's not a dig, it's just a difference in interest. The problem is when you get to those eSociety classes and there's such a clear divide where the eSociety people aren't interested in the subject

matter and then the ISTA people have already taken a class dealing with it makes for a really uncomfortable class atmosphere and it's really hard for any teacher to control that or to-

A: To bridge that gap.

D: Yeah exactly. To appeal to all majors.

A: Yeah I wonder how in the case of maybe a qualitative social science class or something, I wonder how that could be bridged or if it even needs to be. Maybe they just need to be different classes, I don't know.

23:10

D: I think that maybe they just need to- the teachers need to take into consideration what both majors take. Like if ISTA students have already taken advanced stats and eSociety people haven't taken any statistics courses at all, maybe there's no need for a combined course. But at the same time, it's really hard because ISTA- we're allowed to take those eSociety courses, so there's no reason that we should feel like we're not welcome or that eSociety aren't welcome in ISTA classes!

A: Yeah like the subject matter, a conception of the subject matter makes sense, cause they are different majors. You have different interests overall.

D: But at the same time, I'm in an eSociety courses that's one of my favorites right now. It's called digital identity and discourse. And it's fantastic. And I think it bridges the gap between the two majors pretty well! We always have class discussions and everyone participates. Everyone gets really into it. But there's other classes where you see this, you know, you said the divide. And it really bums you out.

24:12

A: Yeah, like, it does seem really important as a data scientist, as people who are trying to become data scientists, to understand the context of where you are. And if you're gonna be living on the internet and trying to analyze the internet, like we should understand not just how to code, but also-

D: How it works. Like how to- yeah, marketing is more than just- you know people like to write off the eSociety students, but marketing's really hard! Like I couldn't do it. I don't know how to get 10,000 likes on a company's photo. Like I know how to spot a very cringey company Twitter post or something. But I don't know how you would make a good one. Like I said, that's just the difference between us that we just have different ways of seeing.

A: Yeah that is a big difference. That's all the written questions I have. It's gone by so fast, I loved talking. Do you have any other stand out experiences that you had in ISTA? Or anything else that we brought up that maybe we skipped over that you-

D: Let me think back through our conversation real quick...I can't really think of anything. I think we touched on all of it. I'm just really excited to be in a major that I can be understood in and that I can thrive in and not have to worry about do I belong here, because I know I do. Because not only do I have the grades to prove it, but the people are just fantastic. And if I wasn't forming real connections, then yes I would leave. But that's not the case. And I think that the ISTA department is going go really, really far in the next 5 years.

A: Yeah I think so too. You're like a super friendly person, and that's a big reason why you have all these friendships. You're really outgoing, but do you think that there are any things that your professors or the way your class was set up or the way the major was set up that have helped you to facilitate those friendships more?

26:21

D: Hmm. I'm not sure! Honestly like most of my friendships just stemmed from like, "Hey, do you wanna work on this assignment together." And that's so funny, right, because you don't think that your study buddy is gonna end up being your best friend for the next semester. But you just kind of become attached at the hip. And it's maybe not because of a challenging class or anything, but it is just because like I said, we all do have those same interests. We all come into a class and realize we're all pretty much the same here, let's make the most of it. And pretty much everyone I've ever talked to in the major is understanding of that and sees it from perspective as well.

A: Yeah, trying to get the most out of it, friendship wise.

D: Yeah.... as a- I kind of wonder what where the School of Information's gonna go next.

27:17

A: Yeah I do too.

D: Cause what there's- in there there's Library Science, there's eSociety, there's ISTA. I think that's about the big three, right? I don't think there's much else.

A: No. Not that I've heard of at all. I should look it up.

D: Last I heard, ASU is finally starting to produce their kind of ISTA version. I think it's information science or data science or something.

A: It seems like there's more programs popping up as data science becomes valuable.

D: Definitely.

A: Like AI.

D: Maybe that could bridge the gap between ISTA and eSociety. Maybe they could be the ones doing that data mining on the social networks and figuring out our patterns. And you saw that in class the other day how after- from knowing 10 of your Facebook likes, this bot knows you as well as a close friend.

A: Oh yeah.

D: So maybe that's something that they could do one day.

A: Like data marketing? Or data mining and marketing and data science, they are really connected.

D: They are.

28:14

A: I'd love to see ISTA understand those connections and make data scientists who not only are like really well-trained in coding, but also who understand the algorithms are really powerful.

D: Yeah, exactly. And know how to market not only their company, but themselves. That's what I really like about FAST (?), like when I was talking to them, it was like I was talking to a real person. Despite that I was talking to an HR person and an engineer, but it just felt like so real. It flowed like a real conversation and it didn't feel forced or anything. And that's what I really hope comes out of ISTA major as a whole is just a bunch of well-rounded individuals that can code and knock off your socks off in an interview.

A: Yeah, instead of just being able to code. I think that ISTA majors are really well-rounded.

D: Me too.

A: That's what I liked about it. Like it's not just one.

29:10

D: I agree. I mean it's been by quest to be a well-rounded individual. Like before I even joined ISTA, I couldn't do an interview. I got the shakes, I got so nervous. I couldn't do anything really and I was lucky enough to get an interview with USAA like after only taking my first semester of coding, which is 130. And I thought that I was gonna ace it, you know I'm gonna be a section leader next semester. I got answers for all their questions. It turns out, I hadn't really found that confidence yet. I was still in my shell from my business school days not knowing who I was, all this stuff. But now I am confident that I can go into an interview and talk about anything, my classes, my job, my friends, just because I'm passionate about it. And that's the feedback that they gave me too, is that it just seems like you know so much. Like you're so passionate about what you do and that's what really shine.



A: Wow, that's awesome.

D: Thanks. No, like I said, it's just your passion shows and your confidence shows.

A: Yeah, definitely. And that's you as a person and then also the classes you've taken and the ways that you've expanded yourself. Love ISTA. Ok, I don't wanna keep you too long, but we just took an hour. Oh we can head over.

D: Yeah, sure. We both have the same place to be [laughs] Well thanks, Miels, this was fun!

A: Thank you so much for sitting down with me!

D: Yeah no prob.

End - 30:33

## Appendix C – Julia Interview

A: Amelia

J: Julia

(?): Unknown word

Transcribed by Lili Steffen

04/22/17

### Julia Interview

A: Um just so that we have it, this is Julia. This is the interview.

J: Hello.

A: It is really loud out here. Do you wanna go to the bench actually?

J: Yeah, let's try.

A: So my first question is did you do any coding in high school or did you come into college with any desire to do coding or information science?

J: Um, not really in high school, no. I didn't take any of the computer science classes or anything like that. I don't actually know if my first high school offered any. I'm sure my second high school did, I just didn't take them. So pretty much the only experience that I had was like when I was really, really little, maybe like 8 or something. Oh God- do you remember the website Neopets?

A: Yeah. [laughs]

J: Yeah [laughs] like trying to do the HTML and CSS for that. And then getting frustrated. It's horrible. That was pretty much it, so.

A: So you had that a little a bit?

J: Yeah.

A: But not any formal training.

J: Yeah. That was pretty much it.

01:09

A: And when you came to college did you- what were you thinking?

J: I actually came in as an undecided major. And was undecided my entire freshman year. Then they're like "You have to declare!" And so I had like taken some business classes and then I declared business and I was like "No, God, I don't wanna do business." [laughs] So really I didn't have any sort of idea about doing it until I just kind of found the major. Then was like "Ok, this major works. Sounds kind of cool. I'll go with it."

A: How did you find the major?

J: Yeah, um. It's actually- so I was kind of struggling to find something that I wanted to do here. Cause I kind of wanted to do something with graphic arts, but then for the arts program here it was kind of like you should have entered as a freshman and gone through- they have like this whole freshman experiencing that I should have gone through. I was like "Well, I don't wanna do that cause then I'll be behind." So I was looking at- I went to meet your major fair and I actually wanted to do the interdisciplinary studies major, and then I got there and they're like that doesn't exist anymore. We just haven't updated our website in two years. [laughs]02:21 So then I, um, I saw the School of Information (unknown?). So I picked up something from them and then I just kind of started looking up all the different classes and the different requirements, and seeing how it would work with the kind of odd assortment of classes I had already taken and what I would be able to take in it. I thought it sounded pretty cool, so now I'm here.

A: You mentioned that you were looking at computer science also? Or-

J: Mmm um, so my mom was actually- she was a computer scientist.

A: Oh cool.

J: And so it was funny- it was kind of both a double-edged sword in that it was like, "Oh yeah, I didn't have any of the like women in tech, that sort of stuff, because she had done it." But then at the same time I know that she got really bored at her job. Just cause she's actually super, super creative and she just got really bored. So I was like, "Oh, well you know, well maybe if I do computer science, I'll get bored." Or, I don't know. So I kind of didn't wanna do it- that. And then of course once I started thinking more about it- once I was in ISTA, it was like, "Oh, well maybe some computer sciences classes"

03:29

A: You were like "Maybe this wouldn't be as boring as I expected"?

J: Yeah, exactly.

A: That was my experience with computer science. I was like, "There's no way I'd wanna code a lot." And then once you start taking it, you're like "Ohhh."

J: I feel like once you do the homework, and it actually- before you realize it, it's been like two hours and you're like "Oh, well I just spent two hours doing this, but it went by really fast."

A: Like the puzzle, yeah. Learning how to do it. Was there any, going a little bit deeper into that, was there- I wanna ask was there, you had said computer science seemed a little bit intimidating. Is that true too? Or it was more you went through the ISTA process?

04:15

J: Yeah, well it was kind of- part of it too was that it was more intimidating, you know. When I was looking at the various majors I saw that for computer science, the way that they listed it on their website was like, "You are supposed to have come in as a freshman knowing that this is what you wanna do. You need to take these classes in this order." There were just so many requirements and so many- I don't know, something about it seemed like you should have already come in with experience from high school. And I definitely didn't have that. And so it definitely was one of those things where maybe you falsely think that everyone's already gonna know everything, but I definitely did have that with computer science. So I was kind-

A: Yeah, that was another one of the factors. I know we had talked about that a little, so I have that recorded. Ok let me get out my questions, but my next question is, now that you're in ISTA, you're a senior, you're like living- how would you characterize the atmosphere of the classes you've taken and the department overall?

J: Just specifically the ISTA classes?

A: Yeah.

05:26

J: I mean overall I really enjoyed most of them. I'd say most of my actual coding classes, I think have all been with Rich, so those have all been great. You know, Rich is always- it's always a really fun class. Some of the other classes-

A: Yeah, even if it's not in ISTA, a coding class that you've taken.

J: Yeah, um, you know generally- generally pretty good. I definitely do notice in some of the computer science classes, and actually one of the ISTA classes, that Human and Computer Interaction one, it will be kind of odd when you realize- you're like, "Oh, I'm one of like 3 or 4 girls in the room." Um, but I don't know, it's just more of something you notice. I haven't specifically noticed it affecting me, just more of something where it's kind of like "Oh, well that's funny." And then you move on with your day. Yeah, no overall I think I've enjoyed my classes and one thing that I really appreciated about ISTA is the flexibility in terms of substituting courses or finding courses that work from other majors, like the Library Information Science ones- I mean they're all kind of linked, but getting to use some of those. Or using ones from the art college. So that's been really nice.

A: Yeah, the program itself has been- you've been able to make it your own.

J: Yeah. Exactly.

06:47

A: Are there any stand out moments from class where you're like, "This was amazing! Someone really supported me. Or this was a really interesting subject." Or a class you really enjoyed in that way?

J: Um, well let's see. I really enjoyed, actually, one of the art classes that I took with Karen Zimmerman. Cause I have absolutely no experience with that stuff whatsoever before I took it. And you know she was really nice and supportive just in terms of a) taking a class in the art college even though I'm not an art student. But just learning everything with the tutorials and helping me after class. And then also Rich's classes. I mean, there were times in 120 where I would solve the homework in ridiculous ways and then get these error problems that I just could not figure out. And then I'd send them to Rich. I just get this like stream of messages that are like, "Ok, it's going wrong here. It's this. Wait no, it's not this. I'm going to figure this out." And you can just tell that he'd just spent a lot of time figuring out what in the world I had done with my code that was just like so bizarre! But yeah, that's always been really nice, getting a lot of help with that sort of stuff, so. [laughs]

08:05

A: Yeah, Rich is really available and cares about- yeah. Going off of the coding stuff, I feel like for me now when I code, there's a certain way I approach it vs. like in the beginning. Do you feel like that has changed? Or do you feel like it's kind of come

easy to you overall? Like what's your- how do you feel like when you maybe encounter a problem that you don't know how to solve like in the code or it's frustrating you.

J: Yeah.

A: How do you feel, what steps do you take, what's that like for you?

J: Um, I'm not sure if it's changed too much. Just in terms of- I mean I haven't been doing it for that long cause I've only been within ISTA for- I guess this is my third semester? I just- I condensed all the ISTA classes together. But definitely it's easier now in terms of that- just with the background knowledge of generally how things work. It's easier to trouble shoot in terms of try fixing things here, or just rearranging things. And then also I know whenever I really get stuck on a problem, I always try the "Ok, put it away. Come back tomorrow." And then sometimes things- you just like fix one thing and it'll work. Just having the general background knowledge I would say-

09:21

A: Really helpful-

J: Cause at the beginning, you know, you don't even really understand what you're doing in terms of- I didn't even know what the command line was! [laughs]

A: Yeah! Like how are you to even know?

J: Exactly, so just having that knowledge is very helpful.

A: So you know Python and then you're in Web Programming and R. Are there any other languages that you code in? Just curious.

J: Mm, no not really. So it's Python- I mean I've had the processing class a little bit, but that's not super strong. And then of course HTML, CSS and then all the ones that we're doing in Web Programming, which is like I think PHP and SQL (?) and I think that's it. Yeah, I haven't really branched out very much.

10:04

A: Understandable, there's a lot of stuff to do, it's hard to find time.

J: Yeah.

A: Let's see, I wanna make sure all this has been covered so we're not going over anything. What do you wanna do? Like what's your dream job? I mean that's a huge question, but what are your overall goals and has ISTA contributed to that?

J: Yeah, um I really want to get into user experience design. Or user interface design. I think that would be just really cool. I wanna do that or something with like Information Graphics, just in terms of- so something to do with combining the information/coding side with the art side. And ISTA has definitely helped there I mean just in terms of obviously having any coding skills whatsoever, plus you know like I said getting to take some of the art classes. Yeah and I think- that's the plane noise!

[plane noise overhead]

A: [laughs]

J: I mean I think eventually I'd like to go to grad school for Human Computer Interactions, User Experience Design. (unknown words, plane loud drowns out speaking)

11:16

A: (unknown) been going for so long.

J: Yeah, they've been a ton today, cause I was at my job earlier and the window's always open and there was like 10-

E: Maybe they're doing like exercises. What's your job? Where do- sorry I'm just curious.

J: Oh yeah, I work as an undergraduate research assistant.

E: Nice!

J: Yeah, in the School of Sociology. I actually got to use Python this semester, so that's super exciting.

E: That's so cool! You're actually using it. So you wanna go to grad school for User Experience.

J: Yeah, grad school for User Experience Design. Yeah, maybe somewhere in Europe. That would be cool, just cause I like Europe. Yeah, that's pretty much- so basically just the combination of the arts and the technology.

E: That's really interesting, I'm glad that I'm talking to you. That's a really good one, combining them. That's what I love about ISTA is that you can apply it to anything.

J: Yeah, really.

12:13

A: Did you do art- did you paint or draw before? Or you just kind of got into that.

J: No, not really. I more like the graphic design stuff like the typography and- I can't draw to save my life. Yeah [laughs]

B: Did you do graphic design? Or once coming into college that was something you discovered.

J: Yeah, it was more kind of like something that I always find really interesting. And you know with school projects, those would be the ones that I would spend unnecessary time being like "Everything has to be perfect on the science display board" or you know, like in the web design classes- you spend way too much time, you're trying to get everything laid out right, when really you're only supposed to be making a form or something like that. But no, before that I hadn't really had any specific experience.

B: That's really cool. So the last specific or directed question is about- we touched a little bit on demographics- there are- oh my God. [clanging noises] Demographically, there are more men than women in ISTA, in coding classes specifically. You said you don't really think about it, but

are there any moments where you've felt your gender-like in an interaction you had with anyone or just by your- I don't know.

13:44

J: I mean, I don't know. I'm sure that there may have been moments, but generally speaking I'm kind of oblivious to a lot of the stuff. I mean I know I've heard some of you guys talk about there's the one particular class with, you know, Akusen (?). And thinking back on it, I was like, "Oh yeah it was kind of like 11 dudes." But I'm so oblivious to that stuff I didn't even notice when it was happening.

A: Yeah, that's- you don't have to make up any instances.

J: Yeah, no I can't really think of any specific ones. But like I said, I'm kind of oblivious when it comes to that sort of stuff, I just go about my day.

E: I think that's probably a good way of dealing with it. Cause there's not that- there's no point in really focusing on it either.

14:34

J: Although, this doesn't really relate to the questions, but Adrianna the other day-she was saying something about- did you read the whole thing about the lady in Über?

B: Yeah!

J: Yeah!

E: I read that article.

J: I know, I was like "Are you kidding me?" This is what I'm saying that generally I'm oblivious and just have no- like I know the statistics in terms of there are way less women in tech. I was like, "That's just ridiculous!" Like-

B: That's like the worry, like what are the ramifications if you're in an environment where you can't get your job done. And that's really disheartening. I mean I wasn't in CS, so I don't know exactly what the comparison is, but that maybe is something that ISTA is- maybe since it is more- I don't know, I'm like trying to tell you my hypotheses right now. Um, but that's less of an issue perhaps, that's what I'm trying to figure out. That's all the questions that I have. I'm trying to think if we missed anything or if there's anything else that you wanna say?

15:40

J: I don't know! [laughs] I mean I guess I just appreciate how, I guess the a) that the ISTA program exists, cause without it I was kind of without a major. And then the flexibility, like I said, in terms of getting to take the classes that I actually find interesting. You know, I'm kind of an odd student in that I don't necessarily find a lot of classes interesting. You know, I'm very



happy to go to class and do everything, but I don't often find them interesting. And within ISTA, you know, you go, "It's like worthwhile!" I dunno.

B: Yeah, it's like really truly your interest. Yeah the thing I see coming from our conversation is that you've really personalized it in maybe you're own.

J: I really got to know the advisors well. All like 10 of them.

B: Every single semester, the new advisor!

J: I know. [laughs]

B: That's why I was kind of pissed, cause I got- I had to withdraw from this class, but if the advisor had remained the same I probably wouldn't have done that.

16:44

J: I had something actually where they never told me that you didn't have to take three natural sciences for the B.A.

A: Oh, they never told you?

J: The never told me. And my advisement report showed that I had to take three. And so I didn't actually take them, I took CLEP tests to get out of all of them.

A: Oh that's good.

E: But then I was like- cause then I was talking and I had other confusion about my advisement report that was just me not paying attention. And they were like, "Yeah but no, you only had to take 2 natural sciences." And I was like, "Say that again?"  
Definitely had to take three.

A: Yeah, especially if you're transferring and there's all the different stuff to deal with. I understand why it would be nice to have one advisor overall.

J: I mean you've probably seen even more than I have.

17:33

E: Yeah, with two majors it makes it especially-

J: Oh yeah.

E: Although, I've only been in ISTA- you said three semesters you have

J: Yeah.

A: I've only been in it for four.

J: Ok, so you must of started fall of last year?

B: Yeah, I took 130 in 2015. Fall 2015.

J: Ok, yeah, so one semester before. Ok. And then did you start section leading?

B: I started section leading 130 last semester.

J: Ok, ok.

B: So it hasn't been too long actually. It's like weird, the whole thing. Um, cool!

J: Great!

B: I'll turn this bad boy off.

[both laughs]

End - 18:16

Appendix D – Kelsey Interview

C: Amelia

E: Kelsey

(?): Unknown word

Transcribed by Lili Steffen

04/23/17

Kelsey Interview

B: So I'm here with Kelsey. Do you want to introduce yourself and say what year you are in the School of Information?

E: I am Kelsey, and I am a junior with ISTA. I just switched majors, so I'm starting with the prerequisite of those. I don't know if that helps.

B: Yeah, that does help. So what kinds of pre-reqs have you done or what are you working on right now?

E: I'm working on ISTA 161. Then I have the eSociety class. 130.

E: How's 130? Do you like it?

B: I love it!

E: You love it?

E: Yeah, oh my gosh. Rich actually approached me- I don't know. He's really, really sweet.

B: He is really sweet. He approached you to be a section leader?

E: Yeah.

B: You should do it!

E: Did you have that?

E: Yeah, I'm a section leader right now actually.

E: You're 315, right?

B: Yeah, and I did it for 130 last semester.

E: Oh wow, ok. I'm really excited. I hope I don't blow it though, cause I really, really wanna do it, but I totally was like "Ahh!"

01:06

A: Are you doing the interview process?

B: He said to just submit an application. Hopefully I'll get it.

E: Yeah, you got it. That's awesome.

B: Thanks!

E: So is that your first coding experience?

B: No, it's not.

E: Ok. So my first official question is had you learned about coding in high school or anything like that?

B: No, no, no. I am- I always have been incredibly feminine, so I think I've never been steered in that direction. Like my mom always, you know, said that she was bad at math and I had trouble with picking up multiplication when I was 9. So therefore I was bad at math in her eyes. So like, they never really directed me to it. My step dad is actually a computer programming. It was- I was never exposed to it, they never talked with me about it. And in media you never see women in it either, so it's never really something I thought about until I just got bored one summer and googled it. So- [laughs]

A: What summer was that when you googled it?

E: About a year and a half ago, so I haven't been doing this for very long. But I really, really love it. I wish I had known about it earlier.

B: Yeah. So you googled it and then you saw- did you start with HTML or Objects (?) Oriented programming?

E: I started with Java.

B: Oh, Java?

02:28

E: Yes, I liked it cause it was very technical and I felt like I was- I don't know, it was kind of ridiculous, but it seemed like more technical than Python, kind of matrices.

A: Yeah, like all the brackets.

K: It should be a fun interview (unknown words, for us to do?).

B: How to transcribe that, exactly. It's really no problem. I'm just happy to talk to people and hear what they have to say, honestly. So you did that. What were you planning on doing when you came into college?

E: Honestly, when I first started college, I didn't really know what I wanted to do. So I knocked out my gen eds and then eventually I did an associates degree, so I figured I would actually try and pursue nursing, cause a lot of the person that I knew in Virginia were nurses and they were all women. And yeah, encouraged me. So I thought it would be nice to be around people- but then due to like a bunch of really unfortunate events, I had to come here. You know, I lost all of my nursing pre-requisites, so it was pretty much at square one. I was like, "Ok this is actually a really great opportunity to change paths, I can do whatever I want, I'm at square one. Other than my degree, my associates degree, which is like nothing.

03:55

A: It's definitely something!

B: Yeah, it really helps cause that makes me a junior and I only have a year and a half left because I'm planning on taking more programming classes during the fall and spring, rather than just knocking all of my (unknown words). Just did eSociety, which was great, but it's- I love programming, I wanna take as many as possible.

E: So that's the programming element. So you came in with your associates and then you're just looking around, like "What can I start out with?"

K: Yeah!

E: At the U of A-

E: Yeah.

B: And was information science one of the first things you saw or how did that process go?

04:31

E: Um, information science isn't very well advertised by the university. I actually found out about it from word of mouth from a girl in my calculus class at Pima. Cause when I first came here, out of state tuition was 30,000 dollars. That's ridiculous. I'd rather just wait. And it worked out really well, you know, cause I got a lot of financial aid coming here. But like, I don't know, it was really just word of mouth. She recommended it and said it was like better. She was really nice and I hadn't met any nice Pima (or female?) programmers.

A: So she was giving you like-

K: Yeah.

A: Had you met Pima (or female?) programmers that were more like-

B: Um, they were like- I met a couple that were just super, super nice and very normal. And I had met, and this is just like, I haven't met too many in general (?) Like when I say a couple, that's out of five, so it's pretty good. But like, I don't know, I've met one that was very kind of aggressive and you know I think that it's just like in these majors where you see all of your friends drop out, you kind of get an ego on you. That's not- no gender is really immune to that, so I think a lot of it is overall attitude.

E: I totally agree, like if you meet 5 people and 2 of them are nice and one of them is a certain way like that.

05:54

E: Yeah, but I met- I actually like the female programmers that I met in computer sciences classes. I actually like them better than pretty much all of the men put together. Like they were just very down to earth and very nice and they wanted to help. And all of the men were like very exclusive and it was very difficult to talk to them, whether they had terrible personalities, or they didn't wanna talk to women. Cause I had a few that just like blatantly lied to me. I don't know if they were trying to impress me, but it was like I can't form a relationship with somebody-

E: That's lying-

B: I'm sorry. Yeah.

E: This is exactly what- so you took CS classes?

E: I took one.

B: One.

06:31

K: Yeah.

A: And then you were like-

E: That's enough. Especially since that girl recommended it. She was very nice. I don't know, and it seemed like a great alternative and the job prospects were just as good as computer science. Like it might not be as heavily recruited, but that's probably just because they don't know about it.

B: And information science, I think, is on the rise too.

E: Yeah, exactly.

E: Which is cool, to be a part of it.

B: All the disenchanting CS majors-

E: [laughs] Yeah. So that girl, she told you this is an alternative, people are nicer, you can still be a data scientist, you can learn to code.

B: Yeah! Yeah and she was just very normal, super approachable. And I found that in- when I went to computer science classes, I really started to shift how I dressed, because like it's during the summer in Tucson, so it's 150 billion degrees.

A: Like the surface of hell, yeah.

07:28

E: But I was still wearing like t-shirts, like I was just sweating through, just because it felt- it made me so uncomfortable.

A: You didn't want to try attention to yourself?

E: Exactly. Yeah. And I can't imagine that it'd be any different at a job, but it's still not a great sign if you feel uncomfortable not wearing that. Which, I love t-shirts, don't get me wrong. But like, it's super hot.

B: Just trying to be cool, yeah. It is worrying. So you once you- moving on to ISTA, how has been taking your core classes? How has your experience been overall?

E: It's been wonderful. Like, my- I really love- Rich is amazing. He's my favorite professor, like, ever. Cause he's like extremely progressive and he sets it- rather than like- you know how you hear a lot of people who are really, really passionate about social justice, but a lot of it is just, it's not communicated in the best way cause they're so passionate about it and they don't back it up with logical statistics and objective analysis. And I feel like Rich really did that, and I think he reached more people that way.

08:43

A: Yeah, that's a really good point.

K: Yeah and like I don't know, I love- don't get me wrong, I love listening to both people, but it's really good to know that there's actually has been people who are into these things and he actually cares enough to look this up. It's just better communicated.

A: Yeah.

B: Like Dr. Atkinson is pretty awesome, too.

E: Oh cool, you really like him?

B: He's really sweet. I don't know, he's just kind of- there.

E: There [laughs]. Yeah. What are some of the things- you said that Rich communicated it in an objective way. What are some of the things that he's done?

B: In the very beginning of the ISTA 130 class he assigned like the Ada Lovelace- I'm sure you're like familiar with it. And um he also-

A: The graphic novel (?)

E: Yeah, and he also like backed up the women statistically their code is more rejected if they know that they're a woman. And like, you know, it's good to know that there actually is data to back up my personal experiences cause I feel like I'm just scrutinized to have to over-compensate to become kind of, I don't know the word for it. Just kind of come off as really arrogant, and I really don't mean to I just want to take it seriously. But I don't know how else to communicate cause they aren't listening to me.

A: Yeah, you have to assert yourself?

10:09

B: Yeah, and I have to talk as if I'm reading from a textbook. You know, it's like nobody wants to listen and I don't wanna talk like that, but I wanna good grade. And, you know, I need to maintain a scholarship. It's a multitude of factors. I don't know if that answers your question.

E: It does!

B: Ok.

E: It definitely does.

E: Ok, good.



E: Yeah, I'm trying to think. So I just had how would you describe the atmosphere of your classes or any stand out moments, but I feel like you're talking- like Rich and Dr. Atkinson are both really-

B: Yeah, and I haven't really encountered that as much with Dr. Atkinson's, it's been mostly with Rich. But Atkinson is inclusive and I don't really- we just talked about gender discrimination, but he doesn't do it as much as Rich did, so.

11:00

E: And I know that he's- I had a class with him too and I didn't feel like there is. Like I think it's an evolving process for both of them too, so it's interesting to hear your perspective, cause I attended classes last year. So Rich gave the Ada Lovelace in 315 last year, and then he's like switching it around, so I think that's interesting how that's evolving. So if you're in 130 or Java, or whatever coding class you're in, what is your strategy if you encounter something difficult, like a bug in the code? What next steps do you take?

B: Oh man. Like last semester, the Python class is actually done by a female professor. I think it was a very rough semester for me, but a lot of my job- my work hours would overlap with the tutoring center, but I had to basically live in the tutoring center cause it was not an intro class! It was- it wasn't, and I had done programming for a while before then, but it was just awful. And I know a lot of people didn't do well, but the people- and a lot of people were on the same page as me, but they had- they were boys that knew each other from high school that were able to have study groups. And, I don't know, in hindsight I should have asked to join, cause I think they would be friendly enough to do so. 12:27 But it was just kind of like I didn't know these people, so lack of connection I guess. I don't know. And there were like three girls in my section and none of us knew each other. So there weren't any team activities where we could talk to each other. So you really just were like this floating entity (?). Like unless you had prior connections, you were kind of screwed. So I had to go to the tutoring center a lot. And I'm not super proud of that, that's just what I had to do.

A: But you learned the materials, so-

K: Yeah, I learned the material. I think ultimately it was a decent class, but it wasn't the best.

13:08

A: So it wasn't intro just cause the level was just super fast?

Yeah. And she also like her lectures weren't useful at all. I kind of just stopped going cause she would- I don't know. Just kind of drone on and on, and then she would like get it wrong and then the material that she had provided was inaccurate. And then she corrected it a couple days before it was due and it was just so stressful. Like I don't know, it's just the lack of organization

E: organization and professionalism. And I feel so bad saying this, cause it was a female professor, but it was just- I don't know if that's the CS department in general, but.

A: Yeah. Ok, and then you went to tutoring to try to like-

B: Yeah, and in this- in ISTA 130 I had a snag with the last homework. Mostly I had to start it- cause I had a- one of the presentations in Atkinson's class, nobody did any of the work in it, so I had to do the entire presentation that started a little late for me. But actually one of my guy friends- not friend, but he's like a new acquaintance in my eSociety class, we're in the same projects and we're in the same ISTA 130 class. So we've been talking, he's been really nice, so luckily that's been- he's been more inclusive.

14:28

B: And you hit a snag on your last homework, but-

E: Yeah.

B: And then did you just solve it or-

E: Yeah, I mostly solved it and then I went in for tutoring for two minutes just to sulk (?) so that was interesting.

A: You say you're not super proud of seeking for help, but you still will do it if you need it?

B: Yeah, definitely. That's how I've managed to- cause I'm not like the smartest person, but like a lot of the reason why I get good grades is cause I'm going to tutoring. I think a lot of people are much, much smarter than me, but they just don't care. And a lot of the stuff like professors don't communicate clearly, so you really have to go in for their (unknown word, probably office hours?)

15:09

E: You have to put the work in in order to get it?

B: Yeah, exactly.

E: That's interesting. I'm sure you actually are very smart, too, so.

B: Thanks. [laughs]

E: Um, so have you planned or do you have any thoughts about what you wanna do when you graduate like as a career?

K: Oh ma.

A: Do you have like a dream job?

K:I don't know, basically I wanna research. Like data science is pretty amazing. I mean like I'm really excited to learn R. I wanted to wait until I got- cause I just did Python last semester, so I wanted to knock out Python. And not overload my schedule too much. But yeah, just data science and software development, like it's all just really, really exciting.

A: So whatever you can do with that?

K: Yeah.

A: Do you feel like ISTA is preparing you?

K: Yes. I think a lot of it is what you make of it. You can take three programming classes- that's an exaggeration. But like a really low amount and graduate. You might be able to get a job, but you are less likely to in software development, which is what I really, really want. And I want to get good at it, to increase job prospects.

16:23

A: Maybe ISTA is that kind of-

K: It's what you make of it, it's like there's options. And a lot of people don't like programming as much and they might want to do something else with their degree. So it's a very flexible degree. That's what I like about it actually.

A: Yeah, everyone seems like they have a different path that they're taking.

K: Mhm, yeah. Yeah Eden, who's also an ISTA major, she says she wants to work in website development with her ISTA degree, so. It's really dependent-

A: A range of things.

K: Mhm.

A: The final question is, so demographically, there are more men than women in ISTA overall. So have there been any specific moments during your college experience or during your ISTA experience where you've really thought about your gender or really felt like your gender? And you've mentioned some instances before.

17:27

K: Oh yeah. Yeah, like I mean it's much less so in ISTA- there's more women. And I think a lot of the women- like the reason why a lot of the guys succeed in computer science is not because they're smarter, it's cause they're better connected. They're more likely to be approached, more likely to be included in the group. Otherwise, like, I think that I'd have to either kind of like desexualize myself or just like, I don't know, be somebody's girlfriend. You

know, that's not what I want. Like getting the group- to be a part of these study groups, it's really difficult. I forgot what I was gonna say.

A: So it's different in computer science?

K: There's more women and the guys have been more down to earth, and so not as arrogant. It's been easier to deal with.

18:10

A: Yeah, I think that's a good point. I almost feel like, I don't know if you agree with this or not, but because there was more women, the guys understand I guess.

K: Yeah. Yeah and I think a lot of it has to do with Rich. Like honestly, he really just kind of drives the point home from the very get-go. And Atkinson does it to a lesser degree. And Dr. Daly is great too. But I really, really like the statistics. I think that people are more likely to listen to that. And obviously statistics can be manipulated, but I don't think a lot of those guys know that! [laughs]

A: Yeah, that github statistic about the code, like how- and even though women are more likely to be rejected if they're actually gendered in their username, but their code is usually better on average. You can't tell.

K: Well you have to be better, or else you'll wash out cause nobody will help you.

A: Yeah, totally not know how to do it and do it on your own too.

19:03

K: Yeah, exactly. And all of these guys will like cheat through the entire thing cause they're well enough connected. Like I've seen that.

A: Oh you've seen that?

K: Yeah, there was this one guy- he didn't try and like- we were in the computer lab, this was like after hours, no tutor was there. But yeah he was- he sat next to me, cause it was pretty crowded. And I was almost done with my program, it was working and I just had to check- put it through the div (?) checker actually, to make sure everything's printing out correctly. And he just was with his group of friends, and he was like, "Yeah, I don't know how to do this problem. Blah, blah, blah." And then he saw my thing and he was just like, "Can I have them?" and I was like, "Ok. But please change it."

A: Yeah.

20:07

K: You know, you'd (?) figured it'd be a good way to like, I don't know, make some connection, it's really like forced upon. Some people that I work with, this stuff is hard. That's part of why I switched is cause it's like I'm not making any connections with these people. Like I was just getting hit on. It was just like I wasn't a person. They didn't really care if I was struggling, they just wanted to know if I was single. And that's an oversimplification, but like-

A: But you did get hit on.

K: Yeah, and that's how it felt. That's why I was just like t-shirts. I just got tired of it. And they were like- I'm older than most of these people, so it's frustrating in certain ways.

A: Yeah, like "I have actually done a lot before this."

K: Huh?

A: You were like, "I actually have done a lot before this."

K: Yeah. Yeah and I have some life experience and they look like they were 12. [laughs] Kind of hard to look (or love?) someone.

A: Like freshman at the U of A.

K: Yeah, exactly. And there some of them that looked older, but like not a lot.

A: Yeah, not great.

20:58

K: Yeah, but I definitely like remembered my gender a lot. It was something that I always remembered, it was on the back of my mind in all my interactions. Like if I ever got- I gave my phone number to a couple of people, and they only- it wasn't to like- there really wasn't any reciprocity. Well, I forgot. Ok. I'm so sorry.

A: Don't apologize!

K: Ok, so I forgot my story. So I sent him the code, and this was bad, but I shared it with him. Synonymous.

A: Synonymous, I've done same things

K: Yeah, I shared it with him. But there was like zero reciprocity. There was- and it wasn't- I just feel like I was just either going to be abused- it was just very frustrating. I think a lot of it might have been the people skill's of 18 year old boys. A lot of them just don't have any. [laughs] So,

I don't know. It might have been just the demographic I was dealing with. But I know girls that would do the same- I think it's more like- I honestly felt kind of weird saying this, cause I know I'm talking about a- like there really isn't too much of a gender- difference in the ability of each gender to complete a task. But I honestly feel like women communicate better and they understand our personal relationships.

22:19

A: Maybe a reason for that is being socialized.

K: Yeah.

A: To communicate.

K: Yeah, I was socialized to believe I was a princess until I was like 8.

A: Yeah, really depends on what they're telling you. So there was not even reciprocity there.

K: Yeah. It was very frustrating, cause I hit a snag later and he was like, "Oh man, I'm sorry to hear that."

A: But he wasn't really doing much better probably.

K: I don't know, probably. But he was- he knew a lot of people that were doing well. So like some sort of- anything would have been cool.

A: Oh, yeah.

23:03

K: I've had a that couple of times. It just kind of repeated itself, it wasn't just one guy. And these guys- the other guys, everyone, they also didn't help after I'd helped. I don't if it's my-

A: It was exhausting-

K: Yeah.

A: And you were like trying to figure out and then-

K: Yeah

A: And not being supported.

K:I don't know if it's my people skills? Like I have no idea, maybe I communicated it wrong. But that- in past experiences, that is not the case I guess. I wanna say the evidence- the culture of the computer science lab is, I don't know, I'm not entirely sure.

A: It's hard to know what all is going on.

K: Yeah. So I don't wanna say, "They discriminating against me!" I don't know, maybe I did something weird. Like I have no idea. But it was something that was- it was my overall experience.

A: Yeah, and your experience is valid and a lot of women have similar experiences.

K: Oh really?

A: Yeah.

24:01

K: Yeah, I felt kind of like the pariah unless I had something useful. It was really strange.

A: That's really strange and hard to deal with.

K: Yeah. Yeah, I mean. I don't know.

A: To try to learn and feel that way-

K: I'm sorry?

A: To try to learn to code and to feel that way is a little bit-

K: Yeah, it was kind of very frustrating. Cause I had this kind of Professor that didn't really care. She had two hours of office hours a week for like 100 students. And it took her like a week to respond to emails. It was just like I couldn't get help from the professor, the tutoring center wasn't super great. And it also was a rough semester in general. My boyfriend was diagnosed with cancer, he's totally fine. He's totally fine now. And he went through chemo and surgery and everything, but I was pretty upset. So it was just very stressful.

A: Yeah, a lot going on.

K: I didn't have too much time and like the time that I did put into it, people we're super receptive, so.

25:04

A: Well, I'm glad that things are better.

K: Thanks. Yeah, everything's totally fine, but it was like the best possible ending to that entire situation. So he's totally fine.

A: That's really good to hear. That's stressful. And you're in a better major!

K: Yeah, exactly. I'm really happy with it.

A: That's good to hear. Do you have anything else that you wanna add or that you feel like-?

K: No. No I just tried to put in all the stories that would be helpful for your thesis.

A: Yeah, I love it. I need concrete stories, that's great.

K: Yeah, I wish I had, you know, something else to give you. Like any sort of concrete evidence. This is all anecdotal, I don't carry around a camera unfortunately. So, sorry.

A: It is anecdotal. And it's interesting being an information science major, and hear about there's so many different kinds of information, that I do really feel like people's stories are a valuable-

K: Yeah!

26:01

A: Kind of information, even if they're not the most scientifically legit or whatever.

K: Honestly, I think if everybody's telling you the same story from a very specific demographic, it's probably true.

A: Yeah. Or if there's those overlaps where you can say- at least 5 people I talked to all said the same thing about this situation.

K: And I've seen it. You know, I don't know. Not as much- not to the degree that I've experienced it, but I've seen it where I've just seen women working alone. They're typically very feminine women. I sometimes see more, I don't know, just kind of like how I'm dressed, you know t-shirt and stuff. They tend to be more inclusive of those women, I guess. I have no idea. I'm more approachable maybe? That's why I started dressing differently, other than like being hit on.

A: Yeah, actually I feel like I have changed the way I've dressed since I- not even, cause I wasn't in CS for very long, so even in information science I feel like-

K: Yeah.



27:03

A: To be taken seriously I need to-

K: Yeah. It was so frustrating. And it doesn't take long. I don't have that much time, like my scholarship only lasts for a couple of years. I need a good (unknown word?).

A: To survive-

K: And if nobody's going to help in this major, I've heard good things from this one girl. I wish I had done it in the beginning. So, it's the only thing I regret.

A: That's amazing that it's just like one girl and you're like, "This is it!"

K: Yeah.

A: I mean I'm sure you read the research, too, but.

K: Oh yeah, yeah, yeah. Well I heard from somebody else not to do it cause they thought that ISTA was only IT work. And they were like they're going to outsource your job. I was like, "Ok, well that doesn't make sense, but I don't know enough about it to say you're wrong." I don't know. [laughs] Yeah, exactly. So there are some misconceptions about the major in general. Like IT, ISTA.

A: Yeah and I also think that maybe since there are so many different ways you can do it, everyone's got a different idea cause they've experienced a different thing.

28:05

K: Exactly. You can use your capstone to get a CISCO (?) certification. It really just- I think it's your internship, I can't remember. It's one of those.

A: Yeah.

K: It really is super flexible, which is what I love about it. And there's a wider variety of people, which makes it easier I think, cause they aren't all like super competitive.

A: And there's not those heavily defined, like, this is what's going on.

K: Yeah.

A: Everyone's just kind of existing, doing stuff.

K: Exactly. You know, there's more flexibility.

A: Totally. Well thank you so much.

K: Yeah, no problem! I hope this was helpful.

A: Thank you so much, I really, really appreciate it.

K No problem. If you have any other questions feel free to email me.

A: Yeah, I will. If I have any updates or

anything. End - 28:53

## Appendix E – Alice Interview

S: Alice

(?): Unknown word

Transcribed by: Lili

Steffen April 18th, 2017

A: So let's talk about your experiences at the U of A in Information Science specifically. So anything you wanna say about that. We can get started. Have you done coding or anything in high school? What were your experiences with information, technology, computing, that kind of stuff, before you came to college?

S: I had no experience whatsoever. I took ISTA- ISTA 116 was the first class that I took that had any programming background at all. I had taken statistics in high school, but I really hated it actually, which is kind of ironic given, you know, I now TA for a stats class. But yeah, no I had no experience and just kind of enjoyed it and wanted to become a part of the sort of (?) section leader community and that kind of just got me into the iSchool entirely. Yeah.

A: It was section leading...is that what you saw in 116? That you had a relationship with your section leader? Not a relationship, but you got inspired by that?

01:10

S: Yeah. I thought it seemed like a really cool thing. And I enjoyed the class. The instructor at that time wasn't the best. But I enjoyed the work I did with [Another Section Leader] who was my section leader. I decided to sort of join it. And then through the process of being a section leader, I learned about the other classes in ISTA. So that was interesting.

A: Oh interesting. So why did you take 116 originally? What was your major?

S: I was a pre-nursing major. So I took- I bite off a little more than I could chew at that time. And took 116 as a statistics requirement- sorry (unknown)

A: No and it won't be like- it's transcribed, so if you stop it's fine.

S: But it, um, I took it as just a typical statistics requirement. Didn't really know what I was getting myself into and then found out, "Oh, hey we're doing a little bit of like really minor programming."

02:15

A: Ok, so then what was your experience like with that when you first started doing (R something, unknown?)

S: Um, I- it wasn't too bad, honestly. I thought it sort of, it came kind of naturally to me, in some ways. It was different because I'd never really known- it was, because R is a kind of- it was a decent introduction because it's basically just a glorified calculator. You're not really doing much programming. At least for- not for what we did with it. So it was easy- it wasn't really understand- as far as understanding how it worked, it wasn't that different from just using a calculator. But then, like, I learned about ISTA 130 and ISTA 120 and thought those were classes that were- at least 120 was going to become Python oriented, and actually a little bit more of just programming. Intro to programming. So that was interesting. And so I didn't know anything before I came into it and now I've taken two classes and it's a really cool (unknown) enjoying it.

03:30

A: I know Adrien mentioned that you were thinking about CS, or like you're taking some CS classes. Is that true?

S: Am I considering it?

A: Yeah.

S: I'm thinking about it. The reason I'm thinking about it is because I think a lot of the courses that are in CS are really important for working in computer science, as far as having a, like, total picture of the languages and things that you're going to need to understand and be able to use.

A: Yeah, there's just more classes available.

04:07

S: Right, exactly. And they have more of like core classes available. The iSchool has a really cool, sort of diverse range of classes, but I think some of the core classes in CS help with that. Which is what was kind of the initial idea between (?) building an iSchool. But it didn't actually work out as they- as whoever, as the person who created it intended it. But, so I'm thinking about doing that. But it's sort of changing a little bit now because CS is sort of- it's very- you have to...it's a commitment. And doing ISTA and CS at the same time is definitely a commitment. And so I like to think my interests are kind of diverse, so I don't really know that's exactly where I want to go. But I think ISTA is really good at- like for diverse interests. It includes programming for a range of different things and just it's more data collection focused, in a way that CS isn't. So as a pair, they're really, really good. But if you're interested in a bunch of different things and you don't wanna just be like "I'm gonna be a software engineer," then ISTA is really good for that.

05:30

A: Totally agree. Yeah, CS that's like so many hours more of coding that you have to be doing in multiple classes.

S: Yeah, absolutely.

A: It would be cool if there were more ISTA classes-

S: Yeah!

A: We should advocate for that! [laughs]

S: [laughs] No, absolutely!

A: So how has your experience been in ISTA overall? I mean you've been a section leader. How would you describe the atmosphere of your classes? Have there been any amazing moments, stand out moments?

S: Just general what's the feeling like?

A: Yeah, like what's the vibe?

06:00

S: Um, very friendly. I feel like- and I'm in a CS class right now and it's one of their sort of fringe classes. It's web programming, which isn't actually a part of the major. And the atmosphere is very different in that class. And you can sort of- it's interesting to see, because it's not one of their core classes, so I don't know. It'd be interesting to see what the core classes look like. ISTA's been very friendly and very good to me. I really enjoy it and I feel like especially section leading and being a part of that- it feels like being a part of a community. It's not a very large major, so there's like- you get to know the people in your classes because you have more than one- more than one class with them (?). And so- it's probably not catching very much!

A: Oh, the coffee thing-

B: Yeah. [laughs] But, I think it's a very friendly and nurturing atmosphere. And there are- I've taken- I mean most of the classes I've taken have only been with like Rich and so. Which I really enjoy, because Rich is really a great guy! So my experience for the most part has been really awesome.

07:16

A: Both in the community as a section leader and then like the classes-

B: Absolutely.

A: The section leading-

B: Yeah, and then you have section leaders who are in your classes like we're all in 323 (?) right now. And so it's kind of- it's a cool thing because we're all friends and we've all become friends. And it's become a sort of community for all of us to belong to. Which is good.

A: Yeah. We can have those connections and learn and work together on stuff.

B: Absolutely.

A: Any classes that you hated?

S: [chuckles] In the iSchool?

B: Yeah.

S: Well...I'm starting to get into the intro classes. And intro classes I think at the university level in general aren't the most fun, because they're so generalized that a lot of the material that you cover may not be where your interest is- or where your interest lies. So- but I'm starting to take more of the core classes. I've taken a few more specialized ones and now I have to take the general-

08:22

A: Requirements.

B: Yeah. Get the requirements in. I actually did not enjoy 116 when I took it.

A: Yeah.

S: ...I enjoyed the content. I didn't enjoy how it was taught. But there haven't been really bad experiences. There were like extenuating circumstances with that. So I don't really- I can't really say I've disliked anything. It's- overall it's been a positive experience.

A: Awesome.

B: Yeah.

A: It's been really good, yeah. Not to put words in your mouth-

B: No you're fine!

A: Like "Oh, she hate it-"

B: No, no, no. I do.

A: Yeah, no not at all. So this is more about your learning and working style. When you're in a coding class and you run into a bug or your code isn't working, what are the steps that you take to solve it on your own or maybe to get help or to reach out to other people?

09:12

B: So the first thing, I guess, that I usually do is- I mean if I know where the problem is and what exactly is causing the problem- the first step is Google, it's our best friend. Because there's a large community of people who all have the same questions and it's just sort of discourse about it. There's always something you can find online. But then if I need further clarification, I'll come to office hours or talk to friends that are in the class. So that's usually how I deal with those sort of problems.

A: So you said that you want to get data science and that's what you're trying to do. For your career goals, is that your dream job to be a data scientist? Do you have any specific industry you want to be working in or something like that?

10:16

B: Um, you know, this is actually like I don't quite know. And that's really the problem that I'm having with choosing a major in general. And I think it tends to happen in a lot of different cases in a lot of different majors. Mine's taking a little longer than usual, but that's- I don't really know. I'm getting a double degree currently in Communication and Information Science. So it would be interesting to find a job that was in the market for both of these places as far as maybe- as far as like marketing research or business development or things like that. That would be interesting in. But yeah, I think it's- I really don't know, but I think the possibilities overall are pretty endless. You can do whatever you set your mind to, you just have to find the right way- the right things to do to get there. And once I figure that out- it's a bit- there are possibilities here that I can go for and take.

11:20

A: Yeah, totally, I feel you. And you feel like Information Science is preparing you for that, at least in some ways?

B: Oh absolutely. Because data science- a lot of data science is in Python, some in R. To some extent, in some cases. And so those languages are really important for data science. And learning those- Python in particular, because I've spent most of my time doing Python even though I'm sort of teaching in R. It's definitely preparing me for that, because now I'm familiar with the software that I might have to use- the program that I have to use. It's very good.

A: So final question. Demographically, there are more men than women in ISTA. Have you had any moments where you felt that specifically, either positively or negatively, felt "Oh, I am woman" or felt that was an issue?

S: I haven't in ISTA. It's not as big of an issue in ISTA. Though I think ISTA is very friendly, and I said that before, but in general I think a lot of- I think there are a decent number of women who start in CS who move to ISTA because ISTA is more welcoming to everyone. Probably because it's less mainstream and less people know about it and get involved in it, which we wanna change obviously. But I think there- in ISTA at least, there hasn't been very much of that. There are like a few moments where someone would make a comment or suggest something that's kind of like you know, you kind of side-eye it. Like, "Really?" But overall my experiences have been positive, despite the gender discrepancy (?)

A: Cool. Do you have anything else you wanna say about your experiences in ISTA?

13:39

B: It's great! Be a section leader! [laughs] We'd love to have you! Yeah it's just been very positive and I think the section leader program, being in classes with section leaders, and being a section leader has been very, very positive. And I think it makes everyone feel very comfortable to know that you're working with people who are at the same level as you and have been through this exact thing too pretty recently. And I think ISTA with the integration of those classes with section leaders and the friendly environment is very welcoming. Yeah. That's my overall feeling about it.

A: Sums it up very

well. [both laugh]

B: Yeah it's so real. Like looking at research about what the best schools have totally changed- they make professional groups for people to get an actual support system-

S: Yeah!

A: Like the section leader program-

B: Absolutely.

A: Which is maybe what I'll say in my thesis-

S: There you go, yeah!

B: Cool, ok.

End 14:3



