## ABSTRACT

Amanda Hartman McLellan, COMPUTER SCIENCE STUDENTS AND LIBRARY TECHNOLOGY: EVALUATING STUDENTS' CAREER GOALS TO CREATE STRATEGIES THAT INCREASE INTEREST IN LIBRARY EMPLOYMENT (Under the direction of Dr. Heidi Puckett). Department of Educational Leadership, December, 2021.

Academic libraries in the United States often have difficulty recruiting for technology-focused positions. This mixed-methods study examines what technology skills libraries are seeking in entry-level technology positions and explores ways to increase interest in library employment. Utilizing Lent's (2013) social cognitive career theory (SCCT) framework, this study seeks to understand why students study computer science, how computer science students seek future employment, and explores how a large university in the southeastern United States can facilitate interest in applying for library technology positions. Quantitative data was determined through an examination of library technology positions to explore trends and what skills employers are seeking. Qualitative data was gathered from recorded interviews with current junior and senior level undergraduate computer science majors. Combined with an in-depth look at the literature and recruitment needs of libraries, possible solutions to the problem of practice are offered in the form of practical internships, interdisciplinary collaboration, and a potential graduate certificate with the goal of connecting computer science students to software development positions in libraries.

# COMPUTER SCIENCE STUDENTS AND LIBRARY TECHNOLOGY: EVALUATING STUDENTS' CAREER GOALS TO CREATE STRATEGIES THAT INCREASE INTEREST IN LIBRARY EMPLOYMENT

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# COMPUTER SCIENCE STUDENTS AND LIBRARY TECHNOLOGY: EVALUATING STUDENTS' CAREER GOALS TO CREATE STRATEGIES THAT INCREASE INTEREST IN LIBRARY EMPLOYMENT

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## DEDICATION

For my mother, who always wanted her daughter to be a doctor.

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# CHAPTER 1: INTRODUCTION

In her 2014 presentation at the Code4Lib conference, an academic conference for library technologists, Bess Sadler of Stanford University urged the library profession to think of training as an issue of social justice. Training allows new people to be able to participate in a community that may seem otherwise closed-off. Sadler (2014) also encouraged the audience to think about ways to improve access to and support for technology jobs in libraries: "We've got a pipeline problem, so let's build a better pipeline". However, while providing a "convenient visual metaphor," the pipeline can limit research, especially for careers that might not follow a linear path (Soe & Yakura, 2008, p. 178).

## Background of the Problem

Libraries and other cultural organizations, such as archives, museums, and non-profits, have unique technology needs that have evolved over time (Bridges, 2003; Croneis & Henderson, 2002; Fernandez, 2012; Grimes & Grimes, 2008; Howard, 2010; Hu, 2013; Michalak, 2012; Raju, 2014; Ratledge & Sproles, 2017). As collections moved from print to digital, workflows changed, and "there remain few jobs in the library that do not assist in providing electronic access to something or use multiple information technologies" (Michalak, 2012, p. 417). Today, many patrons experience the library primarily through virtual means, such as the website, electronic journals or books, or virtual reference services (Fernandez, 2012). Adding to the complexity, not all libraries operate in the same way, so while prior technology experience is often preferred in library job advertisements, a candidate's experience may not translate to a new workplace smoothly (Harralson, 2001).

The positions responsible for managing library technology initiatives and support are also changing. The role of a systems librarian, once often the sole 'technology' librarian position, has

changed substantially (Engard & Gordon, 2012; Kelley, 2015; Ratledge & Sproles, 2017). Whereas a systems librarian traditionally focused on electronic catalog support, now their work may include "digital repositories, user experience, electronic resource management, assessment, and instructional technology" (Ratledge & Sproles, 2017, p. 303). The titles for these positions have also evolved; many libraries now may employ librarians focused on digital initiatives, emerging technologies, digital infrastructure, and web services alongside or in place of a systems librarian (Fernandez, 2012; Kelley, 2015; Ratledge & Sproles, 2017).

To be eligible for a librarian position in most academic libraries, a person must have earned a Master of Library Science (MLS). While library science programs have expanded their technology course offerings, training for these new roles is not necessarily systematic (Chakrabarti & Mandal, 2017; Dean, 2015; Harralson, 2001; Hu, 2013; Lynch & Smith, 2001; Shu & Mongeon, 2016; Zuo et al., 2017). In academic libraries, technology support roles that do not require the MLS are considered paraprofessional. Paraprofessionals, also sometimes called support staff, typically hold at least a baccalaureate degree and are "trained to understand specific procedures and apply them according to pre-established rules under normal circumstances without exercising professional judgement" (Reitz, 2013). There is a long history of paraprofessional support in all aspects of librarianship, though changes in technology, librarianship, and funding have caused some institutions to assign duties once limited to degreed librarians to traditionally lower-waged paraprofessional staff (Fragola, 2009; Gremmels, 2013; Hill, 2014; James et al., 2015).

In an attempt to expand applicant pools and diversify the profession, many libraries have opened positions to professionals with master's degrees other than the MLS (Harralson, 2001; Oliver & Prosser, 2018; Wilder, 2007b). The need for talent diversification is in part due to the

changing nature of libraries. People are being hired for positions that did not exist in libraries a generation ago (Wilder, 2007a). These new roles are sometimes considered paraprofessional, sometimes 'non-library professional', further blending the line between librarian and paraprofessional (Gremmels, 2013). While much has been written about the professional versus the paraprofessional in regards to status and role (Bruce, 2012; Fragola, 2009; Gremmels, 2013; James et al., 2015; Kreneck, 2017; Litwin, 2009; Schilperoort et al., 2021; Stauffer, 2016; Zhu, 2012), little has been written about what attracts people to paraprofessional roles (Oliver & Prosser, 2018) and there is a gap in the literature when it comes to what skills libraries are seeking in regards to technology-specific paraprofessional positions.

East Carolina University's Academic Library Services currently employs eight people in technology-specific paraprofessional roles. They are responsible for hardware and software support, training, server maintenance, custom application development, website development, and digitizing collections. Though one member of the technology staff does have their MLS, it is not a requirement for any of the positions mentioned. Turnover in the division is relatively low; however, the last time there was a vacancy for a full-time application developer, the search failed twice due to a lack of qualified candidates before a successful hire was eventually made.

## Statement of the Problem

As libraries become increasingly dependent on technology, the recruitment and retention of a technologically savvy workforce are important for the library of today and tomorrow. Libraries have unmet needs regarding technology staff and find recruiting employees with technology education and experience difficult. Technology-focused students are unaware that there is a need in libraries for those with computer science knowledge and skills. By providing a pathway through certification, training, mentorship/sponsorship opportunities, and internships,

East Carolina University (ECU) can sidestep the pipeline problem and create a pathway to successful career matching.

## Purpose of the Study

The purpose of this mixed-methods study was to explore ways to recruit and prepare students for entry-level library technology positions. There is an opportunity to look at the future of libraries and recruit and train the tech-empowered library staff that is needed. Information gathered from the findings was used to inform a curriculum for a potential graduate certificate in conjunction with the computer science department and the College of Education's library science program.

The skills that library employers seek were determined by analyzing positions posted to a library technology website. Recorded interviews with current junior- and senior-level undergraduate computer science majors provided qualitative data exploring how computer science students at ECU are preparing for and engaging with the job market or future studies. Combined with an in-depth look at the literature and recruitment needs of libraries, an outcome of this study is information for a potential curriculum aimed at connecting computer science students to technology positions in non-profit work, such as libraries.

## Study Questions

The study questions are:

1. What do computer science majors look for when selecting a workplace?
    a. Where do computer science students look for jobs?
    b. What role does Career Services play in computer science students' job search?
    c. How do computer science majors interpret library job advertisements?
2. What would attract computer science majors to library technology jobs?

a. Do background/demographics make a difference in attraction?

3. What skills are libraries seeking for their technology positions?
    a. How does the ECU computer science program align with the skills needed for success in a library technology position?

## Theoretical Foundation

Social cognitive career theory (SCCT) was used to investigate why an individual chooses to study a particular discipline (Heinze & Hu, 2009; Kaminsky & Behrend, 2015; Lent et al., 2008; Rogers & Creed, 2011; Wang, 2013). SCCT examines how one's interests, expectations, and goals are shaped by both internal and external factors (Greenhaus & Callanan, 2006; Lent, 2013; Lent et al., 1994). Built on Bandura's (1986) social cognitive theory, SCCT "seeks to create a unifying framework for explaining how people (a) develop vocational interests, (b) make occupational choices, (c) achieve varying levels of career success and stability, and (d) experience satisfaction or well-being in the work environment" (Lent, 2013, p. 115).

Explored in more depth in Chapter 2, SCCT takes into consideration environmental factors, as well as intrinsic factors, on personal choice and uses goals as a way to measure progress (Lent, 2013; Lent et al., 1994).

## Definition of Key Terms

*Academic Library* – There are several types of libraries in the United States, the main three being public, school (K-12), and academic. Academic libraries serve a college or university population. Some academic libraries include special libraries as subdivisions, such as archives, law, and medical (American Library Association, 2007).

*ALA* – American Library Association, the largest professional organization for libraries which also serves as an accreditation body for library science schools (American Library Association, n.d.).

*MLS/MLIS* – Master's Degree in Library Science / Library and Information Science. The degree is required for many professional librarian positions. The master's degree in library science is often shortened to 'MLS' though various programs name their degrees something else, "such as Master of Information Studies, Master of Information, Master of Arts, Master of Librarianship, Master of Library and Information Studies, or Master of Science" (American Library Association, 2006a, para. 13). For academic librarianship, the MLS is typically considered a terminal degree (American Library Association, 2006b).

*Minoritized / Marginalized / Nondominant groups* – people "that have wielded or held less power respectively within institutional settings based on salient demographic characteristics that include race, ethnicity, gender, sexual orientation, gender identity, and disability status as well as the intersectionality of these dimensions" (Chun & Evans, 2018, location no. 536).

*Paraprofessional* – term applies to the role of a library worker without a master's of library science as opposed to 'librarian', which requires the MLS (Bureau of Labor Statistics, U.S. Department of Labor, 2019; Litwin, 2009).

*Sponsorship* – As opposed to mentors who give advice and counsel, sponsors leverage their influence to assign work, make connections, offer constructive feedback, and empower their protégés to grow professionally (Hewlett & Sherbin, 2014, p. 18).

*Systems librarian* – originally, the role of a systems librarian was to manage the hardware and software for a library's catalog. However, in recent years, if filled at all, systems librarian

roles may now include “digital repositories, user experience, electronic resource management, assessment, and instructional technology” (Ratledge & Sproles, 2017, p. 303).

## Assumptions

It was assumed that some computer science majors at ECU would be interested in a library technology position, even if libraries may not be able to compete with industry salaries. It was assumed that libraries have difficulty recruiting the talent needed because they create job advertisements with library-specific technologies rather than recruiting based on foundational knowledge and ability to learn.

## Scope and Delimitations

This study focused on East Carolina University, located in Greenville, North Carolina. It is the only large public university in the Eastern part of the state and has a population of undergraduate students studying computer science, as well as graduate students obtaining their master’s degree in Library Science. ECU has a diverse student body, including transfer students and students with veteran status. ECU is like many rural institutions in that it can be difficult to recruit and retain talent compared with the allure of larger cities with more amenities and higher salaries.

## Limitations

The sample population had already declared their major in computer science, eliminating potential participants from other departments who might be interested in a career in library technology. Not all computer science students are interested in exploring the type of work needed in non-profits such as libraries, and the data reflects that. While focus groups allow for participants to bounce ideas off of each other, it is easy for quiet participants to be minimized (Barbour, 2007). One other limitation may be that the job advertisement data comes from one

source, and while many years were studied, the jobs listed will not reflect every possible position.

## Significance of the Study

This study explored ways to recruit applicants for entry-level library technology positions. A potential outcome could be to build on the findings of this study to create a training pathway to introduce technology-focused undergraduates to the potentials of non-profit work and to highlight the needs that match their skillsets. This could potentially be achieved through a graduate certificate in conjunction with the computer science department and the College of Education's Library Science department. An example curriculum for such a graduate certificate was explored.

Regardless of degree, students are not necessarily learning translatable library technology skills in school; as Sadler (2014) notes, "even now, many of the skills needed to run a digital repository or maintain an integrated library system or sustain an open-source software project aren't something you can learn at most universities". A certificate that provides this knowledge and experience could give graduates an advantage when applying to library technology positions or provide the necessary training for newly hired library paraprofessionals.

While it has been used for other professions and areas of study, SCCT has not yet been applied to libraries, and there has been very little written to address recruitment of library paraprofessional positions.

## Summary

There is a need in libraries and other cultural institutions for employees who have a strong technical background. Though every technology used in libraries may not be taught in an educational setting, ECU has an opportunity to provide specific training and preparation to

students interested in computer science and working in cultural institutions. This research benefits libraries wishing to recruit computer science students to entry-level technology job openings. Chapter 2 presents relevant literature for the study. This chapter includes information about the chosen theoretical framework, provides a history of library technology, and explores the specialized technology needs in libraries. It also examines what draws people to study computer science, library science, and examines the ways libraries recruit for technology positions. Chapter 3 includes the study design and methodology. Additional details are provided in that chapter regarding the sample and instrumentation and a more extensive version of the data collection technique. Chapter 3 also provides information as to the data analysis techniques utilized in the study. Chapter 4 shares the results from the study, and Chapter 5 provides discussion on the results.

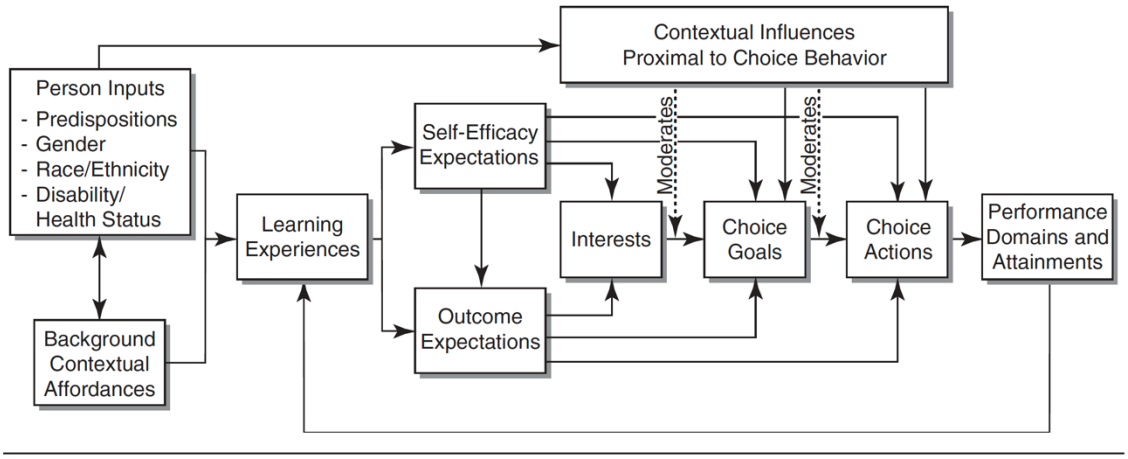
# CHAPTER 2: REVIEW OF LITERATURE

In American academic libraries, technologically savvy employees are increasingly important because of expanded needs from patrons and specialized technology demands from the institutions themselves. However, libraries struggle with recruiting and retaining the necessary technical talent. Computer science graduates are unaware of the technological needs in libraries, and libraries themselves have trouble articulating these needs. This chapter examines the literature applicable to understanding the problem and potential solutions.

## Theoretical Framework

Social cognitive career theory (SCCT) has been used in several studies, including STEM-based research, to investigate why an individual chooses to study a particular discipline (Heinze & Hu, 2009; Kaminsky & Behrend, 2015; Lent et al., 2008; Rogers & Creed, 2011; Wang, 2013). SCCT examines how one's interests, expectations, and goals are shaped by both internal and external factors (Greenhaus & Callanan, 2006; Lent, 2013; Lent et al., 1994). Built on Bandura's (1986) social cognitive theory, SCCT "seeks to create a unifying framework for explaining how people (a) develop vocational interests, (b) make occupational choices, (c) achieve varying levels of career success and stability, and (d) experience satisfaction or well-being in the work environment" (Lent, 2013, p. 115).

As illustrated in Figure 1, SCCT looks at personal attributes developed intrinsically as well as influenced by one's environment (Lent, 2013; Lent et al., 1994). SCCT "assumes that people have the capacity to exercise some degree of agency or self-direction and that they also contend with many factors (e.g., environmental supports and barriers) that can strengthen, weaken, or even override personal agency" (Lent, 2013, pp. 117–118). Lent et al. (2013) break




*Note.* Reprinted by permission of Wiley and Sons.

*Figure 1.* SCCT Factors Affecting Career-Related Choice Behavior, from Lent (2013).

career development into three main variables: “self-efficacy beliefs, outcome expectations, and personal goals” (p. 118).

SCCT defines self-efficacy beliefs as “a dynamic set of self-beliefs that are linked to particular performance domains and activities” (Lent, 2013, p. 118). This is how a person perceives and values their own skills and abilities, which are “subject to change based on future experiences and are responsive to environmental conditions” (Lent, 2013, p. 118) and as such may be influenced by factors such as practice and feedback from an instructor.

Outcome expectations refer to what an individual expects as a result of an action; “whereas self-efficacy beliefs are concerned with one’s capabilities (e.g., ‘can I do this?’), outcome expectations involve imagined consequences of particular courses of action (e.g. ‘if I do this, what will happen?’)” (Lent, 2013, p. 118). Understanding expected outcomes helps people make decisions on whether to invest in a self-efficacy belief as a career, such as someone good at math pursuing an engineering degree. Understanding expected outcomes could also explain “scenarios where self-efficacy is high but outcome expectations are low (e.g. a young woman who is confident in her math-related capabilities but refrains from taking elective math courses because she anticipates negative reactions from her friends)” (Lent, 2013, p. 119).

The third variable in SCCT is that of personal goals, which “offer an important means by which people exercise agency in their educational and occupational pursuits” (Lent, 2013, p. 119). Having goals allows an individual to measure progress, or lack thereof, which “has a reciprocal influence on self-efficacy and outcome expectations” (Lent, 2013, p. 119). Decisions are broken down into choice goals and choice actions because environmental factors may impact one from the other (Lent et al., 1994). Because SCCT acknowledges the importance of environmental supports and barriers on agency, the influence of aspects such as financial aid

receipt or need, college preparedness, and ethnographic differences can be addressed (Wang, 2013).

SCCT has been used by those looking at why students choose STEM majors (Lent et al., 2008; Wang, 2013) but has not yet been applied to why people choose librarianship. By using the SCCT framework, this study examines how best to introduce and support computer science students to library technology positions.

## Literature Review

### History of Library Technology

Though the stereotype of only existing to return books to shelves and to keep visitors quiet persists to this day, librarians have embraced many different technologies and trends as the profession evolved. Like any specialized profession, libraries have unique technology needs. Since the 1970s, when Machine Readable Cataloging (MARC) was introduced to electronically transition the physical card catalog to digital, libraries have been able to enhance and scale their services through electronic means (Croneis & Henderson, 2002; Fernandez, 2012; Hu, 2013; Michalak, 2012). Through the 1980s and 1990s, libraries created robust systems to help manage the purchase, cataloging, and discovery of physical items, created and provided access to digital copies of journal articles and created more and better ways of accessing information. As collections moved from print to digital, workflows changed, and most positions required knowledge of and the ability to use more than one technology (Michalak, 2012).

Emerging technologies, such as the internet, were once feared to threaten traditional librarianship; however, the trend has been to change responsibilities rather than replace people (Taylor et al., 2010). In the forward to the anthology, *Expectations of Librarians in the 21st Century*, Dr. Leigh Estabrook points out that in many of the essays contained in the book,

knowledge and skill with technology is paramount (Bridges, 2003, p. x). These essays, written in the early part of the 2000s, are reflective of a time of technological upheaval in libraries, as the internet had recently become a change agent in the way the world sent and received information.

In the last 10 years, technology has afforded libraries both increased opportunities and challenges. Many patrons today experience the library primarily through virtual means, so it is beneficial when all library staff and faculty are comfortable with technology (Fernandez, 2012). The library of today has expanded its scope from collecting and lending books to include assisting researchers with new publishing models, data curation, virtual spaces, and emerging devices and media formats that "have collectively altered the traditional academic library beyond recognition" (Raju, 2014, p. 163). Technology plays a significant role in this expanded scope. Researchers and students rely on academic librarians being current with technology. Deanna Marcum (2012), in discussing the role of academic librarians, noted that

> researchers on their own cannot take full advantage of technologies of value in their deeply rooted disciplinary practices. Librarians need to help them use these technologies - not in some separate unit out of the mainstream, but as a fundamental service of the research library (p. 35).

With these ventures, new types of positions were created to meet the growing needs (Croneis & Henderson, 2002; Fernandez, 2012; Hu, 2013; Michalak, 2012). In the 1970s through the 1990s, there was a steady rise in technology requirements in library job ads (Lynch & Smith, 2001). Job postings for digital librarians appear as early as 1997 (Choi & Rasmussen, 2009) and the technology skills necessary for librarians have increased (Croneis & Henderson, 2002; Gerolimos et al., 2015; Grimes & Grimes, 2008; Noble, 2018; Wilder, 2007a).

The role of systems librarians, once often the sole 'technology' librarian position, has changed substantially (Engard & Gordon, 2012; Kelley, 2015; Ratledge & Sproles, 2017). Whereas a systems librarian traditionally focused on electronic catalog support, now their work may include "digital repositories, user experience, electronic resource management, assessment and instructional technology" (Ratledge & Sproles, 2017, p. 303). The titles for these positions have also evolved, and many libraries now may employ librarians focused on digital initiatives, emerging technologies, digital infrastructure, and web services alongside or in place of a systems librarian (Fernandez, 2012; Kelley, 2015; Ratledge & Sproles, 2017). The title 'digital initiatives librarian' did not exist before 2002 (Ratledge & Sproles, 2017, p. 308). The profession has increasingly required the ability and aptitude to stay current with technology as more of the work blends with technology through digitization, electronic resources, websites, and more. Positions not traditionally technology-focused now often require knowledge of web markup languages, multiple operating systems, and specific computer applications (Fernandez, 2012; Howard, 2010; Lynch & Smith, 2001). For some librarians, keeping up with the technical requirements can be exhausting: "Librarians undergo constant training as new tools emerge. For many librarians, technological innovation is both stimulating and tiring…as a librarian, you can spend your whole life chasing technology" (Crosby, 2000, p. 13).

In response to advertised needs, library schools integrated information technology concepts into the core courses they were offering (Hu, 2013), and library schools offered more information science courses (Chakrabarti & Mandal, 2017; Dean, 2015; Harralson, 2001; Hu, 2013; Lynch & Smith, 2001; Shu & Mongeon, 2016; Zuo et al., 2017). As a result of this integration, many programs added "and information science" to the library degree (Dean, 2015, para. 18).

Despite a surge in information technology course offerings in a Library and Information Science (LIS) degree, the courses typically are elective and not necessarily focused. The specific skills needed, such as how to "run a digital repository or maintain an integrated library system or sustain an open-source software project, aren't something you can learn at most universities" (Sadler, 2014). Supplemental educational opportunities, such as internships, often provide practical experience missing from the curriculum (Choi & Rasmussen, 2009).

In academic libraries, technology is often siloed in a stand-alone division rather than integrated across the organization (Askey & Hinchliffe, 2017). When libraries (and library leaders) view technology as separate from the library's central role, it can drastically undermine output, customer service, and morale (Askey & Hinchliffe, 2017). Because technology needs differ from library to library, from full control to data centers to maintaining access to vendor-supplied products and services, library technology positions can include "web managers, user experience specialists, content developers, software developers and desktop support specialists, as well as database, system, network and application administrators" (Askey & Hinchliffe, 2017, p. 5). These positions ask for a wide variety of skills and output a diverse set of outcomes, yet many libraries may lump all under 'tech people' who are treated as if they are interchangeable (Askey & Hinchliffe, 2017).

A lack of nuanced understanding, as well as siloing, has several adverse effects, including perpetuating the cycle of misunderstanding "where information technology work happens in a club-like environment behind a mysterious curtain…where women and people of color may be unwelcome" (Askey & Hinchliffe, 2017, p. 7). Since libraries find it difficult to recruit and retain technology leadership positions, technology staff are often not a part of strategic planning. Library technology staff find themselves tasked with implementation without being part of the

development, which can impede innovation and keep libraries in a continual state of being behind the technological curve (Askey & Hinchliffe, 2017).

The bulk of the literature is focused on the changing training needs for credentialed librarians (Bridges, 2003; Choi & Rasmussen, 2009; Croneis & Henderson, 2002; Crosby, 2000; Gerolimos et al., 2015; Grimes & Grimes, 2008; Howard, 2010; Marcum, 2012; Neal, 2006; Ratledge & Sproles, 2017). The literature is lacking in regard to what technology skills are needed for technology support staff/paraprofessionals in libraries, though one article from 2000 does attempt to address this gap (Troll & Myers, 2000).

**Specialized Technology Needs in Libraries**

A library is its own ecosystem, from facilities to housekeeping to accounting and marketing (Neal, 2006; Oliver & Prosser, 2018). Library technology staff have roles with hardware and software support, custom application development, open-source software creation and maintenance, database administration, systems support, digitization, metadata creation, and more. Because there are numerous library systems and technologies, experience with one may not directly translate to the specific technologies at another library (Harralson, 2001).

Many libraries have limited or no staff dedicated to technology, making them increasingly dependent on vendors for software and software support as well as reducing usability and innovation (Sadler, 2014). Vendors who typically were "founded by people with the best of intentions…found themselves dealing with customers who in a chronically under-funded profession were never able to pay realistic licensing fees [and therefore] scrimped on maintenance and development" (Schneider, 2008, p. 17). Libraries found they were somewhat stuck with sometimes outdated software that did not perform all that well, and no real avenue to request improvements (Schneider, 2008).

In response, many libraries have embraced open source software (OSS) development as not only a way to build updated software that meets their institutions' needs, but also as a manifestation of their commitment to providing free access to information (Fernandez, 2012; Khode & Chandel, 2016; Puckett, 2012; Schneider, 2008; Singh, 2014). Because libraries already have a precedent for collaborative work, and do not compete for users in the same way as commercial entities might, OSS development is beneficial to the patrons and the institutions involved (Fernandez, 2012). OSS source code can be made freely available for distribution and modification, allowing users and institutions to adopt and adapt as needed.

OSS is not a viable solution for every institution, for while initial software costs do not exist, money must be spent on server hardware and programmer time for installation, customization, and support. Because development of OSS is typically grassroots, the software can be abandoned and no longer supported by its creators at any time, there may not be help beyond a community forum, and there is typically little formal professional education on developing and maintaining OSS (Khode & Chandel, 2016).

**What Influences Students to Major in Computer Science**

Several studies have been conducted to understand why undergraduates major in computer science or information technology (Archer et al., 2016; Carter, 2006; Gallup-Strada Education Consumer Pulse, 2017; Germeijs et al., 2012; Heinze & Hu, 2009; Montmarquette et al., 2002; Simon et al., 2017; Wang, 2013). There are multiple and often complex influences on major choice that can be categorized into four main areas: "individual, psychological, contextual and social" (Wang, 2013, p. 1,111). A common theme in the literature is that prior positive experience with the subject matter is vitally important in choosing a major (Archer et al., 2016; Heinze & Hu, 2009; Wang, 2013). Positive experiences manifest in high self-efficacy, defined as

"individuals' confidence in their ability to successfully perform or accomplish…tasks or problems" (Wang, 2013, p. 1,087). These positive experiences could be through formal class or extra-curricular activity (Archer et al., 2016; Lent et al., 2008; Wang, 2013). Heinze and Hu (2009) found that students who thought of themselves as more experienced with computers were more likely to major in computer science. While students with prior positive experience with computers and technology are more likely to choose that as a major, it is important to note that research demonstrates that race and gender play a factor in a person's self-efficacy, and may require early intervention (Wang, 2013).

Heinze and Hu (2009) recommend that universities might increase enrollments in technology classes by "providing a broader picture of IT careers and the team skills and business acumen that are required by today's companies" (p. 471). This aligns with some of the criticism from library technology practitioners, such as a blog post from Coral Sheldon-Hess (2015), a library programmer, that criticized her computer science education. Instead of starting off learning a foreign computer language, she suggests that the introduction to computer science be structured to provide context, cover basic concepts, and explore how a computer science degree could be used (Sheldon-Hess, 2015). This also aligns with the recommendations from Acheson and Rybarczyk (2016) on how to integrate career services into the computer science curriculum.

Interestingly, Heinze and Hu (2009) found little correlation between social influence and choice of the information technology major, noting that the sample of students in the United States may be less susceptible to the opinions of family and friends, but that "a high level of perceived support might make a student feel more *satisfied* with a major once it has been chosen" (Heinze & Hu, 2009, p. 470). The study also found that students do not seem to have a

strong understanding of the job market, so future employment opportunity does not seem to be a driving factor in major choice (Heinze & Hu, 2009).

**What Influences People to Study Librarianship**

The reasons people cite for pursuing librarianship are varied, such as an influential librarian or a love of literature (Ard et al., 2006; Clarke & Kim, 2018; Oliver & Prosser, 2017; Winston, 1998). Librarianship is widely undervalued or misunderstood (Harrison & Kim, 2011; Josey, 1994; Kelly, 2019), yet key to recruitment to the profession seems to be an understanding of what a librarian does (Ard et al., 2006; Winston, 1998). Brand awareness may also be an obstacle; when attempting to recruit undergraduates to library school, recruiters discovered that using 'librarian' or 'library' "words seemed to turn off students while the kinds of work that librarians do had some appeal" (Bright et al., 2006, p. 130). Many people point to their love of reading as inspiration, though despite the technological needs of the library of today, few cite their love of technology as a reason for pursuing librarianship (Ard et al., 2006).

In surveys asking when one first aspired to be a librarian, only 6% of respondents stated before college, the highest number being 39% while in college and 32% five or more years after college (Taylor et al., 2010, p. 38), so inspiration from an admired professor or a student job in a library are two of the most significant influencing factors (Ard et al., 2006; Kim & Sin, 2008; Poole, 2017; Taylor et al., 2010; Winston, 1998). Once aware of librarianship, "the promise of an interesting job draws far more people into librarianship than compensation, clientele, or prestige" (Ard et al., 2006, p. 241).

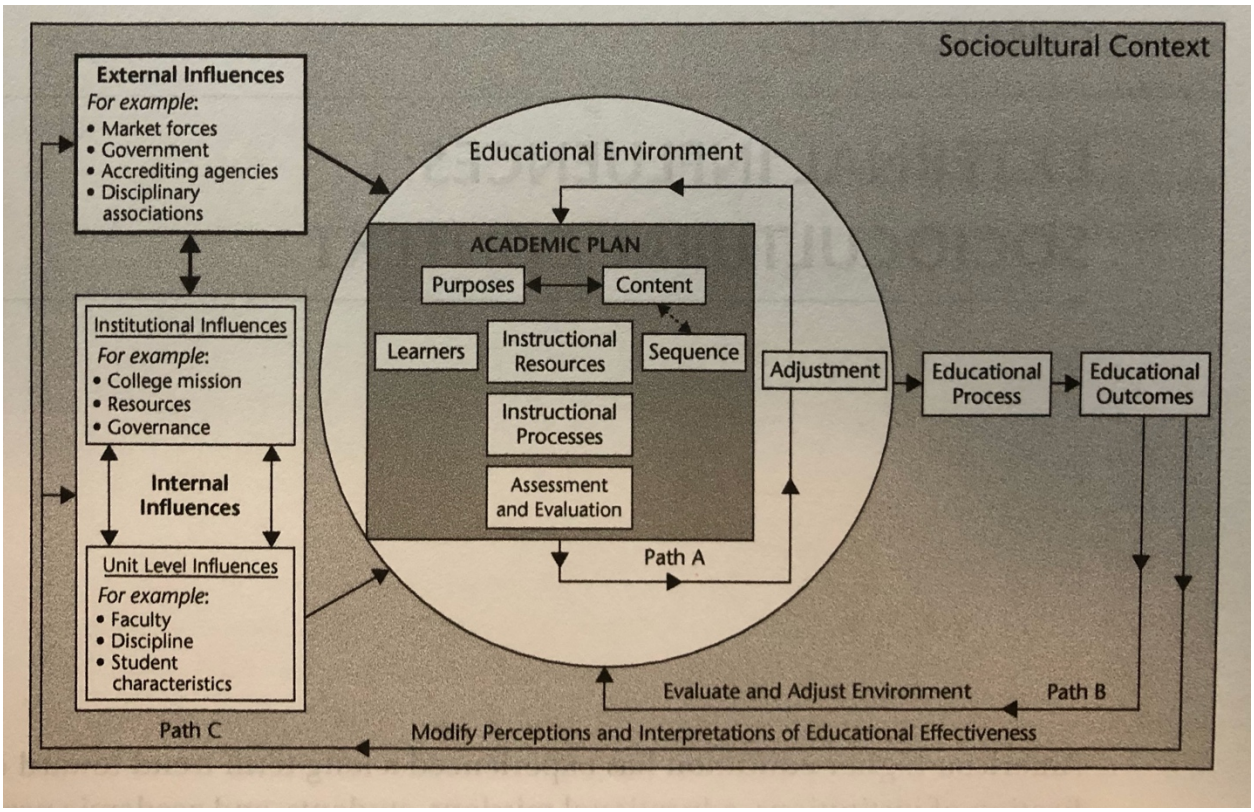
**Examination of Current Library Technology Training Programs**

Outside of library and information science master's programs, there are a few undergraduate programs focused on libraries. Worldwide, there are roughly 100 undergraduate

programs (Zins & Santos, 2017). The American Library Association (ALA) list of Library Degree Programs lists several institutions offering minors, certificates, and bachelor's degrees (American Library Association, 2015) though the list is not comprehensive. Undergraduate programs in information science have existed since the 1970s (Goulding, 2001; Griffith, 1993; Lazorko, 2004). Those programs with undergraduate offerings focused explicitly on technology include nine in California, a community college in Connecticut, two in Illinois, one in Kentucky, two in North Carolina, and one in West Virginia (American Library Association, 2015). In North Carolina, Central Carolina Community College offers a certificate in library technology (Central Carolina Community College, n.d.), and University of North Carolina Chapel Hill offers a bachelor's degree and a minor (Lazorko, 2004; University of North Carolina Chapel Hill, n.d.). There is little research regarding the assessment or efficacy of undergraduate library and information science programs or certificates.

**Designing College Curriculum**

Lattuca and Stark (2009) provide a comprehensive history of curriculum development in higher education. Some of the most significant differences in how a curriculum might be applied stems from the fact that "college faculty members in different fields hold varying beliefs about educational purposes" (Lattuca & Stark, 2009, p. 8). Likewise, different institutions may emphasize one statement of purpose over another, and the authors suggest referring to curriculum as an academic plan to reset any pre-conceived ideas and move out of rhetoric into action (Lattuca & Stark, 2009). Lattuca and Stark (2009) break down the development of an academic plan into eight elements: purposes, content, sequence, learners, instructional resources, instructional processes, evaluation, and adjustment. Illustrated in Figure 2, this model has many benefits, including the ability to dynamically shift according to learner needs (Lattuca & Stark,




*Note.* Reprinted by permission of Wiley and Sons.

*Figure 2*. Academic plans in sociocultural context, from Lattuca and Stark (2009).

2009). This model focuses on course objectives and outcomes in curriculum planning, rather than first considering content, which could lead to information provided without context for outcome (Lattuca & Stark, 2009). This model also increases faculty autonomy while encouraging collaboration. Through the SCCT lens, outcomes align well with an individual's goals, and internal and external factors are considered.

Because of the different approaches to learning outcomes, and limited time faculty have to teach students the material, "there is usually a disconnection between the curriculum and career development" (Acheson & Rybarczyk, 2016, p. 117). Acheson and Rybarczyk (2016) suggest that career development be integrated into computer science curricula as early as possible to help students decide on future courses, including providing connections through a first-year seminar, service learning opportunities, and a capstone or internship.

**The Computer Science Curriculum**

Due to the rapid nature of computing technology, the computer science curriculum has expanded since Mary Shaw's (1985) publication of The Carnegie-Mellon Curriculum for Undergraduate Computer Science, one of the first books addressing how to teach computer science at a college level. Even then, Shaw (1985) explained the need for flexibility and adaptability due to the quickly expanding discipline and the need to integrate theory and practice. Predating even Shaw's work, the Association for Computing Machinery (ACM) and IEEE Computer Society have attempted to establish undergraduate curricular guidelines roughly every 10 years, with the most recent published in 2020 (Association for Computing Machinery & IEEE Computer Society, 2020). Due to the rapid growth in the field, since 2013 the report has differentiated between computer science and the related fields of computer engineering, information systems, cybersecurity, information technology, and software engineering

(Association for Computing Machinery, n.d.; Association for Computing Machinery & IEEE Computer Society, 2020). Some institutions have expanded the computer science curriculum to include a wide variety of more in-depth topics including: cloud computing (Foster et al., 2018), heterogeneous computing (Targeted News Service, 2018) and concurrency and verification (Pedersen & Welch, 2018).

Because of the demand for earlier educational opportunities, schools like Carnegie-Mellon University offer free online courses aimed at high school level learning, as well as teacher training (Targeted News Service, 2019). Many K-12 schools are adopting aspects of computer science education which help attract students to study computer science in college (Heinze & Hu, 2009; Tran, 2018; Wang, 2013).

**Recruitment for Library Technology Jobs**

With so many people unaware that there are specialized needs in libraries, it can be challenging to recruit for specialized jobs, such as technology support. In an attempt to expand applicant pools, many libraries have opened positions to professionals without the MLS (Harralson, 2001; Oliver & Prosser, 2018; Wilder, 2007b). The need for talent diversification is in part due to the changing nature of libraries; people are being hired for positions that did not exist in libraries a generation ago (Wilder, 2007a). In the mid-1980s, roughly 7% of new library hires had no library education, whereas in 2005, that number was 20% (Wilder, 2007b, p. 3). These new hires are working as "media specialists or experts in management fields such as personnel, fiscal matters, systems, preservation, etc." (Oliver & Prosser, 2018, p. 614).

Libraries are competing with many other industries, as there are more IT job openings than there are qualified people (Evans, 2018; Tapia & Kvasny, 2004). With the expanding

technology offerings from library graduate programs, many LIS graduates are drawn to work outside of libraries, often due to higher salaries (Harralson, 2001; Taylor et al., 2010).

Two of the top reasons people choose a career in librarianship are because they were inspired by a role model and because they are attracted to the 'service-oriented characteristics' (Kim & Sin, 2008; Taylor et al., 2010; Winston, 2001). Similar to librarians who often consider their work sacred, or a "higher" calling (Maxwell, 2006; Winston, 1998), professional women in science, engineering, and technology fields are more likely than their male counterparts to view their work as a calling, and cite a "desire to make the world a better place" as a motivating factor in the pursuit of their careers (Hewlett & Sherbin, 2014, p. 6). This has been termed 'vocational awe' and has connections to jobs where one is expected to be honored just to be part, which might manifest in lower pay and burnout (Ettarh, 2018).

In library literature, much is written about recruitment practices for a wide variety of positions, from advice to new librarians who wish to get a job to how, especially academic libraries, need to improve their recruitment practices to stay competitive (Bridges, 2002; Durán et al., 2009; Raschke, 2003; Sproles & Detmering, 2010). There are several critiques of the slow process and significant cost of recruiting academic librarians and calls for modernizing hiring practices and investing in retention (Bridges, 2002; Raschke, 2003). Technology positions in libraries are no different; Raschke (2003) critiques unrealistic expectations, saying "job requirements, whether required or preferred, end up as a potpourri of Olympic-size standards thrown in by an administrator or search committee trying to meet everyone's needs and please every constituency" (p. 61). Search committees want candidates who "are creative, proactive, risk takers, innovators, independent yet collaborative, lifelong learners, and visionaries" (Eckard

et al., 2014, p. 108), but who also have previous experience and a varied skillset (Choi & Rasmussen, 2009; Eckard et al., 2014; Harralson, 2001; Raschke, 2003).

**Diversity in Libraries and STEM**

Though outside the scope of this research project, it is important to note that both libraries and STEM fields in the United States have struggled with the recruitment and retention of minoritized populations. White women had early access to librarianship, whereas people of color have had to fight for representation, and librarianship has not kept pace with the changing national demographics (Acree et al., 2001; Dean, 2015; Harralson, 2001; Josey, 1994; Kim & Sin, 2008; Semenza et al., 2017; Stauffer, 2016; Vinopal, 2016). Libraries position themselves as "provider of equal services to all" (Gulati, 2010, p. 292) and that is not necessarily reflected in the organizational makeup, the collection, and the services provided (Acree et al., 2001; Gulati, 2010; Josey, 1994; Shorter-Gooden, 2013).

Research shows that many Science, Technology, Engineering, and Mathematics (STEM) fields face similar diversity concerns (Baenninger, 2011; Daldrup-Link, 2017; Demaiter & Adams, 2008; Hewlett & Sherbin, 2014; Karukstis, 2009; King, 2013; Ko et al., 2013; McGee, 2018; Ong, 2011; Stoet & Geary, 2018; Tapia & Kvasny, 2004; Towns, 2010). Despite being early contributors to computer science, women were relegated to the sidelines by the 1980s (McGee, 2018; Tapia & Kvasny, 2004). Still today, technology positions tend to skew masculine, which can limit the number of women who apply or advance (Demaiter & Adams, 2008; Hewlett & Sherbin, 2014; Tapia & Kvasny, 2004; Woo et al., 2018).

There is no shortage of literature and research highlighting the importance of a diverse workplace (Brown & Hesketh, 2004; Chun & Evans, 2018; Dunn & Backus, 2015; Herring, 2009; Hewlett & Sherbin, 2014; Hirsch, 2017; Hoogendoorn et al., 2013; Hsieh et al., 2018; Kim

& Sin, 2008; McLain et al., 2016; Noland et al., 2016; Shorter-Gooden, 2013; van Knippenberg et al., 2013; Wachter-Boettcher, 2017). Culturally competent librarians and library staff impact collection development, events, and customer service.

## Summary and Conclusions

Through social cognitive career theory, libraries can examine what factors influence a computer science major to choose that area of study and how that might align with why people work in libraries. By understanding what specialized technology libraries need, integrating career services, and using theory to match students to employment, educational institutions such as ECU can prepare students for future employment as library technologists. By preparing students for working in the library of tomorrow, ECU can position itself as a leader in library technology. Chapter 3 includes the proposed study design and methodology. Additional details are provided in that chapter regarding the sample and instrumentation and a more extensive version of the data collection technique. Chapter 3 also provides information as to the data analysis techniques to be utilized in the study.

# CHAPTER 3: RESEARCH METHODS

Libraries have difficulty attracting and retaining employees with computer science backgrounds. As seen in the literature, there are many reasons for this, among them, lack of awareness, lengthy hiring practices, and potentially restrictive credential requirements (Bridges, 2002; Harralson, 2001; Kim & Sin, 2008; Oliver & Prosser, 2018; Poole, 2017; Raschke, 2003; Tapia & Kvasny, 2004; Wilder, 2007a). The purpose of this mixed-methods study was to explore ways ECU can make computer science majors aware of entry-level library technology positions and prepare them for success in those positions. Here, there is an opportunity to look at the future of libraries and recruit and train much-needed tech-empowered library staff.

The specific technologies and skills libraries seek were determined by evaluating a popular international library technology listserv. Following the social cognitive career theory framework, focus group interviews were conducted to determine what current ECU computer science majors seek in a future workplace and where they look for jobs. The focus groups reviewed three example entry-level positions and discussed attractiveness and concerns and explored what additional training the students feel they would need to be successful in that position. The data collected via the listserv evaluation and focus group interviews allowed me to answer the following study questions:

1. What do computer science majors look for when selecting a workplace?
    a. Where do computer science students look for jobs, and do they utilize Career Services?
    b. How do computer science majors interpret library job advertisements?
2. What would attract computer science majors to library technology jobs?
    a. Do background/demographics make a difference in attraction?

3. What skills are libraries seeking for their technology positions?
    a. How does the ECU computer science program align with the skills needed for success in a library technology position?

These questions seek to understand what factors are most important to an ECU computer science student seeking employment and how that might align with what libraries are seeking. This information, along with an examination of the literature, allowed me to explore ways ECU can direct students to and support students in careers in library technology. It also gives insight into how students view library technology job advertisements. This chapter introduces the research design and implementation and discusses the methodology for analyzing the mixed methods data.

## Research Design and Rationale

A concurrent mixed methods approach was chosen to capitalize on the strengths of both quantitative and qualitative research (Burkholder et al., 2020; Creswell & Creswell, 2018). Since "quantitative research embodies an etic perspective based on existing theory and research as interpreted by the researcher, and qualitative research is characterized by an emic perspective designed to capture the perspective of those being studied" (Burkholder et al., 2020, p. 114), a mixed-methods approach allows me to adopt an intersubjective perspective by integrating objective data gathered from the listserv with the more subjective data gathered from interviews. A mixed-methods approach also allows for understanding data through confirmation or triangulation (Small, 2011). Other methods were considered, such as sequential design, but a concurrent mixed methods design has the benefit of allowing simultaneous evaluation of the listserv dataset and conducting focus group interviews.

The specific skills library employers seek were determined through a quantitative analysis of positions posted on a library technology listserv. Since no comprehensive examination of paraprofessional library technology positions exists, the mixed methods approach allowed me to concurrently gather results from focus groups and evaluate and code the data from the library technology listserv. Without this evaluation, the focus group interviews would be enough to answer the bulk of research questions 1 and 2, but there would be no way of answering question 3.

Recorded focus group interviews with junior and senior-level computer science majors provided qualitative data; for example, students were given job advertisements from this listserv and asked why or why not they would apply. The groups discussed their familiarity with the top mentioned skills from the listserv data and what they would do to become familiar with those skills. A recorded focus group interview with computer science faculty was planned to investigate how the faculty members approach career development and educational outcomes. However, pandemic schedules did not allow this to materialize.

Quantitative data from the focus group interviews establishes a base in understanding how undergraduate computer science majors approach the job search. Demographic data was gathered to look for patterns in responses across similar respondents (Creswell & Creswell, 2018). The research design was intended to build on common quantitative methods of job analysis to categorize the specific skills being sought by libraries and then obtain student reactions to sample job descriptions.

As seen in Table 1, study questions 1 and 2 were addressed through focus group interviews (see Appendix C) with upper-level computer science majors. To answer study question 3, the skills employers are seeking were determined through a quantitative analysis of

Table 1

*Corresponding Data Source to Research Question*

| Research Question | Data Source |
|---|---|
| 1. What do computer science majors look for when selecting a workplace? | Student focus group questions 2, 3 |
| a. Where do computer science students look for jobs, and do they utilize Career Services? | Student focus group question 2 |
| b. How do computer science majors interpret library job advertisements? | Student focus group question 3 |
| 2. What would attract computer science majors to library technology jobs? | Student focus group questions 3, 4, 5 |
| a. Do background/demographics make a difference in attraction? | Student focus group question 1 |
| 3. What skills are libraries seeking for their technology positions? | Listserv data |
| a. How does the ECU computer science program align with the skills needed for success in a library technology position? | Student focus group questions 5 and 6; Faculty focus group |

*Note.* The faculty focus group did not occur, but the data gathered would have helped answer question 3a.

positions posted on the Code4Lib listserv. This is a popular research method in library literature, where technology requirements for librarians have been analyzed (Choi & Rasmussen, 2009; Croneis & Henderson, 2002; Gerolimos et al., 2015; Raju, 2014; Ratledge & Sproles, 2017), but a comprehensive evaluation of what knowledge, skills, and abilities that hiring libraries are seeking for technology staff positions does not yet exist.

The Code4Lib listserv was chosen because it is a job board specifically dedicated to all levels of technology positions in libraries, museums, and other cultural institutions, has wide appeal with an international audience, and there are no cost barriers in posting positions. Though computer science students would not likely be aware of this listserv, the jobs posted are also posted elsewhere, such as college job boards, newspapers, and websites such as Monster and Indeed. The Code4Lib data available goes back to 2009, though the dataset was limited to study the past three years for most current data. One possible limitation to this aspect of the study is that this is the only data source for job positions utilized. This limitation means that it is not wholly representative of all the library technology jobs possible.

The recorded focus group and interviews with computer science students, following a protocol informed by the analysis of the listserv (see Appendix C), provided qualitative data collected in a natural setting. Participants were given three examples of positions pulled from the listserv (see Appendix E) and asked to explain why they would or would not apply. Participants also discussed if ECU were to offer a minor or graduate certificate in library technology, what that might entail, and if that would interest them.

A mixed-methods approach was chosen to allow for information obtained through quantitative methods from the job description analysis to be analyzed alongside qualitative focus group data. Alone, the online survey and job description analysis are useful but do not answer the

key aspects of research question 2. Without further interviews that allow for in-depth questioning and direct observations (Yin, 2017), it would be difficult to fully answer the research questions, address any outlying information, and recommend future programs.

**Population**

At its founding in 1907, East Carolina University, then called East Carolina Teachers Training School, was envisioned as an educational hub housed in Greenville, North Carolina, a "small but thriving tobacco town on the Tar River" (East Carolina University, 2018, para. 2). Due to being halfway between the state capital of Raleigh and the Atlantic Ocean, Greenville is the commercial and cultural hub for much of eastern North Carolina (City of Greenville, 2019). The city has a population of just under 100,000 (City of Greenville, 2019, para. 17), and ECU's total enrollment is slightly below 30,000 students (ECU News Services, 2018, para. 1). Still reflecting the tobacco town roots, the surrounding counties are primarily rural (Rash, 2017). As with many rural institutions, it can be difficult to recruit and retain talent with the allure of larger cities with more amenities and higher salaries.

Not all ECU students live in Greenville. ECU has a strong distance education program that was established in the late 1940s and continued to grow as technology improved the ability to offer instruction, first through television and later, the internet (East Carolina University, n.d.b). Beginning around the same time as distance education offerings, the library science program at ECU began in 1939 and today is offered entirely online (East Carolina University, n.d.c). With recent accreditation from the American Library Association, ECU's library science program has the highest enrollment for a master's program in the College of Education, with an average of 258 enrolled students each fall from 2016-2019 (East Carolina University, 2019b).

Comparatively, the computer science program at ECU has an average of 448 undergraduate students each fall from 2016-2019 (East Carolina University, 2019b). It is important to note that the technology systems department is separate from the computer science department at ECU; a comparison is available in Figure 3. For this study, I am working specifically with the computer science department, not the technology systems department. Computer science was specifically chosen, as that department's stated goal is to "help humanity by solving real-world problems through the innovative and creative use of computer hardware and software" (East Carolina University, 2019a, para. 1). This aligns well with the library's mission of connecting people with information (Joyner Library, 2019) and the skills and knowledge often requested in library technology positions.

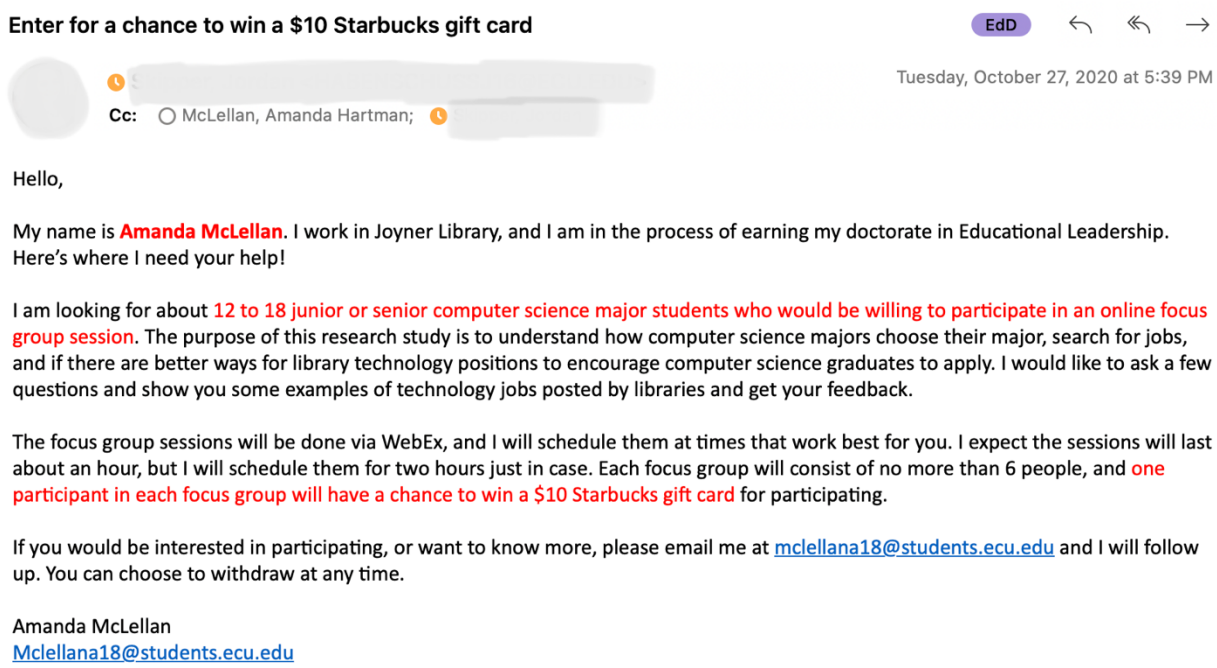
**Sample and Sampling Procedures**

The focus group was chosen with purposive sampling. Working in conjunction with the chair of the computer science department, an invitation to participate in a focus group interview was sent to all junior- and senior-level computer science majors. Since the "aim of 'purposive' or 'theoretical' sampling is to reflect diversity, not to achieve representativeness" (Barbour, 2007, p. 72) it was chosen to include as many students as possible from minoritized groups, including race and gender as well as transfer students and those with veteran status. Juniors and Seniors were chosen as they are the most likely to have participated in or considered the job market and job search process. Since there were few volunteers during the purposive sampling phase, snowball sampling was also employed to attempt to reach more participants. Participants were asked if they knew any classmates who would be willing to answer questions, leading to one volunteer.

| | Fall 2016 | Fall 2017 | Fall 2018 | Fall 2019 |
|---|---|---|---|---|
| **College of Engineering and Technology** | | | | |
| **Computer Science** | **429** | **454** | **454** | **454** |
| 11.0701 Computer Science (BA) | 107 | 94 | 52 | 27 |
| 11.0701 Computer Science (BS) | 322 | 360 | 402 | 416 |
| 14.0903 Software Engineering (New 2018) (BS) | 0 | 0 | 0 | 11 |
| **Construction Management** | **427** | **558** | **606** | **631** |
| 15.9999 Construction Management (BS) | 427 | 558 | 606 | 631 |
| **Engineering** | **702** | **572** | **590** | **555** |
| 14.0101 Engineering (BS) | 702 | 572 | 590 | 555 |
| **Technology Systems** | **1,175** | **1,261** | **1,287** | **1,310** |
| 11.0103 Information and Computer Technology (BS) | 243 | 277 | 280 | 308 |
| 15.0612 Industrial Distribution and Logistics (BS) | 140 | 123 | 114 | 112 |
| 15.0612 Industrial Technology (BS) | 599 | 609 | 656 | 658 |
| 15.0613 Industrial Engineering Technology (BS) | 118 | 157 | 153 | 134 |
| 15.1301 Design (BS) | 75 | 95 | 84 | 98 |
| **College of Engineering and Technology Total** | **2,733** | **2,845** | **2,937** | **2,950** |
| | | | | |
| **Total** | **2,733** | **2,845** | **2,937** | **2,950** |

*Note*. Data retrieved from East Carolina University - https://performance.ecu.edu/portal/

*Figure 3.* Undergraduate enrollment for ECU College of Engineering and Technology 2016-2019.




*Note*: Screenshot by author. Contact information for department's administrative assistant, who sent the email, has been redacted.

*Figure 4*. Initial email to computer science students.

A brief outline of the purpose of the study was included in the initial email (see Figure 4), as well as commitment expectations and requirements. Focus groups were formed based on available time to meet and limited to no more than six participants per group to allow for easier transcription and better small-group interaction (Barbour, 2007). The initial goal was to form at least two focus groups to allow for inter-group comparisons and to allow for capturing of 80% of codes or themes (Guest et al., 2017). Scheduling difficulties meant only one focus group was formed, and two additional individual interviews consisting of the same questions were conducted.

To attract a higher number of responses to the invitation, all participants were entered into a drawing for a $10 Starbucks gift card. One gift card was available for each focus group. Participants were assigned a number after the focus group sessions, and a number generator chose the winning numbers at random.

**Ethical Considerations and Informed Consent**

Since the study involved working with human subjects, IRB approval was required (see Appendix A). Before collecting any data, I completed the Collaborative Institutional Training Initiative (CITI) training. This training enforces the rationale for IRB and ensures that I understand the importance of participant protection when working with human subjects.

Following IRB approval, the focus group invitation was sent via ECU email to all junior and senior level computer science majors who were asked to volunteer. Two follow-up invitation reminder emails were sent. When a potential participant expressed interest, they were sent the informed consent statement (see Appendix B) as required of an exempt study. This purpose and participant rights were reiterated to the participants at the beginning of each session. Participants

had the right to withdraw from the study at any time, either by not responding to the invitation for participation, or, if selected, by choosing to no longer participate.

The participants were informed that due to the group nature of a focus group, answers might not be confidential (Barbour, 2007), though no identifying information would be published, the data would be de-identified, and that all answers would remain as confidential as possible. Participants had the right to choose to participate and not answer every question. The nature of the questions posed a low risk for sensitive information, but it would be possible. An encrypted key document with participant unique IDs and contact information is maintained in my ECU sanctioned OneDrive and password protected for the duration of the study. Raw data will be stored up to one year beyond the completion of the study, then purged. Aggregate, de-identified data will be stored indefinitely.

Focus group sessions were recorded via WebEx and transcribed with Otter.ai, and were de-identified. Video recording via WebEx allowed for clarification on who is speaking if the audio recording is unclear and provided the ability to observe body language. Otter.ai is an interviewing application and website that uses artificial intelligence to transcribe the audio recording. Once the interview was transcribed, the video file, as well as the transcription, were stored in my secure OneDrive account and not on WebEx or Otter.ai's servers.

**Instrumentation**

A qualitative semi-structured focus group interview protocol (see Appendix C) was developed for this study. Several questions were inspired by the University of California's Higher Education Research Institute's College Senior Survey (University of California, Los Angeles, 2019) and others inspired by Gallup Strada's report "Where Students Get Valued Advice on What to Study in College" (Gallup-Strada Education Consumer Pulse, 2017). The

focus group interview questions and protocol were reviewed by colleagues with computer science and library science expertise to ensure validity.

A semi-structured protocol allowed for answering study questions 2b and 3a while also allowing freedom to cover additional applicable topics in response to natural conversation. This protocol allowed the ability to probe deeper on interesting responses, solicit opinions about three example job advertisements for library technology positions, and explore how ECU could match curriculum with job requirements.

**Procedures**

This study has two datasets: the job descriptions from the listserv and the focus group responses. The listserv data was downloaded from https://jobs.code4lib.org/jobs via the Google Chrome plugin DataMiner for Chrome. Described in further detail in Chapter 4, this plugin automates data collection by copying text from a website and copying it into a spreadsheet for further analysis. The plugin pulled the job title, location, date posted, status, and link into a CSV file. The open-source application OpenRefine was used to initially sort the downloaded information and filter out position descriptions that were outside of the scope of this study, such as temporary positions or those located outside of the United States. Positions that required a master's degree or higher were also filtered out at this time, as the focus of this study was aimed at entry-level positions obtainable by a recent computer science graduate. The Code4Lib data available goes back to 2009, though the dataset was limited to study the past four years for most current data.

Once the listserv dataset had been limited to scope, I saved a .pdf of each relevant job advertisement and uploaded it to NVivo 12 for further analysis. This is described in further detail in Chapter 4.

Following IRB approval, an invitation to the focus group interviews was sent to current computer science majors via ECU email (see Figure 4). Perhaps because of a shortened semester due to COVID-19, no participants volunteered the first semester that the invitation was extended, and the invitation was sent again the following semester. The study originally intended on utilizing in-person focus groups; however, COVID-19 prompted the use of virtual tools. The semi-structured focus group interviews were recorded using WebEx. A transcript was made from the recording using the transcription application Otter.ai which uses artificial intelligence to transcribe. These transcriptions were used to code and find common themes and codes in comparison with the quantitative data previously gathered. Deductive coding using codes based on SCCT were combined with inductive coding based on common themes from participant transcripts (Barbour, 2007, pp. 116–127).

**Pilot Study**

In Spring 2019, a small, qualitative pilot study was conducted. The study sought to explore what motivates computer science majors at ECU to choose that field of study and to examine the preparation the students may receive to ensure success in the job market or future studies. I interviewed a past graduate of the ECU computer science program who currently works in an information technology position at the university library. This interview provided context when compared to future focus group interviews with current computer science students at East Carolina University.

The interview lasted a little more than twenty minutes and took place in my office in Joyner Library. The interview was recorded, transcribed, and coded. The participant has worked in the ECU libraries for the last fifteen years in various technology roles. He is the only person in the library technology department to have graduated from ECU's Computer Science program. In

addition to this interview, the departmental website for the Computer Science program was analyzed for starter and emergent codes.

The participant volunteered to be interviewed. He was not compensated for his time but was permitted to do so during work hours. At the time, I was his direct supervisor, but I made sure that the participant understood that participation was voluntary and would have no relation to his performance evaluation.

The starter codes from the literature were Exposure, Preparation/Education, Mentorship/Sponsorship, Hurdles, and Goals. After comparing the interview with the Computer Science department's website, one emergent code, "Vocational Awe", arose as a subcode of Goals. Vocational awe is the idea that someone considers their job to be more a calling, and has been connected to jobs where one is expected to be honored just to be a part of the field, which might manifest in lower pay and burnout (Ettarh, 2018).

Without prior exposure to technology, a student is less likely to pursue a degree in computer science. These findings seem in alignment with the interview participant, who spoke of having early access to a personal computer and the agency to take it apart and put it back together again. Though his computer science coursework did give him the foundation to build on, he did say that the curriculum was "very theory-based" and general, but "they just talked about the technical nuts and bolts of the theory of computer science and nothing really on how to make it applicable or usable" (M. Tucker, personal communication, March 15, 2019).

Some of the hurdles the participant faced while going to school are common, and I expect to find them replicated with the current computer science majors. He began his education at a community college and transferred to ECU. The participant had a 40-mile commute and worked part-time. The participant indicated he had difficulty determining what classes to take to ensure

he would complete the degree and graduate. The current Computer Science Department's website still does not offer much in the way of aid for students looking for graduation criteria – there is a link on the page with information about the degrees, but it links to an older version of the online course catalog, which could be confusing (East Carolina University, n.d.a, para. 7).

The participant did not realize he was a first-generation college student until our interview, so while he may not have realized it at the time, he had the additional hurdle of not necessarily having a network of informational support (Mangan, 2015; Schwartz et al., 2018). When he graduated, the sort of position the participant wanted was something more involved than help desk support and something local to Eastern North Carolina. His first job was with a small manufacturing company where he did not feel valued, and he wanted a better workplace culture with reliable, steady employment. He did not specifically seek out a position in the library but was attracted by the allure of a steady job in a more positive setting.

This pilot study suggests that much of what the literature is saying in terms of recruitment for technology fields, including library technology positions, is applicable to East Carolina University. Prior exposure to and interest in computers tends to be the leading motivators for a student to study computer science. Both formal and informal methods of mentorship are underutilized and could help students navigate the pathway both to studying computer science and deciding the pathway to take post-graduation. Deliberate attempts to broaden the viewpoint of the student, to learn about not just theory, but computer science in application could also be useful. One important outcome from the pilot study was the realization that more data points are necessary to understand the research questions fully.

## Data Processing and Analysis

Discussed in depth in Chapter 4, I utilized standard formats that allowed for thorough analysis. Tools such as the DataMiner plugin, OpenRefine, and NVivo 12 were used to analyze the data in spreadsheets pulled from the job descriptions from the Code4Lib listserv.

Focus group interviews were transcribed to allow for coding, and emergent codes based on Tesch's eight steps were developed (Creswell & Creswell, 2018). All data was imported via CSV files, and NVivo was used to assist with preliminary coding. I looked for patterns and insights across the triangulated data that provide insight to answers to the research questions (Yin, 2017). The starter and emergent codes developed in the pilot study were compared to the analysis of the new data to explore similarities.

## Methodological Assumptions and Limitations

Metrics for trustworthiness outlined by Lincoln and Guba (1985), and widely used elsewhere since, evaluate research for trustworthiness through credibility, transferability, dependability, and confirmability. Credibility is established by using direct quotes from participants and by compiling information from independent data sets. The listserv data and focus group interview protocol are included as part of this dissertation, allowing for other researchers to replicate at their institutions if they desire. Though not all factors may transfer, it would be interesting to see how a researcher in another region adapts the survey design for use within their sphere of influence. I have dependably recorded all methods and instruments, allowing for external confirmation.

## Role of the Scholarly Practitioner

Inspiration for this line of inquiry comes from my own personal difficulties recruiting qualified diverse applicants for open library technology positions and a conversation with a

computer science major who, despite working at the library's circulation desk, had no idea there was even an IT department in the library. Though that student has since graduated, he helped plant the idea that computer science and library science could be more closely aligned at ECU.

Not every computer science major will be interested in a career in librarianship, and my goal is not to intervene and push students into further study, only to examine if a minor or graduate certificate would be of interest, gain insight as to how students read job advertisements, and better understand what computer science graduates seek in employment.

I had no direct prior experience with ECU's Computer Science Department and no prior opinions, positive or negative, of the performance of said department or its graduates. Though I have taken and taught computer science courses at other institutions, my aim is not to find fault with current practices, only to understand what current practices are and investigate potential additional paths of study and cross-departmental collaboration. I also have no direct experience with ECU's Library Science program, though I am an adjunct lecturer at the University of Illinois School of Information Science.

The only participant I had any authority over was the pilot study participant who, at the time of the interview, was my direct report. The pilot study participant volunteered to be interviewed. He was not compensated for his time but was permitted to do so during work hours. I ensured that the participant understood that participation was voluntary and would have no relation to his performance evaluation.

## Summary

Using a mixed-methods design, this study explored how ECU can facilitate a training pathway for library technology positions. A text analysis of staff positions posted to the Code4Lib listserv identified skills most desired by libraries. In focus groups, upper-level

computer science majors were asked to discuss why example library job advertisements would or would not be attractive, and their opinions on coursework for a potential graduate certificate were solicited. Chapter 4 discusses the results of the instrumentation, and Chapter 5 includes the summary of the findings and conclusions drawn.

# CHAPTER 4: RESULTS

Libraries have difficulty attracting and retaining employees with computer science backgrounds. As seen in the literature, there are many reasons for this, among them, lack of awareness, lengthy hiring practices, and potentially restrictive credential requirements (Bridges, 2002; Harralson, 2001; Kim & Sin, 2008; Oliver & Prosser, 2018; Poole, 2017; Raschke, 2003; Tapia & Kvasny, 2004; Wilder, 2007a). The purpose of this mixed-methods study was to explore ways ECU can direct and prepare computer science majors for entry-level library technology positions. Here, there is an opportunity to look at the future of libraries and recruit and train much-needed tech-empowered library staff.

Specific technologies and skills for which libraries are recruiting were determined by evaluating a popular library technology listserv. Following the social cognitive career theory framework, focus groups and interviews examined what current ECU computer science majors seek in a future workplace and where they look for jobs. The focus groups and interviews reviewed three entry-level positions to discuss attractiveness and concerns and explore what additional training the students feel they would need to succeed in that position. The data collected via the listserv evaluation and focus group interviews allowed me to answer the following study questions:

1. What do computer science majors look for when selecting a workplace?
    a. Where do computer science students look for jobs, and do they utilize Career Services?
    b. How do computer science majors interpret library job advertisements?
2. What would attract computer science majors to library technology jobs?
    a. Do background/demographics make a difference in attraction?

3. What skills are libraries seeking for their technology positions?
    a. How does the ECU computer science program align with the skills needed for success in a library technology position?

These questions seek to understand what factors are most important to an ECU computer science student as they seek employment and determine how that might align with what libraries are seeking. This chapter outlines the study results in examining ways ECU can direct students to and support students in careers in library technology. It provides a detailed description of the process used to analyze library technology job postings to understand whom libraries are seeking to hire. This chapter also provides insight into how students view example library job advertisements.

## Impact of COVID-19

In early 2020, the quick global spread of the novel coronavirus, COVID-19, caused much of the world to cease regular operation. The early days of the pandemic were full of unknowns. However, by the end of March 2020, East Carolina University was one of many institutions to follow state guidelines, move instruction online, and require employees to work remotely (Zachary, 2020). As the pandemic stretched through the summer, the realization that the university would be unlikely to return to a pre-pandemic normal sunk in. Not only was the illness rate climbing, many students found themselves trying to care for younger siblings or ill family members, sometimes without adequate internet service, while trying to maintain grades, jobs that often exposed them to the virus, and struggled with lack of social interaction (June, 2021).

On a much smaller scale, the COVID-19 pandemic directly impacted this study. I had intended to conduct in-person focus groups with computer science students during the fall and spring of 2020. With the pandemic still raging, those focus groups were moved online, and it was

challenging to schedule students whose semesters had been compacted to allow for a longer break. What was intended to be two focus groups ended up being one focus group and two semi-structured individual interviews using the same protocol as the focus group. The pandemic also likely influenced how participants responded to questions asked, and it should be noted that the pandemic will have a long reach into the future job search and prospects for these students.

I had also intended to hold a separate focus group with computer science faculty. Faculty found themselves forced to pivot to online courses with little notice and condense their already full course outline into fewer weeks. The department was already short-staffed; the additional stress brought by the pandemic understandably meant that the faculty needed to focus on student instruction. Though the two faculty who did respond were gracious and interested, busier than usual schedules meant scheduling them for a focus group did not happen. The protocol for the intended faculty focus group is available in Appendix D.

The pandemic may have also affected the number of positions posted to the Code4Lib listserv. As seen in Figure 5, of the years considered, 2020 had the fewest positions posted, nearly half the number of jobs posted in the prior year. The United States alone lost nearly 10 million jobs, and many colleges, universities, and non-profit institutions have implemented hiring freezes to combat economic uncertainty (Bauman, 2021; Gould, 2021).

## Participants

### Participants in Qualitative Data Collection Phase

With assistance from the computer science department chair, the department's administrative assistant sent an invitation to participate in a focus group interview to all junior and senior level computer science majors (see Figure 4). This email was first sent on August 31, 2020 and resent on October 27, 2020.

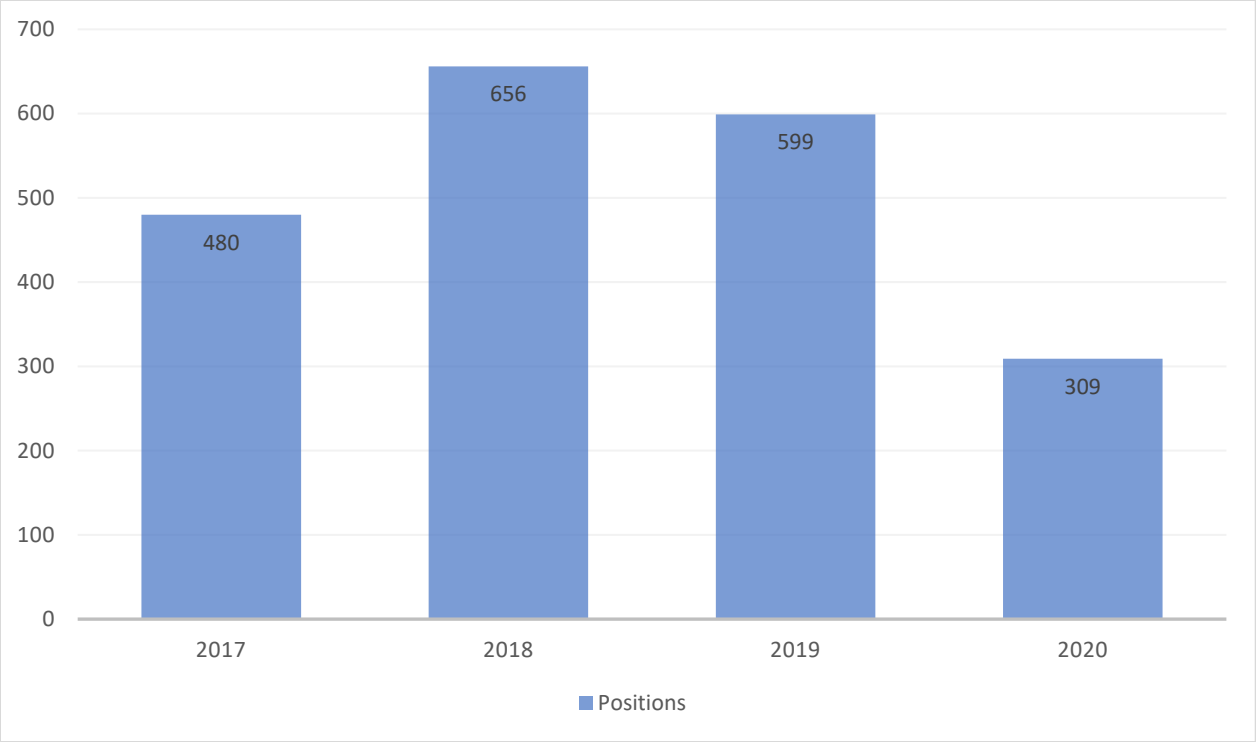



*Figure 5*. Job postings by year from Code4Lib listserv, 2017-2020.

Initially, three students expressed interest in study participation. One student expressed interest but did not reply to follow-up communications. Purposive sampling was the original sampling procedure, though snowball sampling was employed when one of the participants in the focus group recommended a classmate to be interviewed. Participant names have been replaced with pseudonyms to maintain privacy. End of the semester busy schedules delayed the initial focus group, which was made up with "Peter" and "Gabrielle", and took place January 11, 2021, from 2:00 to 3:02 p.m.

***Participant One: "Peter"***

"Peter" is a junior computer science major from a large city in the western part of North Carolina. Peter only applied to ECU, and he chose ECU because he was accepted to the Supporting Transition and Education Through Planning Partnerships (STEPP) program, which exists to support students with learning disabilities (East Carolina University, n.d.d). Peter cites early exposure to computer science, as his father is the chief operating officer of a small software company located in the western part of North Carolina.

Though his father helps with general career advice and provides moral support, Peter does not consider him a mentor since his father's role at his company is more "big picture" and he "doesn't know any programming or any computer science-based stuff." His father has been able to get Peter shadowing experience at his company, listening in to the daily developer's calls. Peter says that experience has "been kind of nice, just to… hear …the language and how they talk. And it's kind of just like an overview of what different people are doing or have done… or any bugs that have come up."

Peter says he is interested in getting work at a large tech company like Google or Microsoft because that is what he has "seen on the news all the time." However, he would not be

opposed to working elsewhere "as long as it's, I guess, programming-based or computer science field-based." He does not have a strong concept of what type of workplace culture would be of interest to him, but something that provides structure as well as some freedom.

When looking for a job, Peter's most significant motivating factor is higher pay. He would also be interested in a workplace that is willing to invest in his professional development and would consider getting a graduate degree if his place of work would pay for it.

***Participant Two: "Gabrielle"***

"Gabrielle" is also a junior computer science major, originally from a large city in the central part of North Carolina. After high school, she attended a different mid-sized university in the state for a year before dropping out because she did not like the program. She then went on to earn an associate degree in data science from a community college local to her hometown. She realized she was not ready to join the workforce and thought a bachelor's degree would afford her more opportunities. She applied to two universities, a mid-sized university in the western part of the state and ECU as a backup. Though she had initially wanted to attend the other university, they accepted her late, only a few days before the start of the semester, and she had already transferred to ECU.

Gabrielle also cites early exposure to computer science through her father, who is a data analyst. She says he pushed her towards coding as a teenager, telling her, "you'll be set [financially] if you do this." Gabrielle's father is still very much an influence; she feels he is "very much a mentor." He assists her with classwork, preparing for the job hunt, and providing motivation, telling her, "if you really want an internship or job, you have to practice every single day."

Gabrielle is not sure what kind of job she wants. She listed several different technologies she might be interested in, saying she has "considered everything but cybersecurity and hardware" and thinks getting some internship experience might help give her some direction. She has much anxiety about interviews that require live coding demonstrations, a common practice in technical interviews (Wyrich et al., 2019). Her father has helped her prepare for these high-pressure scenarios with reading material and personal coaching.

Gabrielle says the two most important factors for her when looking for a job will be flexible hours and the ability to work remotely. She would sacrifice higher pay for a job that offered more flexibility or less stress. She feels that high-stress situations produce her best work but wouldn't be sustainable, saying that would lead the company to "constantly expect that of me. I don't think I would like that very much."

***Participant Three: "Joseph"***

Gabrielle connected me with the third participant, "Joseph", and Joseph was interviewed on January 22, 2021, at 2:00 p.m. Joseph is also a junior and originally from a city in central North Carolina. He chose computer science because he liked video games and many of his friends were studying it. He does not have anyone he considers a mentor other than his peers. His mother works as an accountant; ironically, after he had chosen his major, Joseph found out that his mother had studied computer science when she attended college in the late 1990s. He does not ask her for help, though, since the "major has completely changed… she couldn't have helped me if she wanted to."

Joseph is interested in pursuing a software development career, ideally at a large technology company or the federal government. Though he is not actively looking for a job or internship, he has met with ECU's Career Services, who helped him craft a resume. When

looking for a job, Joseph said he would look at location first; while he would like to live in a bigger city and he would be willing to move, he thinks it will be easier to find "a job in Greenville, North Carolina than… all the top-rated [areas] like Google in the valley." He does not have an ideal workplace environment; he would be happy with any job in his field, but he finds salary to be a more important factor than lower stress or other benefits.

***Participant Four: "Mark"***

The final participant interview was with "Mark". The interview took place on February 5, 2021, at 3:00 p.m., after Mark emailed me the week prior, expressing interest in the study. Mark is a senior and chose computer science because of his interest in video games. He was between two universities but chose ECU because it was closer to home. The more he researched computer science, the more he was interested in studying it because of the worldview it offered. He said, "You look at the world completely differently after you initially take some classes… [you] learn how things work, or how to fix things. It's just a new mindset for problem-solving."

Mark does not have anyone he considers a mentor, though he enjoyed interacting with his professors in the department. His parents do not come from a computer science background, but they did impress "that you want a job that you like, enjoy doing what you love," and Mark realized he loved video games and problem-solving.

Mark has no interest in further education at this time, instead preferring to "get into the field as soon as possible." He has applied to several positions with video game development companies and says he is also looking at research support positions at other universities. He would also be interested in software development positions, noting that he would like to be a member of a team. He realizes he needs work experience, and he may not necessarily be able to be picky. He says that while he "wouldn't mind working at a video game development company,

even if it's like the lowest level just to get my foot in the door," he realizes they might have low expectations of him since he is "right out of college having no experience."

The most important factor Mark uses when looking for a job is "no previous experience required." He looks for positions that he can bring "background knowledge of applications and utilities" to make training easier. He knows entry-level positions rarely come with high salaries, but he factors in the cost of living when looking at positions and does look at potential commute and traffic. Overall, he tries to keep an open mind when looking for a job, and if the cost of living and salary seem to be in alignment, he tries not to worry about the day-to-day specifics "because anything would be brand new wherever you went. So I just try to keep a clear head instead of going in thinking I know what's going to happen."

**Summary of Participant Demographics**

Juniors and seniors were chosen as they are the most likely to have participated in or considered the job market and job search process. COVID-19 resulted in a condensed semester and forced the focus groups to move online; what was intended to be two in-person focus groups ended up being one virtual focus group and two virtual semi-structured individual interviews. All four focus group/interview participants are originally from North Carolina or were living in North Carolina before matriculation to ECU. Of the four participants, three are juniors; one is a senior. All but one participant identifies as white, and all but one participant identifies as male. One student, Gabrielle, is a transfer student. Participants' grade levels, plan after graduation, and job search status can be seen in Table 2.

Table 2

*Participants*

| Name | Level | Plan After Graduation | Job Search Status |
|---|---|---|---|
| Peter | Junior | Work | Looking for internships |
| Gabrielle | Junior | Unsure | Looking for internships |
| Joseph | Junior | Unsure | Not actively looking |
| Mark | Senior | Work | Looking for a job |

## Data Collection

The data for this study was collected in two phases, each further outlined in this section. Quantitative data was collected by a systematic review of a popular library technology listserv's job board. Qualitative data was gathered through a focus group and two interviews following the same semi-structured protocol. Though designed to be gathered concurrently, pandemic delays in recruiting and scheduling focus groups and interviews meant that the quantitative data was gathered and analyzed before the qualitative data was gathered.

### Quantitative Data Collection – Listserv Review

The website Code4Lib Jobs (https://jobs.code4lib.org/jobs) was selected as the source for data in the quantitative collection phase. This website was chosen because it is a job board specifically dedicated to all levels of technology positions in libraries, museums, and other cultural institutions, has broad appeal with an international audience, and there are no cost barriers in posting positions. Though computer science students would not likely be aware of this listserv, the posted jobs are typically published elsewhere, such as college job boards, newspapers, and websites such as Monster and Indeed. The Code4Lib data available goes back to 2009, though the dataset was limited to 2017 – 2020 for most current data. This data source is not inclusive of all possible library technology jobs but provides a diverse sample set.

Listserv data was downloaded to a spreadsheet using the Google Chrome plugin DataMiner. Code4Lib Jobs was chosen because it is a job board specifically dedicated to all technology positions in libraries, museums, and other cultural institutions. It has broad appeal with an international audience and has no cost barriers in posting or viewing positions.

Once installed in the browser Chrome, the DataMiner plugin uses a screen-scraping technology to capture information displayed in the same place on multiple pages (Software

Innovation Lab LLC, 2021). After signing in with a Google account, the user can create a "recipe" that allows for the download of information on a page based on CSS or HTML elements (see Table 3). DataMiner plugin has eight steps to set up the recipe, allowing the user to ensure the correct data is being scraped even across a site with multiple pages, such as a blog or job listings (see Figure 6).

I created a recipe that matched the CSS element "card-body" to a new row in a CSV file. The column data source match can be seen in Table 3. Once the recipe was created and tested for accuracy, I clicked back through the postings to find the first post made in 2017. Job listings posted from January 2017 through December 2020 were selected for analysis. The Code4Lib Job Board lists 25 positions per page, chronologically from most recent to oldest, and the recipe needed to know how many pages to scrape. This post, made January 3, 2017, appeared 82 pages back, and I used the plugin to run the recipe over those 82 pages.

This resulted in a CSV file with 2,050 entries that listed each position's date of posting, title, status (e.g., full-time, part-time, contract), link to the post on the Code4Lib listserv, and location. Since jobs can be reposted to this website, duplicates determined by title and location were removed from the initial dataset, leaving a total of 2,046 position listings for further analysis.

**Qualitative Data Collection – Focus Groups**

In the initial email (see Figure 4), students were invited to participate in research. The email was sent by the computer science department's administrative assistant, who emphasized parts of the message in red. Students were told the purpose of the research study and that I would like to convene focus groups via WebEx to ask a few questions and show some examples of technology jobs posted by libraries and get feedback. Students were instructed to email me if

Table 3

*DataMiner Column Data Source*

| Column | Title | Matched Element |
|---|---|---|
| 0 | DatePosted | div:eq(2) |
| 1 | Title | .card-title |
| 2 | Status | a.badge |
| 3 | URL | a.stretched-link |
| 4 | Location | div:eq(3) |

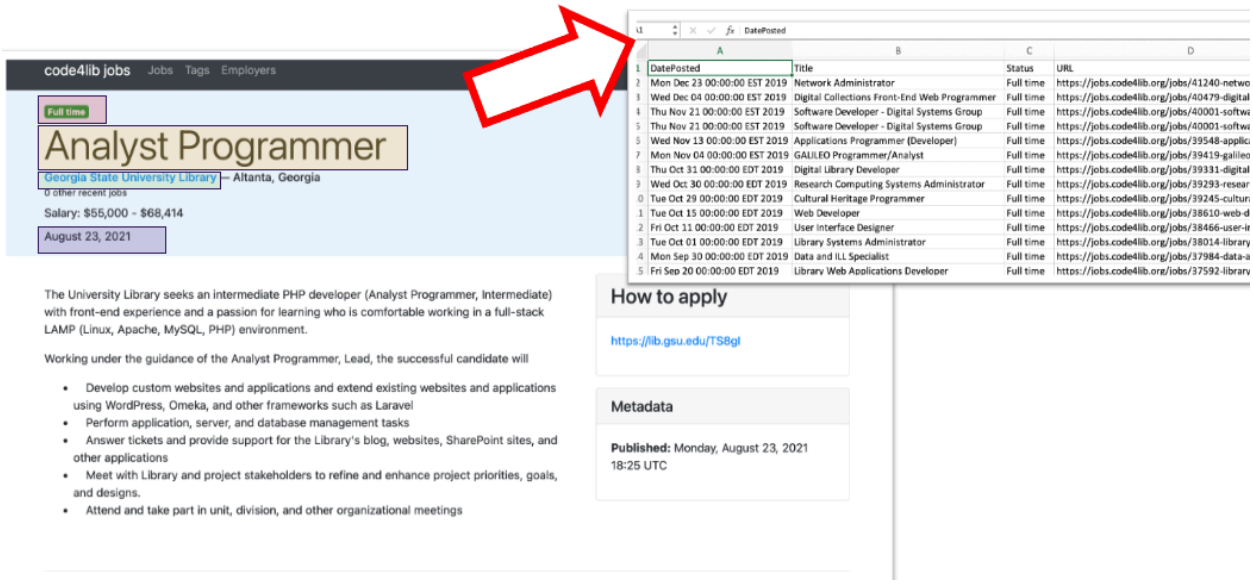



*Figure 6*. Illustration showing areas on the Code4Lib job board pulled into CSV.

they wanted to participate or obtain more information and that they could choose to withdraw at any time.

Initially, three students expressed interest in study participation. One student expressed interest but did not reply to follow-up communications. End of the semester busy schedules delayed the initial focus group, which was made up of Peter and Gabrielle, and took place January 11, 2021, from 2:00 to 3:02 p.m. Gabrielle connected me with the third participant, Joseph, and Joseph was interviewed on January 22, 2021, from 2:00 p.m. to 2:45 p.m. The third interview with Mark took place on February 5, 2021, from 3:00 p.m. to 3:49 p.m.

All three focus groups/interviews were conducted via WebEx and recorded with the participants' verbal consent. Each session began with a brief introduction to the study and a reminder of their rights as participants (see interview script in Appendix C).

When the recordings were available through the WebEx website, they were each downloaded as a separate .mp4 file. These .mp4 files were uploaded to Otter.ai for automatic transcription. The automatic transcription process typically takes as long as the source material (Lai, 2020). Since each interview was roughly an hour, the transcription process took about an hour each, or three hours total.

When Otter.ai had finished transcribing the interviews, I reviewed the transcriptions and made minor edits for accuracy. I then exported the transcription files as .txt files. The downloaded files resulted in 48 pages of transcription from the three groups: 18 for the focus group and 15 for the two individual interviews. The .txt files were uploaded to NVivo 12 to allow for coding and further analysis.

## Data Analysis

After gathering the data, it was analyzed to look for pattern and meaning. Designed to be concurrent, these analyses could be done at the same time, though due to the difficulty in recruiting focus group participants, the quantitative analysis was primarily completed before the focus group and interview transcription.

### Quantitative Data Analysis – Listserv Review

OpenRefine, an open-source data cleaning and sorting tool, was used to initially review and sort the data (Metaweb Technologies, Inc, 2021). OpenRefine allows for creating custom filters that I used to identify positions that would be obtainable by a recent computer science graduate and thereby fitting within the scope of the research project. First, I used the faceting tool in OpenRefine to remove positions that were not listed as full-time in the type field, reducing the list to 1,911 positions. Next, I used the faceting tool to remove jobs with the following words in the job title field that indicate the position requires an advanced degree: librarian, archiv* (this used Boolean logic to remove archivist and archives), curator, professor, dean, AUL (short for Associate University Librarian), liaison, scientist, fellow, tenure. Next, jobs with the following words in the title field were removed as they indicate the position requires knowledge outside of the computer science realm: metadata, makerspace, electronic resources, catalog. As this study was aimed at entry-level positions, I removed positions with the following words in the title as they indicate requiring more experience: head, director, manager, founder, senior.

Finally, I used the faceting tool to search the location field for positions located outside of the United States and removed those from consideration. This left 539 positions from the original 2,046. I then individually reviewed each of the remaining 539 positions and using OpenRefine's

flagging option, flagged those positions for which a graduating computer science major would be qualified. Of the remaining 539 positions, an additional 85 were filtered out upon review because they were not caught by the faceted filters listed above but would fall into one of the filtered categories or, in several instances, the post did not have the full position description or required qualifications listed, making it impossible to analyze. Upon further inspection, many of the positions required two or more years of experience and were thus filtered out. This refinement resulted in a total of 69 opportunities, about 3% of the original list, that would be considered entry-level, and based on qualifications listed, would be obtainable by someone who had recently graduated with a bachelor's degree in computer science.

I then opened the link for each job posting on the Code4Lib listserv and exported each of the 69 postings to .pdf. The PDF files were then imported to NVivo 12 and coded. Fifty-three of the positions were listed with academic libraries (including one community college library), five with public libraries, and eleven other types of institutions, such as positions with library vendors or consortia.

The positions were coded into five functional areas of responsibility. Though a position may have duties listed under more than one of these areas, the primary responsibility was coded. Forty-three fell under Software/App Development, 11 fell under Web Development, eight fell under Systems and Server Administration, six fell under Data Analysis, and two fell under Hardware/Networking (see Figure 7). Most of the positions coded as software/app development do not require knowledge of specific programming languages, instead listing examples; JavaScript has the highest number of mentions, followed by PHP and Ruby (see Figure 8). Most frequently occurring web development technologies, HTML, Drupal, CSS, and WordPress, are shown alongside in Figure 8. In many positions, there is overlap in these technologies; for

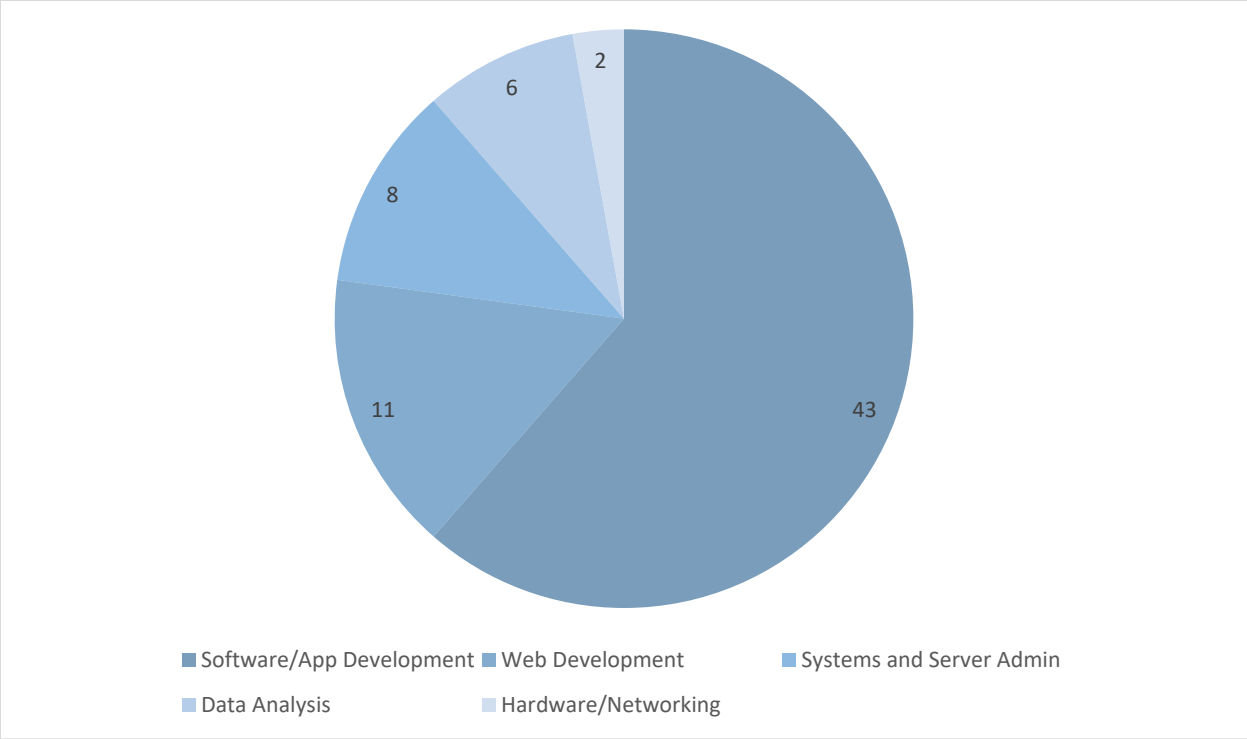



*Figure 7*. Entry-level positions by type.

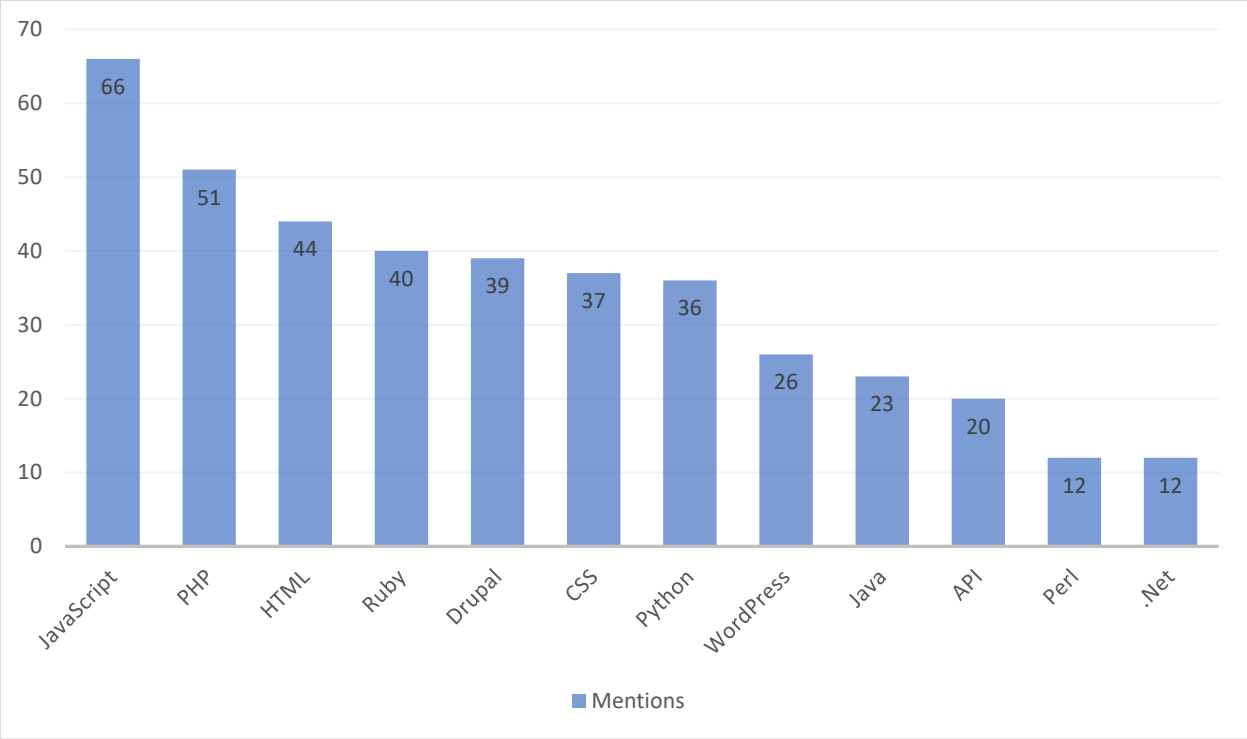
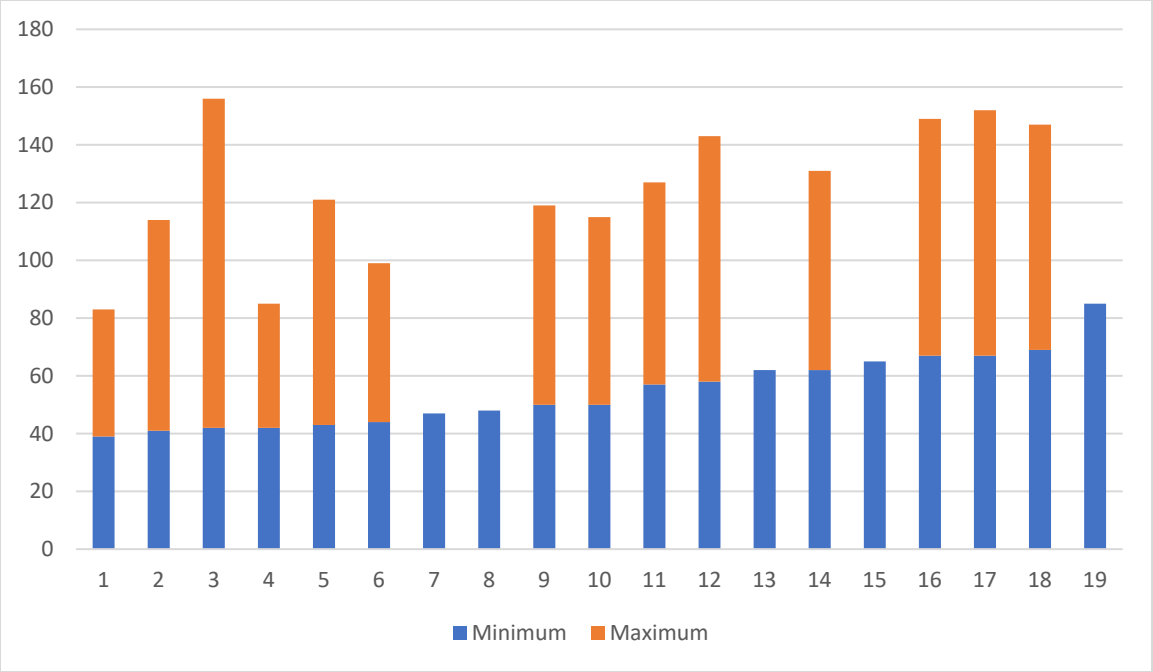



*Figure 8*. Top programming languages and web technologies mentioned in Code4Lib data.

example, a web development position that would support a website built in the content management system Drupal may require knowledge of PHP, Drupal's base language.

Only 19 of the 69 positions list a salary range (see Figure 9). Those that list salary ranges typically do so with annual numbers; three list hourly salary and one listed monthly salary. Five list minimum salaries only; the others use a range. The average starting salary listed is $54,600, which is lower than the National Association of Colleges and Employers (NACE) average starting salary projection of $68,668 for computer scientists (National Association of Colleges and Employers, 2020). The lowest salary range listed is $42,000-43,000 for a web development position in a Midwest public library. The largest salary range listed is $42,000-114,000 for a software developer at a large research institution's library in the northeast.

Three of the 69 applicable positions were chosen as examples to solicit feedback from students in the focus groups and semi-structured interviews. Since all 69 positions would ostensibly be obtainable by a recent computer science graduate based on required qualifications, to be considered examples, the positions must include a substantive enough position description to allow for feedback, and the positions had to list salary. The chosen positions were an applications developer position with the Reaching Across Illinois Library System (RAILS), a digital library developer position at Northern Illinois University, and a programmer/analyst position for the Georgia Library Learning Online (GALILEO) project hosted by the University of Georgia. Position descriptions for all three can be found in Appendix E. For the digital library developer and the programmer/analyst positions, I was able to obtain copies of the official university job postings so that students could compare the Code4Lib job post with the human resources system website. These are also included in Appendix E alongside screenshots of the Code4Lib Jobs posting.




*Note*. Four positions only listed starting salary, not a range. Those positions that listed salaries hourly/monthly have been converted to annually for comparison.

*Figure 9.* Salary range in thousands of dollars, sorted from lowest starting salary to highest.

## Qualitative Data Analysis – Focus Groups

Once the .txt files were uploaded to NVivo 12, I reviewed each transcript and marked starter codes and emergent codes, which evolved into common themes: prior positive exposure to computers/computer science influencing the decision to major in computer science; concern about future employment and how best to prepare for the job market; the importance of support, mentorship, or sponsorship in cultivating success; and important factors to consider when looking at a potential employer or job (see Table 4). The starter codes from the literature were Exposure, Preparation/Education, Mentorship/Sponsorship, Hurdles, and Goals, and one emergent code, "Vocational Awe" arose from the pilot study.

### *Prior Positive Exposure to Computers/Computer Science Influencing Decision to Major in Computer Science*

Prior positive exposure was a frequent theme in the interviews. In the SCCT framework, interest in future careers often starts with exposure to the topic, where "young people are selectively encouraged by parents, teachers, peers, and important others to pursue, and try to perform well, certain activities from those that are available to them" (Lent, 2013, p. 120). All participants cited exposure to computer science in high school or earlier or a parent who works in or adjacent to the field. Gabrielle, whose father is a data analyst, explained that her father "kind of pushed me towards coding when I was fifteen… he was like, 'you need to try this. You know, you'll be set if you do this.'" Peter's father is the chief operating officer of a small software company located in the western part of North Carolina, and Peter has had the opportunity to visit his father's office and to follow the industry, saying "it's been kind of an interest from an early age."

Table 4

*Qualitative Data Codes and Themes*

| Codes | Resulting Themes |
|---|---|
| Family/friend employment<br>Video games<br>Perceived future financial success | Prior positive exposure to computers/computer science influencing the decision to major in computer science |
| Academic hurdles<br>Ideal workplace<br>Internship<br>Search for job<br>Unknown future<br>Pandemic<br>Work experience | Concern about future employment and how best to prepare for the job market |
| Career Services<br>Faculty<br>Mentor<br>Prep-education | The importance of support, mentorship, or sponsorship in cultivating success |
| Autonomy<br>Clear expectations/terminology<br>Fun/Engagement/Interesting work<br>Location<br>Pay<br>Professional development<br>Structure<br>Teamwork<br>Work from home/Flexibility | Important factors to consider when looking at a potential employer or job |

Peers are a big influence as well. Joseph says he chose computer science because "a lot of my friends were going into it. My, one of my friend's older brothers was a computer science major, and he had made it to the software engineering area, and he was doing well for himself." An important part of this prior exposure for both Gabrielle and Joseph is the observation that a career in computer science means financial success.

Along with adult and peer influence, hobby and pastimes are another point of exposure. Joseph and Mark specifically point to growing up playing computer games. Both point to how much fun they had playing games, but that it was also fun to understand the game's environments. Joseph explained that "for some video games, I'd have to, like, create a server and whatnot. And that aspect of it interested me."

***Concern About Future Employment and How Best to Prepare for the Job Market***

Another common theme in the interviews is that each participant expressed uncertainty about their futures. Gabrielle and Peter are focused on getting internship experience to help them figure out their career goals. Gabrielle lamented that "I don't know what I want to do. I have no idea." She discussed her interest in blockchain technology but was unsure what to do with that interest. She expressed much anxiety about the practice of having job/internship applicants undergo a live coding test during the interview: "I have been losing motivation really quickly, especially with the live coding, right? That's, that's a lot of anxiety and it's not fun."

Peter says he would like to work at a large tech firm, like Google or Amazon, but when asked why, he was not sure, saying:

> I don't really have a good grasp on what exactly I want, I just think those are the ones that I've, you know, seen on the news all the time…but really could be anyone as long as it's, I guess, programming-based or computer science field-based, I guess.

He also was not able to articulate what he would like in a future workplace, saying, “I haven’t really been out in the field, I don’t really know… what I want.”

Joseph made a point to say he was keeping his expectations low, realizing that without a lot of experience, he didn’t have a lot of room to be choosy: “You know, like, as a college student, I’m just like, I need to get whatever I can.” Mark, the senior applying for jobs, says that the biggest factor he looks for is “no previous experience required” since he is unsure about exactly what he would like to do, other than he would love to work in the video game industry.

### *The Importance of Support, Mentorship, or Sponsorship in Cultivating Success*

Overall, participants felt that their education prepared them well for employment, though all expressed the desire for more internship opportunities. Other than Gabrielle, whose data analyst father is actively involved in mentoring her, the other participants do not feel that they have a true mentor. Gabrielle described how her father acts as a mentor:

> My dad is definitely still in a position to help me. And I consider him to be like my mentor of some sort. And, like, he helps me a lot with the job search and finding internships, and he helps me with material that I don’t understand.

Whereas Joseph, who found out his mother studied computer science in college after he had chosen his major, says that he does not have a mentor and since his mom “did her comp sci degree in like the late 90s. Okay, so like the major’s completely changed… Yeah…She couldn’t have helped me if she wanted to, is what I’m getting at.”

Participants felt that the computer science faculty were very supportive but that they were stretched thin. Mark felt that he did not want to burden his computer science professors with a mentorship request since while “the professors did a great job…but there’s just been times where

professors have either been sick or other [complications] and… the head of the department is the only fill in professor."

### *Important Factors to Consider When Looking at a Potential Employer or Job*

When asked directly, participants did not know how to describe their ideal workplace; most answered that they would be happy to get any job related to computer science. However, when presented with example job descriptions (see Appendix E), each participant pointed out positive and negative aspects of those potential jobs, including salary, flexibility, location, and opportunity for professional development. As this theme directly answers study question 1, these factors are examined in further detail in Results.

## Results

In order to capitalize on the strengths of both quantitative and qualitative research, a mixed methods research design was selected (Burkholder et al., 2020; Creswell & Creswell, 2018). Since "quantitative research embodies an etic perspective based on existing theory and research as interpreted by the researcher, and qualitative research is characterized by an emic perspective designed to capture the perspective of those being studied" (Burkholder et al., 2020, p. 114), a mixed methods approach allowed me to investigate the study questions which cannot be answered by one dataset alone. This approach allowed for the adoption of an intersubjective perspective by integrating objective data gathered from the listserv with the more subjective data gathered from interviews. By utilizing mixed methods, I was able to view data generated by libraries as well as collect feedback from a small sample of the people libraries are hoping to attract via job advertisements.

**Analysis of Study Question 1**

Study question 1 investigated what students who major in computer science look for when selecting a workplace, where they search, and what support they utilize. All participants expressed concern about the difficulty in finding work and internships, which was already difficult before the pandemic.

When thinking about future employment, all participants expressed the desire to simply find a job without citing specific characteristics; Peter summed it up by saying he was not sure exactly what he was looking for, but as long as it is "programming-based or computer science field-based" he would be happy. The participants were all keenly aware of their lack of experience, prompting Mark to answer the question of what he looked for while searching for a job with "no previous experience required." Joseph had similar feelings, saying, "Usually for a lot of [positions] you need five years of this experience. It's refreshing to see like; you just need a familiarity."

Though participants were somewhat vague in describing their ideal workplace, when presented with example job descriptions (see Appendix E), each participant pointed out positive and negative aspects of those potential jobs, which are examined further in Analysis of Study Question 2.

The participants in all stages of the job search relied on internet sites such as Indeed to look for postings. As Mark explained, "well, most of the time, I just look through Indeed, just to see what openings are available," and Gabrielle said, "And then LinkedIn, everyone uses LinkedIn. Right?" Other sites mentioned include StackOverflow, Payscale, Glassdoor, and USA Jobs. Gabrielle also mentioned Handshake as being helpful in their search for internships. Most

participants used similar keywords in their searches: general terms like "computer science" and the names of specific coding languages like "python" or "java."

One participant, Joseph, starts by limiting his search by location because he believes it would be easier to get a job locally than a large corporation on the West Coast, saying, "I don't think I know any language well enough to pass the coding interview" at a place like Google or Microsoft. However, all participants expressed an interest in opportunities outside of North Carolina if given a chance.

Of the four participants, all but Mark had heard of the Career Services Center, but only Joseph had visited the center. He found the experience very helpful, saying they helped him with his resume: "I had no clue what to put on a tech resume… it's like there was a big learning curve for me. So I had to go talk with Career Services, and they guided me really well."

Most participants have not given much thought to benefits beyond pay. When presented with a hypothetical scenario of two positions in the same area, one with a higher salary but seemingly longer hours and more stress, versus one with lower pay but seemingly more relaxed, 3 of the 4 participants chose higher pay. Joseph noted that while he was not in it, "there's definitely a demographic that would rather work at one of those places, instead of a big tech company." Gabrielle is the only participant who chose the lower stress position because "high-stress situations…usually produce my best work, which will then lead them to constantly expect that of me."

Each participant was given copies of three entry-level library technology jobs and asked to discuss them. Participants were drawn to job advertisements that discussed working with a team and needing little supervision because, as Gabrielle says, "that means that…they are putting trust in me and my work." All four participants were very interested when a job ad specifically

mentioned the ability to work some of the time remotely, expressing the importance of flexibility and freedom. Most participants liked when a position description was more specific about what duties were to be performed and said they liked when positions specifically said professional development and training were available.

During the reviews, all participants noted the listed salaries and locations. One of the positions had a lower salary and a long list of duties, prompting Peter to say, “Seems like there’s a lot for, I guess, an average amount of pay. That kind of stood out.” Joseph and Mark both asked if when a position lists multiple programming languages if they expect someone coming into the position to have experience with all of them and that it was unclear why those languages were chosen. Mark said, “I mean, if you know how to write one programming language, you pretty much know how to write in all of them. It’s just a different syntax… it felt like they overextended with the amount of languages [listed] there.”

All participants were unfamiliar with library-specific terminology, such as Drupal. Gabrielle noted that she “would still apply, and I would Google what that was.” All participants said that when they come across something unfamiliar in a job ad, they search to see if they can figure out what it is. When asked if they were aware that libraries, museums, and other cultural institutions had positions like this, all four participants said no.

**Analysis of Study Question 2**

Study question 2 sought to answer what would attract computer science majors to library technology jobs. To understand motivation, it was important to understand what inspired each student to study computer science. Each focus group session started with a question to participants, asking them to share their background and why they chose to study computer science. All participants note prior exposure to computer science in line with the SCCT

framework. The love of video games prompted half of the participants to explore computer science. Three of the four participants have a parent who works in a career related to computer programming.

While there were no discernable patterns to answers based on demographics, all participants said they did not know these types of positions were available in libraries. Joseph enjoyed learning that libraries were looking for computer science majors, saying, "I didn't know libraries did this stuff... I just thought libraries just collect books and whatnot." Even Mark, who had worked as a student assistant in ECU's library, did not know about these specific types of positions, saying that "I know there are techs, library techs, I just never really knew what they did or how they got that job."

When evaluating the three sample positions, participants were asked what they liked about a particular position as well as what they didn't like or found confusing. Overall, the sample positions were attractive, and some codes were more prevalent than others when it came to answering the question about what participants found attractive and what could be improved.

***Autonomy and Flexibility***

Two of the most common codes from the participants was the desire for autonomy and flexibility. In the RAILS position, there is a line that reads, "You will work as part of a team and individually with little supervision." Gabrielle responded positively to this, "because that means that, you know, they are putting trust in me and in my work." Peter also picked up on this line, saying:

> I do like the fact they like they're not over your shoulder 24 hours a day, or 8 hours a day, I guess. Like, I'm watching you and grading you on how you're doing… just kind of let

> you do the thing and get work done. That's kind of nice. I don't think I would enjoy someone over my shoulder.

The positions that listed flexible hours or the ability to work from home were desirable, causing all four participants to note that they thought that option was enticing and prompting Mark to think about what that would look like:

> And the two, three days working from home, working at home is also nice. I'm assuming it's like, you'd be able to, you know, hop on a Zoom call, or WebEx with another coworker or your boss and be like, 'Hey, I'm having trouble with this' or send an email and people probably get back right away. I mean, if I was working at home, I'd pretty much be available the whole time because everything I would need would be around me.

***Professional Development***

Two of the participants, Peter and Joseph, both said that a job that offered further training and education would be attractive. One of the three sample positions, the RAILS position, specifically said, "Opportunities for professional development and for participation in professional organizations." However, none of the participants picked up on that statement, which is buried in the last section (see Appendix E).

***Competitive Pay***

Competitive pay is one of the significant desirable factors. One of the reasons several participants chose to study computer science was that they saw it as a pathway for financial success. Mark has thought a lot about salary:

> I do a lot of thinking about salary and what I would expect to make. But given I have no experience and it would be an entry-level job, I wouldn't expect the moon or whatever; I'd be happy with whatever I get because it's more than I'm making now.

Though participants were aware that without much experience, a starting salary might be initially low, if given a choice, three of the four would pick a higher-paying, more stressful position over a lower-paying but less stressful position. Peter said that it depended on how stressful it was, and Mark explained, "I'd take the higher paying one… I feel like if I chose that job that I'll have the experience of someone that earns said higher salary, which would give me more options."

Overall, the participants said that they would be interested in applying to two of the three positions. The GALILEO position, which had a salary listed of "$48,000 or commensurate with experience," was a turn-off for all four participants, who said they would not apply to this position because of the low pay for what seemed to be a lot of responsibilities. Peter thought that the GALILEO position's pay did not match what duties they were asking to be done, saying, "Seems like there's a lot for, I guess, an average amount of pay."

***Interesting Work***

Mark especially liked the introduction to the RAILS position that asked three bulleted questions to start the position ad: "Okay, those questions are great. Do you enjoy solving problems? Are you looking to join a small team of IT professionals?" He felt like it appealed to some of the reasons he went into computer science, saying, "You look at the world completely differently after you initially take some classes, like everything, anything electronic or with computers around you. Learn how things work or how to fix things. It's just a new mindset for problem-solving." Joseph was not interested in the GALILEO position because the duties listed were not of interest, saying "a lot of the things it's asking me to do is kind of like, I just I just don't find this job too interesting." Gabrielle highlighted specific technologies listed in several of the positions, saying, "I also really liked the Python and the JavaScript, like, how we would work in those" and of a different job ad, "I've never developed in Swift, so that would be fun."

### *Clear Terminology and Expectations*

Several participants thought the positions could be more specific. Joseph thought one of the position's duties was unclear:

> That's…the shortest paragraph out of all of them, and that's kinda the most important part. You can put all the languages you want, like [experience with or] some kind of familiarity...But… I don't know what I'm going to be doing exactly.

He compared the positions to ones he has seen from other companies who are not technology-focused: "like if Lowe's or Walmart is hiring some tech person, well, they'll just put a bunch of buzzwords they find," unlike tech companies who are very specific. He added, "why do I need to know, like, eight different [computer] languages to work at Lowe's?"

The consensus in all three groups was that the people who wrote the job advertisements could better clarify what they meant by specific terminology. Some library-specific terminology was especially confusing, causing Joseph to say:

> Like for the duties responsibilities, it says, all aspects of the library's digital asset management systems. Well, what are the assets? You mean books or something? Or like the inventory? Or is there more to it? Because I'm not… familiar with that.

Notably, the library-specific technology listed in the positions with which participants were most unfamiliar is the content management system popular with libraries, Drupal. Gabrielle said, "I've never really heard of Drupal. So, I mean, I would still apply, but I would be like, what's Drupal?" and Joseph wondered if since he is a junior, he just has not learned it yet, saying "I don't quite know what Drupal is. But I don't know if that's because …I still have like, another year and that's something that's gonna come up in my next classes."

Mark felt that the layout of some of the position descriptions was confusing and that this would have turned him off:

> I also don't like the way how this looks so congested on this page. Like, short and sweet and to the point, kind of their like primary function. In code, we're supposed to comment how things work not like what they do… they should just say this position is responsible for yada, yada, yada.

**Analysis of Study Question 3**

Study question 3 investigates what technologies and skills libraries seek for their technology positions by examining the Code4Lib job board listserv data. Some commonalities emerged: positions tended to be vague about specific duties, positions often appeared wishful with the list of knowledge, skills, and abilities (KSAs) they were asking for, and positions often required more experience than may be necessary.

Thirty-two distinct technologies in five functional areas were mentioned with the most frequency (see Table 5). Though a position may have duties listed under more than one area, the positions were sorted by primary responsibility: 43 Software/App Development, 11 Web Development, 8 Systems and Server Administration, 6 Data Analysis, and 2 Hardware/Networking (see Figure 5). JavaScript has the highest number of mentions, followed by PHP and Ruby (see Figure 6). Most frequently occurring web development technologies, HTML, Drupal, CSS, and WordPress, are shown alongside in Figure 6.

Most of the positions categorized as software/app development do not require knowledge of specific programming languages, instead listing several possibilities after "such as." An example from the Northern Illinois position is a bullet point with "Working knowledge of Web development tools, languages, and frameworks, such as PHP, Apache/HTTP, HTML, Javascript,

CSS, MySQL, Java/Jetty/Tomcat, RESTful APIs" (see Appendix E). This common approach of listing multiple possible languages and skills was confusing for Mark, who said of the RAILS job ad: "for the first bullet under skills, it says familiarity with PHP, Perl, Python, JavaScript, MySQL. That doesn't really specify if they want all of them or just know how to do one of them." He found this redundant and added, "if you know one programming language, if you know how to write one programming language, you pretty much know how to write in all of them. It's just a different syntax."

Overall, ECU's computer science program aligns well with what skills libraries are asking for in their technology positions. Participants felt very comfortable with most of the technologies listed, except for the library-specific technologies, which all participants said they would research if they were going to apply for a job that mentioned something with which they were unfamiliar. As mentioned earlier, library-specific technologies, such as the web content management system Drupal, also caused some confusion. Working with a content management system of any kind is not likely to be part of the computer science curriculum since it is web development. Most participants were less interested in front-end/web development, which makes sense as at ECU, students most interested in web development would be more likely to major in technology systems design instead of computer science (East Carolina University, 2021a).

Participants seemed interested in the option of a potential graduate certificate in library technology, since it would give them hands-on experience with some of the technologies mentioned in the job ads, especially if it were combined with hands-on experience in the library. Three of the participants thought it would be beneficial to have an additional certification to put on their resumes. While none of them were particularly interested in a career in library

Table 5

*Technologies Required in Entry-Level Job Postings*

| Code | Technologies Included | Number | Percent |
|---|---|---|---|
| Programming language | Javascript, PHP, Ruby, Python, Java, .Net, Perl, API | 59 | 85.5% |
| Web Development | Drupal, html, css, xml, WordPress | 43 | 62% |
| Library technologies | Library systems, ILS, Integrated Library Systems, Interlibrary Loan, digital repository, ContentDM, Omeka, Islandora | 31 | 45% |
| Databases | Databases, DBMS, SQL, mySQL, postgres, solr, oracle | 43 | 62% |
| Server | Apache, Windows Server, Linux, LAMP | 40 | 58% |

technology, they thought it would be beneficial if they could connect it to obtaining real-world experience.

Joseph's only hesitation is that "it's like a year of like, I guess, studying for like, a library thing. And that's not really something that people are like, 'Oh, yeah, that's cool.'" But he thought having the ability to concentrate a graduate certificate with another area on campus could be beneficial:

> In all honesty, like, like computer science is a relatively new major compared to like, mathematics and English, a lot of like, learning and like changing the curriculum might go through in the next ten years…Especially like, like, twenty years ago, most companies did not have that much to do with coding, but now, like every company has something to do with it…So yeah, I like the certificate thing that you said like, yeah, that sounds like something that could get big.

## Summary

As determined through a focus group and interviews, essential factors for computer science students at ECU when looking for future employment are obtainability, pay, and location. Computer science students interviewed have a decent grasp of what Career Services offers though more could use that assistance. The students expressed uncertainty about their futures: overall, they feel prepared for working with the technologies they have learned through their education but are unsure what to expect from working in the field. They also are not necessarily prepared for some of the specific technology libraries are seeking. Chapter 5 will summarize and interpret these findings and suggest a possible curriculum for a graduate certificate in library technology.

# CHAPTER 5: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Libraries, like so many other industries and professions, have become increasingly dependent on technology. To build the library of today and tomorrow, libraries need to recruit and retain librarians comfortable with technology and support staff with technological expertise. Many factors contribute to the fact that libraries have difficulty attracting qualified technology staff, including salary. However, a significant contributing factor is that students graduating from computer science programs are unaware that libraries need for their knowledge and skills. By providing a pathway through certification, training, mentorship/sponsorship opportunities, and internships, ECU can address the gap libraries and other industries face when seeking technologically savvy employees.

This mixed-methods study aimed to explore ways to recruit and prepare students for entry-level library technology positions. An examination of library technology positions posted to a listserv explored what skills employers are seeking. Recorded interviews with current junior and senior level undergraduate computer science majors provided qualitative data. Using the SCCT framework as the theoretical foundation, this study explored how computer science students at ECU prepare for and engage with the job market or future studies. Combined with an in-depth look at the literature and recruitment needs of libraries, one possible solution is offered: a potential graduate certificate, with the goal of connecting computer science students to development positions in non-profit work, such as libraries.

## Summary of the Findings

The purpose of this mixed-methods study was to explore ways ECU can direct students to and prepare computer science majors for entry-level library technology positions. The following questions guided the study:

1. What do computer science majors look for when selecting a workplace?
    a. Where do computer science students look for jobs, and do they utilize Career Services?
    b. How do computer science majors interpret library job advertisements?
2. What would attract computer science majors to library technology jobs?
    a. Do background/demographics make a difference in attraction?
3. What skills are libraries seeking for their technology positions?
    a. How does the ECU computer science program align with the skills needed for success in a library technology position?

The specific technologies libraries are seeking in potential employees were explored through an evaluation of a popular library technology listserv. Following the social cognitive career theory framework, I conducted a focus group and two interviews to determine what current ECU computer science majors are seeking in a future workplace and where they look for jobs. The participants discussed three example entry-level positions to evaluate attractiveness and concerns and explore what additional training the students feel they would need to be successful in that position.

The analysis of the listserv found that roughly 3% of the positions posted would be considered entry-level, that is, ostensibly obtainable by someone who recently graduated with a bachelor's degree in computer science. Most of these positions would be considered software or application development, though there was considerable overlap in duties that may include elements of the other major categories: web development, systems and server administration, data analysis, and hardware/networking. Most position postings do not include a salary range.

Library technology positions tend to appear idealistic, with several bullet points under 'required skills', though the language is often vague.

The focus group and interviews found that, in alignment with SCCT, students chose computer science because of prior exposure to the subject, often through video games or a parent's work. This is corroborated in data gathered from a 2017 focus group of ECU computer science students where the responses to the question of why the students chose computer science fell into four themes: creativity/mental challenge, employment, love of computers/video games, and ranking/referral/scholarship (M. Ringler, personal communication, August 25, 2020).

Based on SCCT, I expected mentorship to play a larger role in the participant's choice of major and future employment. Other than Gabrielle, whose data analyst father is actively involved in mentoring her, the other participants do not feel that they have a true mentor. Gabrielle described how her father acts as a mentor:

> My dad is definitely still in a position to help me. And I consider him to be like my mentor of some sort. And, like, he helps me a lot with the job search and finding internships, and he helps me with material that I don't understand.

Whereas Joseph, who found out his mother studied computer science in college after he had chosen his major, says that he does not have a mentor. He does not consider his mother as a mentor since she "did her comp sci degree in like the late 90s. Okay, so like the major's completely changed… Yeah…She couldn't have helped me if she wanted to, is what I'm getting at." Mark noted that the computer science faculty were always very helpful, but that one of his professors had had medical issues, and everyone seemed very overloaded, and he did not want to "burden" them.

The participants do not have a particular workplace ideal in mind when they search for future employment, but they do have a fair amount of anxiety about finding work or internships. They are comfortable searching for positions online and use a combination of keywords and limiters, such as location, to find positions that might be a good fit. Obtainability is the most important factor, after which pay is second. When presented with a scenario of a possible position with lower stress and moderately lower pay versus a higher paid but highly stressful position, one participant chose the lower stress, and two others said they would consider it, depending on salary range.

Perks beyond pay are also attractive, such as flexible schedules and the ability to work from home. Most participants also were interested in positions that advertised the ability to keep learning through professional development.

## Interpretation of the Findings

The findings of this research study on attracting computer science students to library technology jobs are directly related to the research discussed in Chapter 2. Much has been written about library technology, but most has been aimed at those who have or are in the process of obtaining a master's degree in Library and Information Science. Little has been published about attracting and supporting staff to non-librarian roles in libraries.

### Technology Needs in Libraries

Chapter 2 included information describing how a library is, in many ways, its own ecosystem; a library's employees are not limited to credentialed librarians but include a wide range of people with different areas of specialization, such as marketing, finance, and building maintenance (Neal, 2006; Oliver & Prosser, 2018). There are specialized technology support positions in many libraries that can range from hardware and desktop support to application

development. This is supported by the data gathered from the Code4Lib listserv which could be separated into five major functional areas of responsibility: Software/App Development, Web Development, Systems and Server Administration, Data Analysis and Hardware/Networking.

Libraries have a history of supporting open source software (OSS) development out of need and their commitment to providing free access to information (Fernandez, 2012; Khode & Chandel, 2016; Puckett, 2012; Schneider, 2008; Singh, 2014). OSS in use in libraries would likely be too specific to include in a list of requirements for an entry-level position, but a library could post the primary programming language used; as Joseph said:

> In college so far we've used Python, Java and C++, a little bit of C. On my own time, I've tried to learn…basic web development… once you know one language learning another one isn't…crazy hard…you could do it like a week if you really…put your mind to it.

**What Influences Students to Major in Computer Science**

While the rationale behind selecting a college major can be complex and multifaceted, a common theme in the literature is that prior positive experience and confidence with computers can lead to a student choosing computer science (Archer et al., 2016; Carter, 2006; Gallup-Strada Education Consumer Pulse, 2017; Germeijs et al., 2012; Heinze & Hu, 2009; Montmarquette et al., 2002; Simon et al., 2017; Wang, 2013). Prior exposure is also aligned with the theoretical framework used for this study and appeared as one of the main themes in the data analysis. Heinze and Hu (2009) found that students who thought of themselves as more experienced with computers were more likely to major in computer science. All study participants cite exposure to computer science in high school or earlier. Peer influence, parent influence, and a love of video games are all manifestations of prior exposure.

Heinze and Hu (2009) found little correlation between social influence and choice of the information technology major, suggesting that the sample of American students were less likely to be influenced by the opinions of family and friends and that students do not seem to have a strong understanding of the job market, so future employment opportunity does not seem to be a driving factor in major choice (Heinze & Hu, 2009). Both assessments seem to be refuted in the data set from this study. While demonstrating a fair amount of uncertainty about the future, the study participants seemed to have a solid grasp on the importance of experience leading to future employment. Some have utilized career services at ECU, others have obtained assistance from their parents practicing for the coding interview. Joseph made a point to say he was keeping his expectations low, realizing that without much experience, he did not have room to be choosy: "You know, like, as a college student, I'm just like, I need to get whatever I can." Mark, the senior applying for jobs, says that the most significant factor he looks for is "no previous experience required."

While students with a prior positive experience with computers and technology are more likely to choose that as a major, research demonstrates that race and gender influence a person's self-efficacy (Wang, 2013). The data gathered for this study was too limited to assert the validity of this statement, and no study participants brought up issues regarding race or gender.

**Recruitment for Library Technology Jobs**

Recruitment for library technology jobs can be difficult. One of the biggest hurdles libraries face is awareness; all study participants were unaware that libraries had developer positions. Joseph said, "I didn't know libraries did this stuff... I just thought they just collect books and whatnot."

Awareness aside, hiring procedures can take a long time, the pay available might be lower than industry, and libraries are competing with many other industries, as there are more IT job openings than there are qualified people (Bridges, 2002; Evans, 2018; Raschke, 2003; Sproles & Detmering, 2010; Tapia & Kvasny, 2004).

Raschke (2003) critiques unrealistic expectations, saying, "job requirements, whether required or preferred, end up as a potpourri of Olympic-size standards thrown in by an administrator or search committee trying to meet everyone's needs and please every constituency" (p. 61). This was brought up by several study participants, noting that the jobs seemed to list a lot of specific required skills but often were vague about what exactly the position would be doing. Joseph noticed that:

> A lot of the descriptions…the knowledge you need to know… that's a lot of stuff. [Maybe not if] I was super into [library technology], but if I say I was just a person that was just trying to get a degree in Comp Sci, I saw like all those… I kind of get disinterested because a that's a lot of material.

He felt it was unclear if experience with every one of the listed programming languages and skills were needed or if they were examples. He thought it might be more precise if "they just said what they actually need someone to do."

Positions that ask for many years of experience frustrated Mark, who said, "it probably doesn't take five years to learn everything there is to know about that." Underscoring the importance of highlighting professional development opportunities, Joseph discussed that while many people might be turned off by a long list of requirements and would not apply, if a company instead put "you need to at least have an understanding of Java and C++ …and these other languages…we can help you understand that over time."

Libraries could simplify job advertisements, focusing on the broader theme of problem-solving, as the RAILS position did with inviting questions and then being specific about what duties are genuinely required and which could be developed with assistance. As discussed in Chapter 4, libraries could also ensure they are advertising positions in various locations, including LinkedIn, and utilizing a more aesthetically pleasing and usable format than what the institution's recruitment management system often allows.

**Theoretical Framework**

Social cognitive career theory (SCCT) has been a valuable tool in various fields to examine how one's interests, expectations, and goals are shaped by internal and external factors (Greenhaus & Callanan, 2006; Lent, 2013; Lent et al., 1994). Built on Bandura's (1986) social cognitive theory, SCCT "seeks to create a unifying framework for explaining how people (a) develop vocational interests, (b) make occupational choices, (c) achieve varying levels of career success and stability, and (d) experience satisfaction or well-being in the work environment" (Lent, 2013, p. 115).

By using the SCCT framework, this study connects personal attributes that lead to career development goals. According to the theory, one of the significant aspects of being interested in a career is prior positive experience (exposure). This was very evident in the data, as each study participant had exposure to computer science through either personal interest, such as video games or because a parent works in the computer science field. This early positive exposure helps support self-efficacy as the participants saw others like them being successful.

Reflecting on the importance of exposure in choice of major, it is equally important in selecting a potential line of employment. If computer science students have no avenue for positive exposure to library technology positions, they are less likely to want to pursue

employment in libraries. An internship, work study opportunity, or even a targeted class project could provide awareness as well as positive exposure.

As previously discussed, I expected mentorship/sponsorship to be a more prominent theme. This indicates that there may be some opportunity to provide the computer science students mentorship support opportunities within the institution and perhaps within the library.

Since this study focused on students who are not yet in the workforce, the third central area of SCCT, satisfaction/outcome expectations, was not explored. I believe this also explains why "vocational awe" did not arise as a theme in the participant interviews as it did in the pilot study. Participants did not express their interest in computer science as a calling, and generally held very reasonable expectations for future employment.

## Limitations of the Study

Although I was able to collect appropriate data to analyze and provide responses to the research questions, limitations and delimitations of the study were identified. The most significant limitation of this study was the impact of the COVID-19 pandemic. The pandemic forced what were intended to be in-person focus groups online, and the compressed schedule made it difficult to meet. What was intended to be at least three focus groups ended up being one focus group and two semi-structured individual interviews. While enough data was gathered to conduct the study, a more extensive sample set would have yielded more comparison points. The pandemic also likely influenced how participants responded to questions, including the interest in having a flexible work schedule.

The pandemic-induced compressed schedule also made it very difficult to conduct a focus group with computer science faculty. Faculty found themselves forced to pivot to online instruction with little notice and condense their already full course outline into fewer weeks. The

department was already short-staffed; the additional stress brought by the pandemic understandably meant that the faculty needed to focus on student instruction. Though the two faculty who did respond were gracious and interested, busier than usual schedules meant scheduling them for a focus group did not happen.

One interesting limitation regarding the listserv data is the listserv itself. Because there are few requirements, many recruiters opted not to include the complete job information on the listserv post, requiring the job seeker to follow a link to the institution's human resources database. Many of these posts were eliminated from consideration because there was not enough data to determine if a position would be considered entry-level or not, and the link to the human resources page was no longer active. For the sample positions for digital library developer and the programmer/analyst, I was able to obtain copies of the official university job postings so that interviewees could compare the Code4Lib job post with the human resources system website. The interviewees, by and large, found the extra information and layout of the human resources page to be confusing.

Lastly, there is no way to determine if the job posting in the listserv resulted in a successful hire. There is also no way in the current study design to track retention post-hire.

## Implications of the Findings for Practice

One of the core implications of this study is that computer science students at ECU would like more opportunities for hands-on experience and would benefit from a structured internship or course-affiliated project. The library already employs students in various capacities, so there is precedent for student employment. The library has large amounts of structured data and custom development projects. The library technology department could benefit just as much from a formal collaboration with the computer science department.

Libraries have many technology-based positions without a dedicated pipeline or training program to help place and support staff in those positions. This study may have implications for how libraries create and recruit for technology-based positions. Data gathered will be used to help inform future job openings in ECU's library technology department. As seen, many of the positions appeared to contain a wish list of required knowledge, experience, and skills that could discourage applicants. ECU's library technology department will be as specific as possible in specifying needs and less restrictive regarding required skills. Several positions were eliminated for consideration in the current study because they required two or more years of experience; one option libraries could consider would be to make required years of experience optional. Where state human resources allow, ECU's library technology department will reduce required years of experience on library technology positions.

Libraries also can do a better job raising awareness that technology skills are needed. Researchers must continue to examine ways to break through to potential employees that may be wholly unfamiliar with the work done in libraries and the need and desire for diverse skillsets.

The study results may have practical implications in how universities can utilize their vast employee base to provide mentorship opportunities for students.

## Social Justice, Diversity, Access, and Equity Implications

As one of the largest employers in the region, East Carolina University has embraced its mission to be a model for regional transformation, and this study is an extension of that ethos. By aligning the technology skillset of computer science with the more humanities-focused library science discipline, ECU can prepare computer science students to be instrumental in developing and supporting library technology.

Training, education, and support are excellent tools supporting social justice. Training allows new people to be able to participate in a community that may otherwise seem inaccessible. With an emphasis on open-source development, library technology is intended to promote access to information for as many people as possible, and students interested in making a societal impact through application development would find this work fulfilling if only they knew it was an option and they had a pathway toward employment. As discussed in the recommendations section, ECU could also build a formal mentoring program connecting computer science students to those employed in computer science related positions on campus.

Though outside the scope of this research project, it is important to note that both libraries and STEM fields in the United States have struggled with the recruitment and retention of minoritized populations, as discussed in Chapter 2. Libraries, especially in the wake of social justice movements such as Black Lives Matter, have begun to focus and emphasize the importance of diversity, equity, and inclusion in staffing as well as collection development and description. Of the 69 entry-level positions reviewed, the words “diverse” or “diversity” are only mentioned in 36 (52%) of the postings. The analyzed position descriptions predate the renewed emphasis on DEI in libraries, so it would be interesting to compare to positions posted in the most recent year.

Of note, though the sample dataset was too small to draw significance, only one study participant identified as female, and only one identified as non-white.

## Recommendations

Though participation was limited by the pandemic, the data was robust enough to draw several conclusions and make recommendations. Most immediate is the computer science students’ desire for more hands-on experience opportunities in the way of internships or work

study. ECU's Academic Library Services (ALS) has participated in student employee job fairs to attract a wider variety of potential student employees, but targeted recruitment at certain departments could result in more diverse student hiring by major. A summary of this research will be presented to the library director with a proposal to create an internship opportunity in the Discovery and Technology Services Division specifically aimed at computer science students. Within the library, recent efforts have been made to mentor and support student employees as they navigate future employment, and this work should continue. The summary to the library director will include the statements by Mark, who despite working as a student assistant at one of the library's public service desks, had no idea that libraries employed developers. Library staff and faculty could engage their student employees in conversations about their majors and career plans and make connections to areas within libraries that would be of interest.

A potential outcome identified early in the study would be to create a training pathway to introduce technology-focused undergraduates to the potentials of non-profit work and to highlight the needs that match their skillsets. The first phase of this project would be to collaborate with the computer science department to develop internship, work, or volunteer opportunities in the library that correspond to curricular need.

During the focus group and interviews, the idea of a potential graduate certificate in library technology was brought up. Participants liked the idea overall. Joseph was unaware of graduate certificates as a concept, and when the idea was explained, he said, "Yeah, I see that being kind of useful. My only issue with that is that… it's like a year of… studying for…a library thing. And that's not really something that people are like, 'Oh, yeah, that's cool and interesting.'" As outlined in SCCT, positive exposure to library technology would influence a person's career goals, and this could be achieved via the internship or work study. However, a

graduate certificate specifically in library technology may be more attractive to people newly employed to library technology positions, especially if the institution was willing to pay for it.

ECU already has several online graduate certificates available (East Carolina University, 2021b). The certificates range in topics, but all require a minimum of three distinct courses and at least nine credit hours. An interdisciplinary graduate certificate could be made up of existing courses from the Library Science department and courses in the College of Engineering and Technology (see Appendix F). Though there are other applicable courses, and faculty would need to be consulted, the selected sample courses focus on topics that appear in the listserv data.

The courses selected as possible candidates for a graduate certificate represent the major areas of need as determined from the listserv data (see Table 6). On the assumption that the persons applying are coming from a computer science or other technological background, emphasis in graduate certificate coursework should expand on the knowledge base already obtained and introduce students to library concepts specific to libraries and other cultural institutions. The course "LIBS 6016 Technology for Library Services" may not, by itself, be adequate or may need to be modified, as the current course assumes a library perspective, not a computer science perspective, but the overall content may be similar.

Beyond an introduction to major library concepts and technologies obtainable from LIBS 6010 and 6016, the list of possible courses matches the most frequently appearing technologies from the listserv (see Table 5). This includes a focus on software development, web development, database and server management and digital libraries. Also included in the list of possible courses are ITEC 6200 "Technology Project Management" and ITEC 6011 "Technological Ethics, Diversity, and Leadership". These were included as possible electives as they align with the "nice to have" skills expressed in several of the job advertisements. Project

Table 6

*Courses Matched to Technologies Required in Entry-Level Job Postings*

| Code | Technologies Included | Possible Course Match |
|---|---|---|
| Programming language | Javascript, PHP, Ruby, Python, Java, .Net, Perl, API | SENG 6240, SENG 6285 |
| Web Development | Drupal, html, css, xml, WordPress | ICTN 6845 |
| Library technologies | Library systems, ILS, Integrated Library Systems, Interlibrary Loan, digital repository, ContentDM, Omeka, Islandora | LIBS 6610, LIBS 6016, LIBS 6852 |
| Databases | Databases, DBMS, SQL, mySQL, postgres, solr, oracle | SENG 6240 |
| Server | Apache, Windows Server, Linux, LAMP | SENG 6285 |

management is a skill that would benefit any employee engaged in technology projects, and an awareness of the ethics, diversity, and leadership issues in technology could assist in bridging some of the diversity and ethical gaps mentioned in Chapter 2.

Alternatively, the library technology courses could be part of an elective pathway on a more general certificate. Joseph was interested in the concept of a customizable graduate certificate that would combine his knowledge from his computer science degree to a different discipline, especially if employers would be willing to pay for the certificate. Mark also liked the idea of a customizable certificate, saying:

> Definitely, because there used to be a class where you could get like a video game certificate or whatever. And they removed that the year before I got here…well I don't know if it was a certificate… [but it would be nice to have] something to put on the resume where it kind of stands out.

Gabrielle and Peter liked the idea, especially if it could be combined with an internship or other hands-on experience.

Another area where ECU could have a direct and meaningful impact is to create a mentorship program matching existing information technology employees with computer science students. The computer science department website already emphasizes internship programs (East Carolina University, 2019a), but mentorship, alongside internship experience, can boost not only exposure but also self-efficacy, both essential components of SCCT. Every participant in the study was eager for practical experience, but none seemed to have built strong mentorship relationships outside of family members. Since I was unable to meet with computer science faculty, I am not able to report their insights regarding the need for support and potential

mentorship opportunities outside of the department. However, this would be important to obtain before implementing any program.

This may align well with the work being done at ECU with the newly-launched Towards Hiring, Resources, Inclusion, Value and Excellence (THRIVE) program (East Carolina University, 2021c). Though THRIVE is focused on women-identifying faculty in STEM, the lessons and experience may be directly applicable, especially to women and other minoritized populations in computer science.

Libraries themselves can improve their job advertisements, especially for positions that would be considered entry-level technology positions. Even if competitive pay is out of reach, a library posting could attract applicants by focusing on the four other areas that would attract computer science majors: noting potential autonomy and flexibility, professional development opportunities, interesting work, and clear terminology and expectations. Libraries should not require multiple years of experience if possible and should avoid wishful lists of skill requirements. In addition to Indeed.com, positions should also be posted on LinkedIn, as every participant mentioned LinkedIn as an essential tool in their job search, prompting Gabrielle to say, “everyone uses LinkedIn. Right?”

To expand this study, I would want to include faculty focus group data and recruit more participants to be able to analyze demographic data. It would also be interesting to compare data from the technology systems major to the data gathered from computer science majors. Additional research into what attracted current employees to library technology positions would be useful. It would also be interesting to follow up with institutions with positions posted to determine hiring success rate and retention. Further research into how the library technology position landscape shifted post-pandemic would also be valuable.

## Role of the Scholarly Practitioner

This project has been a humbling experience, and I am eternally grateful for the many people who have supported me. This study took several unexpected turns, and while the pandemic did force some shifts in focus, the data is still valuable for understanding ways to attract computer science to library technology positions.

I would like to use the listserv study data in the future to compare my results, which are pre-pandemic, to jobs posted post-pandemic to see if there is a noticeable shift in either benefits/perks being offered or if there are changes in required skills and knowledge. I will seek publication opportunities regarding the listserv data and how participants responded to reviewing job advertisements. I would also like to have conversations with the faculties of the College of Engineering and Technology and the College of Education to see if there would be any interest in creating the foundations of what could be an interdisciplinary graduate certificate. Specifically, I am interested in collaborating with the computer science faculty to provide a possible place for computer science students to get real-life opportunity.

The data shows students desire more internship opportunities on campus, and I would like to use that data to create structured internships, work study, or course-connected projects within my division in the library. Importantly for me, this study has re-emphasized why I chose to work in higher education: working with students. Though my current role is often more behind-the-scenes support, there are opportunities to provide meaningful learning experiences to students, and the SCCT framework can help provide that structure.

Earning the doctorate in educational leadership has given me a solid foundation on leadership theory in a higher educational context. I have been able to apply lessons I learned to my everyday work, and it was this degree and this study that aided my promotion to my current

position as an assistant director. ECU's Educational Leadership program taught me how to use a social justice lens to look critically at the institution's policies and procedures and has given me the tools to make effective change within my sphere of influence. Data-driven decision making is important, and this program has expanded my toolkit and understanding of how to best gather and utilize data to make informed decisions. I will continue to be a change agent by building on what I have learned through this study and the program to foster connections and provide hands-on learning opportunities for students.

## Conclusions

A strong technical background is a vital skill for potential employees of libraries and other cultural institutions. Despite this, libraries have difficulty attracting technologically skilled employees to their technology positions. This is due to several factors, including lack of awareness of need, potentially unclear or confusing job advertisements, and difficulty competing against industry jobs. One way to promote awareness and provide experience would be through providing meaningful internships and project experience in library technology departments. Another would be in developing an educational pathway such as a graduate certificate.

Though every technology used in libraries may not be taught in an educational setting, ECU has an opportunity to provide specific experience and preparation to students interested in computer science who might be interested in working in cultural institutions such as libraries. The concept of a graduate certificate or other forms of customizable micro-credentials is attractive to students, especially if connected with practical experience through internships or employment.

Libraries can improve their job advertisements by making them more precise, avoiding unnecessary jargon, and reducing requirements to reflect actual needs. By emphasizing support

and professional development opportunities, libraries can attract applicants interested in expanding their experience.

To best reflect a diverse patron population, libraries must employ people from a variety of diverse backgrounds, including those with technical expertise. East Carolina University has an opportunity to embrace its history of service and regional transformation in creating a training pipeline for computer science graduates to work in libraries and other cultural organizations, such as archives, museums, and non-profits. While these positions may be stepping-stones, they could provide much-needed experience for recent graduates while benefitting the community at large.

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# APPENDIX A: INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

**EAST CAROLINA UNIVERSITY**
**University & Medical Center Institutional Review Board**
4N-64 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** ·
**rede.ecu.edu/umcirb/**

## Notification of Exempt Certification

From: Social/Behavioral IRB
To: Amanda McLellan
CC: Heidi Puckett
Date: 5/6/2020
Re: UMCIRB 20-000967
CS to Librarianship Pipeline

I am pleased to inform you that your research submission has been certified as exempt on 5/6/2020. This study is eligible for Exempt Certification under category #1 & 2ab.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

| Document | Description |
|---|---|
| Amanda Mclellan Proposal 3 2020.docx(0.01) | Study Protocol or Grant Application |
| Consent Paragraph.doc(0.02) | Consent Forms |
| Participant Recruitment Email Draft.docx(0.02) | Recruitment Documents/Scripts |
| scripts.docx(0.01) | Interview/Focus Group Scripts/Questions |

For research studies where a waiver of HIPAA Authorization has been approved, each of the waiver criteria in 45 CFR 164.512(i)(2)(ii) has been met. Additionally, the elements of PHI to be collected as described in items 1 and 2 of the Application for Waiver of Authorization have been determined to be the minimal necessary for the specified research.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

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## APPENDIX B: INFORMED CONSENT STATEMENT

You are being invited to participate in a **research** study titled "Rethinking the pipeline: Examining recruitment of computer science majors to librarianship" being conducted by Amanda McLellan, a graduate student at East Carolina University in the Educational Leadership department. The goal is to conduct focus groups that will include a total of about 18 individuals in/at East Carolina University. The focus group interview will take approximately 60 - 90 minutes to complete. It is hoped that this information will assist us to better understand how computer science majors choose their major, search for jobs, and if there are better ways for libraries with entry-level technology positions to encourage computer science graduates to apply. Your responses will be kept confidential and no data will be released or used with your identification attached. Your participation in the research is **voluntary**. You may choose not to answer any or all questions, and you may stop at any time. We **will not** be able to pay you for the time you volunteer while being in this study, however, each focus group will hold a drawing for a $10 Starbucks gift card. One participant from each focus group will win. There is **no penalty for not taking part** in this research study. Please call Amanda McLellan at 804-615-6898 for any research related questions or the University & Medical Center Institutional Review Board (UMCIRB) at 252-744-2914 for questions about your rights as a research participant.

*Note.* the title of the study was changed after the informed consent statement was initially sent.

## APPENDIX C: STUDENT FOCUS GROUP PROTOCOL

Date: _____ Time of Interview: _____
Interviewer: Amanda McLellan
Focus Group Attendees:_____
Place: _____

The purpose of this research is to understand how computer science majors choose their major, search for jobs, and if there are better ways for library technology positions to encourage computer science graduates to apply. You are being invited to take part in this research because you previously indicated that you would be willing to participate. By doing this research, I hope to learn what factors influence a computer science major's job search and what would attract computer science majors to library technology jobs.

1. Tell me about yourselves, how you chose ECU and computer science.
    a. [Probing questions might include first-generation student status, question about influencer / mentor]
2. Have you thought about what you will do after graduation?
    a. [Probing questions might include tell me more about that plan]
    b. Where do you look for jobs?
    c. What keywords do you use?
    d. Have you met with anyone from ECU's Career Services?
    e. [If indicated a mentor / influencer] Is that person someone who offers you career advice?
3. When looking for a future/potential workplace, what kind of things would be most attractive in a workplace?
    a. [Probing questions might include asking about benefits, commute time, salary]
4. I would like to show you a couple of example job advertisements and have you walk me through them. [Three jobs chosen from listserv given, one at a time]
    a. Is this a job to which you would apply?
        i. What about it makes you say that?
        ii. What would need to be different in order for you to want to apply?
    b. [Probing questions might include asking to tell me more about that]

5. I found that many jobs I evaluated were looking for these skills. How would you rate your ability with each?
    a. [List of top 5-10 skills as determined from library listserv evaluation]
    b. How would you obtain this skill if you don't already have it?
6. If ECU were to offer something like a graduate certificate that covered [x,y,z skills from listserv] would you find that attractive? Why or why not?

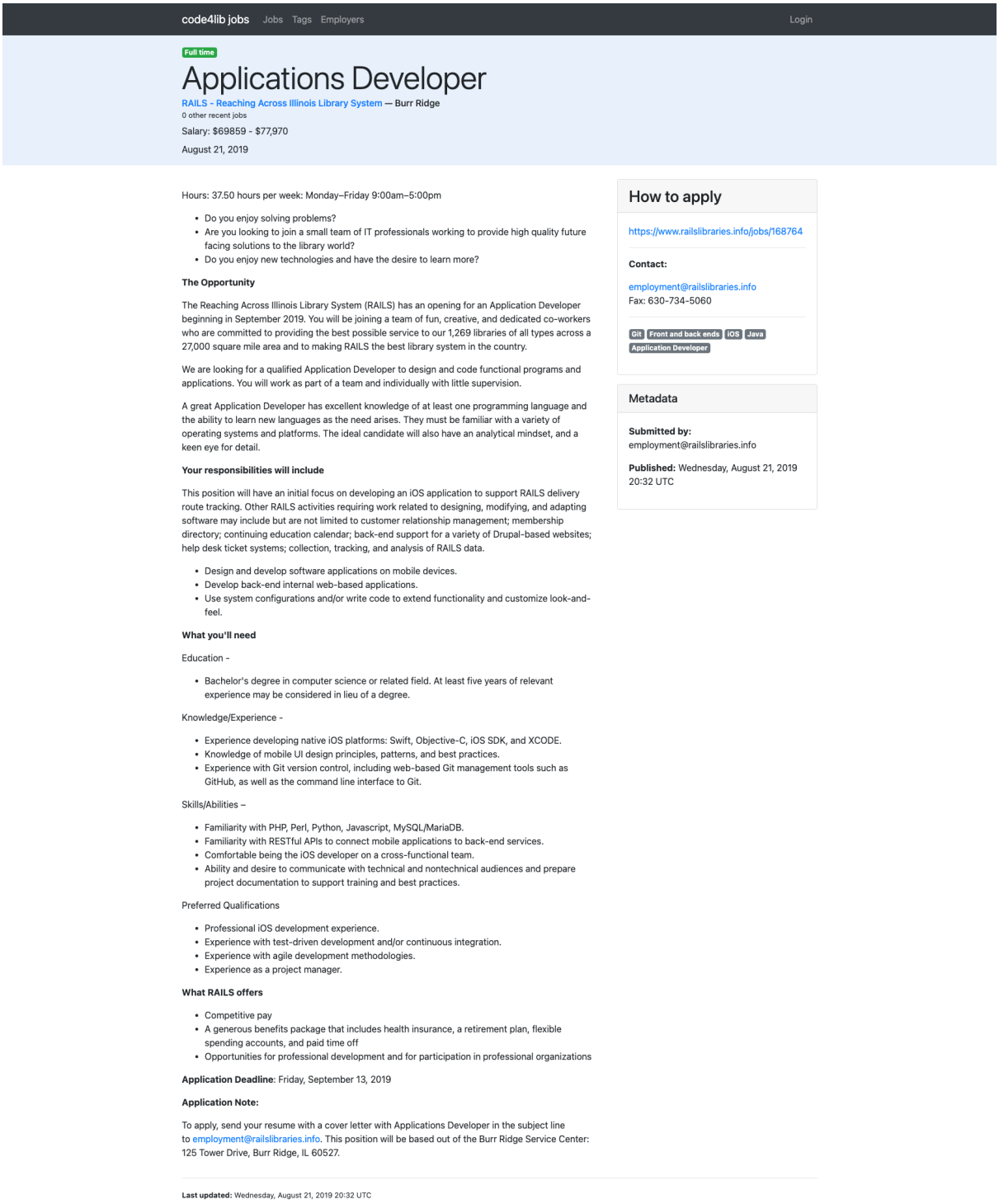
## APPENDIX D: FACULTY FOCUS GROUP PROTOCOL

Date: _____ Time of Interview: _____
Interviewer: Amanda McLellan
Focus Group Attendees:_____
Place: _____

The purpose of this research is to understand how computer science faculty members design their curriculum and investigate ideas on possible cross-departmental collaboration. You are being invited to take part in this research because you previously indicated that you would be willing to participate. By doing this research, I hope to learn what factors influence a computer science major's job search and what would attract computer science majors to library technology jobs.

1. Tell me about yourselves, how long you've been at ECU and what drew you to becoming a computer science professor.
2. What, in your words, is the purpose of higher education?
3. When you design a course, what is your process? What is most important to you?
    a. [Probing questions might include tell me more about that process]
    b. Do you collaborate with any of the centers or resources on campus?
4. When your students are looking for jobs and internships, do they seek your advice and mentorship? What does that look like?
5. I am investigating the idea of a graduate certificate in library technology, thinking of it as a cross-departmental collaboration between computer science and the library science faculty. Have you had any successes or challenges with cross-departmental efforts before?
    a. [Probing questions might include asking to go further]

# APPENDIX E: SELECTED LIBRARY TECHNOLOGY POSITIONS



code4lib jobs Jobs Tags Employers Login

Full time

## Applications Developer

RAILS - Reaching Across Illinois Library System — Burr Ridge

0 other recent jobs

Salary: $69859 - $77,970

August 21, 2019

Hours: 37.50 hours per week: Monday–Friday 9:00am–5:00pm

- Do you enjoy solving problems?
- Are you looking to join a small team of IT professionals working to provide high quality future facing solutions to the library world?
- Do you enjoy new technologies and have the desire to learn more?

**The Opportunity**

The Reaching Across Illinois Library System (RAILS) has an opening for an Application Developer beginning in September 2019. You will be joining a team of fun, creative, and dedicated co-workers who are committed to providing the best possible service to our 1,269 libraries of all types across a 27,000 square mile area and to making RAILS the best library system in the country.

We are looking for a qualified Application Developer to design and code functional programs and applications. You will work as part of a team and individually with little supervision.

A great Application Developer has excellent knowledge of at least one programming language and the ability to learn new languages as the need arises. They must be familiar with a variety of operating systems and platforms. The ideal candidate will also have an analytical mindset, and a keen eye for detail.

**Your responsibilities will include**

This position will have an initial focus on developing an iOS application to support RAILS delivery route tracking. Other RAILS activities requiring work related to designing, modifying, and adapting software may include but are not limited to customer relationship management; membership directory; continuing education calendar; back-end support for a variety of Drupal-based websites; help desk ticket systems; collection, tracking, and analysis of RAILS data.

- Design and develop software applications on mobile devices.
- Develop back-end internal web-based applications.
- Use system configurations and/or write code to extend functionality and customize look-and-feel.

**What you'll need**

Education -

- Bachelor's degree in computer science or related field. At least five years of relevant experience may be considered in lieu of a degree.

Knowledge/Experience -

- Experience developing native iOS platforms: Swift, Objective-C, iOS SDK, and XCODE.
- Knowledge of mobile UI design principles, patterns, and best practices.
- Experience with Git version control, including web-based Git management tools such as GitHub, as well as the command line interface to Git.

Skills/Abilities –

- Familiarity with PHP, Perl, Python, Javascript, MySQL/MariaDB.
- Familiarity with RESTful APIs to connect mobile applications to back-end services.
- Comfortable being the iOS developer on a cross-functional team.
- Ability and desire to communicate with technical and nontechnical audiences and prepare project documentation to support training and best practices.

Preferred Qualifications

- Professional iOS development experience.
- Experience with test-driven development and/or continuous integration.
- Experience with agile development methodologies.
- Experience as a project manager.

**What RAILS offers**

- Competitive pay
- A generous benefits package that includes health insurance, a retirement plan, flexible spending accounts, and paid time off
- Opportunities for professional development and for participation in professional organizations

**Application Deadline**: Friday, September 13, 2019

**Application Note:**

To apply, send your resume with a cover letter with Applications Developer in the subject line to employment@railslibraries.info. This position will be based out of the Burr Ridge Service Center: 125 Tower Drive, Burr Ridge, IL 60527.

**Last updated:** Wednesday, August 21, 2019 20:32 UTC

### How to apply

https://www.railslibraries.info/jobs/168764

**Contact:**

employment@railslibraries.info
Fax: 630-734-5060

Git Front and back ends iOS Java Application Developer

### Metadata

**Submitted by:**
employment@railslibraries.info

**Published:** Wednesday, August 21, 2019 20:32 UTC

*Figure E1*. Selected position: Applications Developer for RAILS as seen on Code4Lib Jobs.


*Figure E2*. Selected position: Digital Library Developer for NIU as seen on Code4Lib jobs.

# Digital Library Developer

## Position Details

Posting Detail Information

| | |
|---|---|
| **Position #** | 00027707 |
| **Position Title** | IT Technical Associate |
| **Working Position Title** | Digital Library Developer |
| **Posting Type** | Civil Service |
| **FTE** | 1.00 |
| **Representation** | |
| **Department** | Libraries |
| **Primary Function** | This position is responsible for creating and enhancing the tools, interfaces, and workflows that support the University Libraries' digital asset management systems, enabling scholars, students, and the public to effectively discover and use its varied collections. They will collaborate with the Digital Collections & Metadata Librarian, the Digital Collections Steering Committee, and external partners to plan and design websites and use emerging web service technologies to improve the user experience and provide long-term access to the Libraries' digital assets. |
| **Duties and Responsibilities (generally)** | Maintains, develops, and extends all aspects of the Libraries' digital asset management systems, which contain the library's own digital collections, past and current collaborative digital projects, and the University's institutional repository. |
| **Minimum Required Qualifications for this position** | • A Bachelor's degree in computer science, information systems, or a related field<br>• Experience writing custom code, configuring software packages, performing complex system analysis, and/or building integration between software packages<br>Ability & Skills<br>• The ability to handle multiple tasks and projects simultaneously<br>• The ability to work effectively both independently and as part of a dynamic team<br>• The ability to think flexibly, to find and implement solutions, and to adapt to a rapidly changing environment<br>• Excellent verbal and written communication skills |
| **Education and Experience Preferred** | • Working knowledge of Web development tools, languages, and frameworks, such as: PHP, Apache/HTTP, HTML, Javascript, CSS, MySQL, Java/Jetty/Tomcat, RESTful APIs<br>• Experience with Drupal 7 and/or Drupal 8/9<br>• Familiarity with AWS and cloud service providers<br>• Experience working on community-driven open source projects<br>• Experience with version control and collaboration tools, such as Git or Subversion<br>• Familiarity with semantic web/linked data technologies, such as RDF, SPARQL, and OWL<br>• Working knowledge of Linux administration |
| **Working Hours** | M-F 8:00-4:30; **Potential for work-at-home 2-3 days per week** |
| **Hiring rate/range** | Commensurate with experience and internal equity |
| **Posting Date** | 10/31/2019 |
| **Closing Date** | 01/13/2020 |

| | |
|---|---|
| **Priority Review Date** | |
| **Open Until Filled** | No |
| **Special Instructions to Applicants** | • For information about Northern Illinois University's benefits package, please visit: **https://www.niu.edu/hrs/benefits/index.shtml**<br>• Fully complete the Education and Work History sections of the application. Be specific on your entire work history, including the employment dates and duties for all positions held.<br>• **Transcripts are required to be uploaded (if multiple transcripts, please attach each transcript in a separate PDF file) at the time of application. Please note: Unofficial transcripts are acceptable at the time of application; official transcripts will be required if hired.**<br>• Once your complete application is submitted, it will be reviewed to determine if you meet the minimum qualifications for this classification.<br>• Please monitor your e-mail for further information regarding your application status.<br>• The Civil Service examination for this classification is based on your application materials. If you meet the minimum required qualifications for this position, you will receive a score calculated from your education and experience, and your name will be placed on the active employment register by exam score. After the application deadline, the names within the top three scores will be referred to the department for interview. Once this position has been filled, all names will be removed from the employment register in accordance with SUCSS rule 250.60h10.<br>• If eligible for veteran's preference points, DD214 paperwork reflecting an Honorable discharge MUST be emailed (civilservicetesting@niu.edu), faxed (815-753-2335), or hand delivered to Human Resources prior to the posting deadline date in order to receive the maximum eligible points on the Civil Service examination:<br>Fax: 815-753-2335<br>Attn: IT Technical Associate (27707)<br>Address: Northern Illinois University<br>Human Resources<br>1515 W. Lincoln Highway<br>DeKalb, IL 60115<br>• Employment is contingent upon your passing a satisfactory criminal background investigation. You may not begin work until the criminal background investigation results have been received and cleared by Human Resources.<br>• For more information on the Information Technology Technical Associate classificaiton, including salary ranges, typical duties, and minimum acceptable qualifications, please visit:<br>**https://www.sucss.illinois.gov/pages/classspec/Detail.aspx?tblClassIndexID=2626** |
| **Link to Department Homepage** | http://library.niu.edu/ulib/ |
| **Physical Demands** | This position might work-at-home 2-3 days per week |
| **EEO Statement** | In accordance with applicable statutes and regulations, NIU is an equal opportunity employer and does not discriminate on the basis of race, color, national origin, ancestry, sex, religion, age, physical and mental disability, marital status, veteran status, sexual orientation, gender identity, gender expression, political affiliation, or any other factor unrelated to professional qualifications, and will comply with all applicable federal and state statutes, regulations and orders pertaining to nondiscrimination, equal opportunity and affirmative action.<br>The following person has been designated to handle inquiries regarding the non-discrimination policies:<br>Ethics and Compliance Officer, Title IX Coordinator<br>Health Services 230<br>TitleIXCoordinator@niu.edu<br>815-753-5560 |
| **Is Background Check Required** | Yes |

| | |
|---|---|
| **Visa Policy** | In compliance with federal law, all persons hired will be required to verify identity and eligibility to work in the United States and to complete the required employment eligibility verification document form upon hire. |
| **ADA Accommodation** | NIU remains committed to ensuring that its recruitment and application procedures include full opportunities for applicants with disabilities. Employment opportunities will not be denied to anyone because of the need to make accommodations for a person's disability during either the application or interview process. An applicant who believes they require an accommodation to participate in the employment process due to a disability may request that accommodation through the Accommodation Request Form. This form can be obtained by contacting the Office of Academic Diversity, Equity and Inclusion (ADEI) at 815-753-8399. |
| **Clery Act Information** | NIU provides information regarding campus security, personal and fire safety, including topics such as: crime prevention, emergency response procedures and crime reporting policies, in addition to crime and fire statistics for the most recent three calendar years. The Annual Security Report containing security and safety information is available at www.safety.niu.edu/clery or by contacting the University Police Department and Public Safety Department at 815-753-9628 to receive a hard copy. The Annual Fire Safety Report is available at www.niu.edu/clery/fire_report.pdf or by contacting the Environmental Health and Safety Department at 815-753-0404 to receive a hard copy. |
| **Quick Link** | http://employment.niu.edu/postings/49293 |

## Supplemental Questions

Required fields are indicated with an asterisk (*).

1. * How did you hear about this vacancy?
   - Public Job Posting
   - Internal Job Posting
   - Agency Referral
   - Advertisement/Publication
   - Personal Referral
   - Website
   - Mailing
   - Listserv
   - Phone Contact
   - Word of Mouth
   - Other
2. * Describe your professional work experience relevant to this position.
   (Open Ended Question)
3. * Please provide the name of the employer and the dates of employment where you gained this experience. Please note that this information must be verified on an NIU application and/or resume.
   (Open Ended Question)
4. * Do you have a Bachelors Degree?
   - Yes
   - No
5. * What field/major is your degree in?
   (Open Ended Question)
6. * Do you hold a Master's Degree or higher?
   - Yes
   - No
7. * What field/major is your Master's degree or higher in?
   (Open Ended Question)

## Applicant Documents

**Required Documents**

1. Resume/Curriculum Vitae
2. Cover Letter
3. Transcripts (unofficial with official required at hire)
4. List of References

**Optional Documents**

1. Transcripts #2 (unofficial with official required at hire)
2. Transcripts #3 (unofficial with official required at hire)
3. Other



*Note.* This document is four pages long.

*Figure E3*. Selected position: Digital Library Developer for NIU as seen on NIU website.

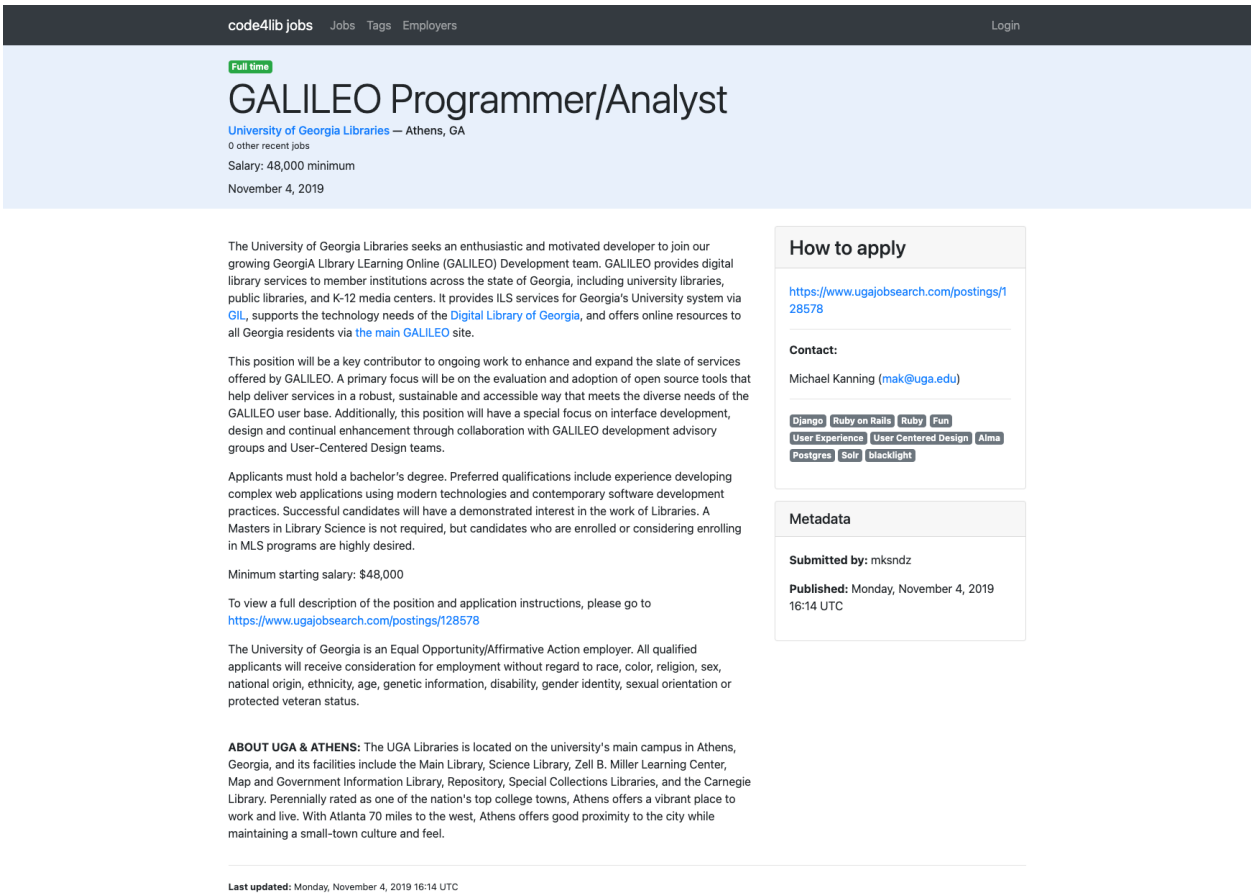



*Figure E4*. Selected position: Programmer/Analyst for GALILEO.

# GALILEO Programmer/Analyst

## Posting Details

Posting Details

| | |
|---|---|
| **Posting Number** | S04242P |
| **Working Title** | GALILEO Programmer/Analyst |
| **Department** | Libraries General Operations |
| **About the University of Georgia** | The University of Georgia (UGA), a land-grant and sea-grant university with statewide commitments and responsibilities is the state's oldest, most comprehensive, and most diversified institution of higher education (http://www.uga.edu/). UGA is currently ranked among the top 20 public universities in U.S. News & World Report. The University's main campus is located in Athens, approximately 65 miles northeast of Atlanta, with extended campuses in Atlanta, Griffin, Gwinnett, and Tifton. UGA was founded in 1785 by the Georgia General Assembly as the first state-chartered University in the country. UGA employs approximately 1,800 full-time instructional faculty and more than 7,600 full-time staff. The University's enrollment exceeds 36,000 students including over 27,500 undergraduates and over 8,500 graduate and professional students. Academic programs reside in 17 schools and colleges, as well as a medical partnership with Augusta University housed on the UGA Health Sciences Campus in Athens. |
| **About the College/Unit /Department** | The UGA Libraries is located on the University of Georgia's main campus in Athens, Georgia. Its facilities include the Main Library, Science Library, Zell B. Miller Learning Center, Map and Government Information Library, Richard B. Russell Special Collections Libraries, Health Science Carnegie Library, and Repository, which receive more than three million visits per year and provide a vast array of electronic and print resources. They offer extensive hours, including 24/7 operation at the Miller Learning Center. The UGA Libraries offer distinctive, nationally significant special collections, including the Hargrett Rare Book and Manuscript Library, Richard B. Russell Library for Political Research and Studies, and Walter J. Brown Media Archive and Peabody Awards Collection. Information about the UGA Libraries: http://www.libs.uga.edu/ Information about Athens: http://www.libs.uga.edu/athens/. |
| **College/Unit/Department website** | www.libs.uga.edu |
| **Posting Type** | External |
| **Retirement Plan** | TRS or ORP |
| **Employment Type** | Employee |
| **Benefits Eligibility** | Benefits Eligible |
| **Full/Part time** | Full Time |
| **Work Schedule** | |
| **Additional Schedule Information** | M-F; 8 hrs/day; some evening and weekend work and/or on-call duty may be required. |
| **Advertised Salary** | $48,000 or commensurate with experience |
| **Posting Date** | 10/30/2019 |
| **Open until filled** | No |

| | |
|---|---|
| **Closing Date** | 12/16/2019 |
| **Proposed Starting Date** | 01/01/2020 |
| **Special Instructions to Applicants** | |
| **Location of Vacancy** | Athens Area |
| **EEO Policy Statement** | The University of Georgia is an Equal Opportunity/Affirmative Action employer. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, ethnicity, age, genetic information, disability, gender identity, sexual orientation or protected veteran status. |

Position Information

| | |
|---|---|
| **Classification Title** | IT (Information Technology) Professional |
| **Pay Grade** | 050 |
| **FLSA** | Exempt |
| **Job Family** | Administrative |
| **FTE** | 1.0 |
| **Minimum Qualifications** | Requires at least a baccalaureate degree in the field. Please contact your Human Resources office for an evaluation of education/experience in lieu of the required minimum qualifications. |
| **Preferred Qualifications** | • Experience with common data interchange formats, such as XML and JSON<br>• Demonstrated experience developing and delivering complex web applications using modern technologies and contemporary software development practices.<br>• Experience working with Git version control in a team environment, preferably within GitHub or GitLab<br>• Experience with User Experience (UX) thinking and design<br>• Experience working with or the capacity to learn about search indexes commonly used in digital library contexts, such as Solr or ElasticSearch<br>• Experience working with or the capacity to learn about common digital library software, both open-source (e.g., Blacklight, FOLIO) and vendor provided (Ex Libris Alma, Primo)<br>• Experience with the development and use of web APIs<br>• Bachelor's degree in Information Science or similar discipline;<br>• Demonstrated interest in Library Science. |
| **Position Summary** | Georgia LIbrary Learning Online (GALILEO) is an online gateway to authoritative, free and subscription-only information resources to all residents of the state of Georgia. GALILEO member institutions include the universities and colleges of the University System of Georgia, the Technical College System of Georgia, Georgia K-12 schools, public libraries and some private higher education and K-12 institutions. Through collaboration and resource sharing, GALILEO seeks to provide equal access to information for all Georgia citizens.<br>This position will have the unique opportunity to work on a diverse set of highly impactful digital library services with the growing GALILEO Development Team. The main GALILEO website provides a discovery interface for resources available to all Georgia citizens via an affiliated institution. With GALILEO Interconnected Libraries (GIL), integrated library services are provided to academic libraries centrally, with a focus on resource sharing and collaboration. The Digital Library of Georgia (DLG) serves as the statewide digital library focused on Georgia's cultural heritage and includes the Civil Rights Digital Library and the Georgia Historic Newspaper project. As a member of the GALILEO Development Team, this position will be a key contributor to ongoing work to enhance and expand the slate of services offered by GALILEO. A primary focus will be on the evaluation and adoption of open source tools that help deliver services in a robust, sustainable and accessible way that meets the diverse needs of the GALILEO user base. Additionally, this position will have a special |

| | |
|---|---|
| | focus on interface development, design and continual enhancement by working closely with GALILEO development advisory groups and User-Centered Design teams. |
| **Knowledge, Skills, Abilities and/or Competencies** | • Understanding of the value of diversity, inclusion and accessibility in the workplace and in the development and implementation of software tools and other technology<br>• Ability to work independently to apply knowledge to solutions of new and varied problems<br>• Ability to establish and maintain effective working relationships, including the ability to communicate complex, technical concepts to diverse audiences<br>• Experience working with MVC frameworks such as Ruby on Rails, Django or Laravel.<br>• Experience with automated software testing and/or test-driven development (TDD)<br>• Experience working with relational databases, e.g., PostgreSQL or MySQL |
| **Physical Demands** | Typical for office environment |
| **Is driving a responsibility of this position?** | |
| **Does this position have operation, access, or control of financial resources?** | No |
| **Does this position require a P-Card?** | No |
| **Is having a P-Card an essential function of this position?** | No |
| **Does this position have direct interaction or care of children under the age of 18 or direct patient care?** | No |
| **Does this position have Security Access (e.g., public safety, IT security, personnel records, patient records, or access to chemicals and medications)** | Yes |
| **Credit and P-Card policy** | Be advised a credit check will be required for all positions with financial responsibilities. For additional information about the credit check criteria, visit the UGA Credit Background Check website. |

Duties/Responsibilities

| | |
|---|---|
| **Duties/Responsibilities** | Work with the GALILEO Development Team to design, develop, document, test and maintain the GALILEO suite of digital library tools. Using an Agile-inspired development and User-Centered design processes, implement flexible and reliable services to address the changing and varied needs of the GALILEO user base. |
| **Percentage of time** | 60 |

Duties/Responsibilities

| | |
|---|---|
| **Duties/Responsibilities** | Research, design and evaluate enhanced interfaces for the suite of online tools provided by GALILEO. Participate in Advisory groups, focus groups, and other means of engaging with user groups to determine user needs and expectations. Help develop user stories and feature specifications to guide the work of the development team. |

| | |
|---|---|
| **Percentage of time** | 25 |

Duties/Responsibilities

| | |
|---|---|
| **Duties/Responsibilities** | Engage in Professional Development, Education or Training. Actively participate in relevant digital library communities, e.g. code4lib, ELUNA. Maintain awareness of new technologies and services provided by vendors and the open source community. |
| **Percentage of time** | 10 |

Duties/Responsibilities

| | |
|---|---|
| **Duties/Responsibilities** | Flexibility, Engagement, and Responsiveness<br>• Participate in GALILEO listservs and applicable communications and work with the GALILEO Support Services group as appropriate.<br>• Participate in library-wide communication by reading, responding to, and initiating information transmitted via GRAPEVINE (the Libraries' listserv) and other communication tools, and appropriate library-wide or departmental meetings and asking questions, seeking clarification, or initiating discussion on library issues. |
| **Percentage of time** | 5 |

## Posting Specific Questions

Required fields are indicated with an asterisk (*).

## Applicant Documents

**Required Documents**

1. Resume/CV
2. Cover Letter

**Optional Documents**



*Note.* This document is four pages long.

*Figure E5*. Selected position: Programmer/Analyst for GALILEO as seen on UGA website.

## APPENDIX F: SAMPLE GRADUATE CERTIFICATE COURSEWORK

Core (3 credit hours)

- LIBS 6016 Technology for Library Services (3 credit hours)
    - Use of various technological resources and tools that impact contemporary libraries. Examination of standards and issues through collaboration and production.

Electives (choose 3 courses)

- LIBS 6010 Foundations of Library and Information Studies (3 credit hours)
    - Development and functions of libraries and information centers, professional practice and ethics, and current issues and trends.
- LIBS 6852 Digital Libraries (3 credit hours)
    - An overview of digital libraries and the roles they play in the profession. Topics may include the influence of digital libraries, system interaction and usability, intellectual property and preservation issues.
- ICTN 6845 - Web Site Development (3 credit hours)
    - Latest technology in developing successful web sites on Internet as related to industry and business applications, including protocols, standards, and programming tools.
- ITEC 6200 Technology Project Management (3 credit hours)
    - Comprehensive systems used to control projects to achieve technical, managerial, and economic objectives. Emphasis on management controls, computer applications, human factors, and productivity.
- ITEC 6011 Technological Ethics, Diversity, and Leadership (3 credit hours)
    - Exploring leadership, teamwork, professional, ethical, global, diversity, and social dimensions in organizations to apply and manage technology for effective operational performance.
- SENG 6240 - Software Architecture and Design (3 credit hours)
    - Software development issues related to software architecture and design. Examines software development and implementation.
- SENG 6245 - Software Construction (3 credit hours)
    - Application of software specifications, design patterns, object-oriented design and concurrent programming, and testing techniques for designing, constructing, and testing large-scale software systems
- SENG 6285 - Cloud Computing (3 credit hours)
    - Techniques for developing applications and services to run on distributed networks using virtualized resources accessed over the Internet