FITC Institute Final Report
Appendix N

Internship Analysis Report: Florida State University

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1. Introduction

One of the aims of the FITC Career Alliance Assessment project is to examine the education pathways of students in computing disciplines as they prepare for entrance into the information technology (IT) workforce. As a complement to the secondary and post-secondary computing curricula analysis of select north Florida schools, experiential learning activities, specifically student internships, were identified and examined because students' educational pathways often involve learning opportunities beyond those listed in a course syllabus. For example, students often pursue internship positions while in school or shortly after graduation, which may complement their classroom learning. Quite often, a student internship is a component of a program's graduation requirement. This report examines the internship postings provided by the Florida State University (FSU) Career Resources Center for computing technology programs.

1.1 Research Questions

The study describes the data resulting from the competencies that emerged from the text mining analysis of internship postings collected from the FSU Career Resource Center to answer one research question:

RQ1: What are the competencies that the FSU Career Resource Center internship postings suggest students will receive as a result of their experience?

This report first previews select literature of studies in IT education, experiential learning and then specifically, internships. We then present the analysis methods using the Association of Computing Machinery and the Institute of Electrical and Electronics Engineers (hereafter, ACM/IEEE) Body of Knowledge-based codebook. This report conclude with a brief description of the findings and discussion of the internship analysis.

2.0 Literature Review

2.1 IT Education and Experiential Learning

The pace of technological change demands that students be educated with an ideal IT curriculum that is flexible enough to adapt to a dynamic IT environment and is provided by educators who remain adept at innovative technology advances. This fleet approach requires that educators remain vigilant to the needs of all stakeholders, including students, communities, and employers (Brewer, Harriger, & Mendoca, 2006) and may include all types of instruction such as face to face/classroom instruction, distance learning, and experiential learning. Experiential learning includes internships, externships, apprenticeships, service learning, and/or mentoring set in real-world situations.

2.1.1 Experiential Learning Impacts

The experiential learning approach integrates work-based experience into the curriculum design in addition to building specific courses around them (Carpenter, 2003), an important bridge between theory and practice in the professional education classroom (Bartz & Calabreses, 1991; Kingma, 2011). Cantor (1997) reinforces the broader impacts of experiential learning, citing service opportunities for students as safe platforms to apply classroom learning to real-world situations and to expand community relationships with potential employers, civic leaders and others. Mpofu (2007) indicated that learning outcomes in a service-learning context exceeded that of classroom instruction "for tasks requiring critical thinking and application of skills" (p. 51) and provides career clarification, higher grades, and an opportunity to self-assess skills and abilities within context and establish a framework for networking (Howery, 1983; Jackel, 2011; Markus, Howard, & King, 1993).

In the U.S., experiential learning is a hallmark of two and four-year colleges, providing a "mix of learning activities and awards that is the informal market-based cousin to the more highly regulated European apprenticeship systems" (Carnevale, et al., 2011, p. 5) that affords career exploration with an academic focus that features applied learning and occupation-specific skills. Further, "earning while learning" (Geel & Backes-Gellner, 2012, p. 313), or the engagement in industry related occupations while in school, results in lower unemployment trends, decreased job search duration, relatively higher wages, and increased job responsibility once employed in a career-focused occupation.

2.1.2 Types of Experiential Learning

The U. S. Department of Education defines experiential learning as “all programs that are designed to expand the setting of learning experiences beyond the traditional school environment to occupational and community settings [using] planned experiences...to promote cooperation between traditional educational institutions and business, industry, labor, government and community groups to support learning” (Miller, 1982, p. 3).

Experiential learning theory defines learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience"(Kolb, 1984, p. 41). Characteristics of experiential learning include active learning, student-based perspectives, subjective experiences, personal growth, and participative learning that includes evaluation and reflection (Kolb, 1983). Most experiential learning activities are either classroom-based (e.g., instructor demonstrations, multi-phase group projects) or industry-based (e.g., job shadowing, service learning, and internships). Capstone projects exhibit promise for educational situations that lack abundant industry collaboration but require a great deal of preparation and oversight (Gorka, Miller, & Howe, 2007).

2.2 Internships

Studies show that employers express concerns with the job readiness of graduates in IT-related disciplines, noting that students or graduates who are highly skilled in technical competencies often lack valuable general workplace competencies or soft skills (Galloway, Marks, & Chillas, 2014; Venables & Tan, 2009). In the curriculum guidelines for undergraduate computing programs, the Association for Computer Machinery and the Institute of Electrical and Electronic Engineers (ACM/IEEE) specify four main ways to incorporate soft skills that employers desire into undergraduate computing curricula: non-technical skill courses, capstone projects, team projects, and internship programs (Makasiranondh, Maj, & Veal, 2011). Researchers examined the potential value of internships for undergraduate IT students from the perspective of three main stakeholder groups: students in computing disciplines, IT employers, and postsecondary academic institutions (Galloway et al., 2014; Ralevich, & Martinovic, 2010; Venables & Tan, 2009).

One phase of FITC Assessment project focused on the course syllabus analysis results from four programs in the Information Technology (IT) program at the Florida State College at Jacksonville (FSCJ), where an internship was a required part in A.S. in Networking Systems Technology program. Each credit hour in the internship course consisted of 30 contact hours which relates to 25 hours of documented jobsite internship experience[1]. A 50 hour internship was included in A.S. in Computer Information Technology program, to provide valuable work

[1] http://www.fscj.edu/academics/areas-of-study/information-technology/networking-systems-technology-as

experience.[2] Other phases of this FITC Alliance assessment also looked at job postings and IT curricula and reported that, using the ACM/IEEE IT framework, job postings analysis found the share of this competency found in job postings was 15.3% while the BS/IT curriculum analysis reported this as comprising 12.43% of the competencies expressed in syllabi (Ma, et al., 2015a; Ambavarapu, et al., 2015).

2.2.1 Potential Benefits of Internship Programs

Research has found that internships offer students the chance to develop soft skills in a workplace environment and allow them to gain hands-on experience with the technical skills they have learned in school (Vairis, Loulakakis, & Petousis, 2013). Through internships, students also have the opportunity to develop career goals and to determine if they feel well suited to a particular job before they enter the workforce, therefore becoming more employable once they graduate (Shoenfelt, Stone, & Kottke, 2013; Vairis et al., 2013). Lee et. al (2014) found that new IT professionals perceive internship experience as highly valuable when entering the workforce.

Similarly, research suggests that employers benefit from internship programs because student interns are likely to be familiar with the latest technologies and to offer a fresh, unique perspective (Galloway et al., 2014). Additionally, in a related phase of this assessment examining IT employer needs, the employer interview participants spoke favorably of internships for students, agreeing that internship experience is especially valuable for teaching soft skills or general competencies such as communication and organizational knowledge. Furthermore, academic institutions that provide internships are well positioned to offer a curriculum that meets the needs of the industry and students seeking to increase their employability (Ralevich, & Martinovic, 2010).

2.2.2 Challenges in providing Internships

Other studies suggest that although internships are a means of increasing employability, students who already exhibit desired workplace competencies are more likely to secure an internship position than students who could use the internship experience to develop business or soft skills (Chillas, Marks, & Galloway, 2015). Employers expect interns to be immediately productive workers as opposed to inexperienced students requiring training (Chillas et al., 2015). In addition, Ralevich and Martinovic (2010) report that some employers are unwilling to offer internship opportunities due to potentially high immediate costs (e.g., administrative, training, or insurance costs), and there may be a conflict between students' expected wages and the reality of their positions.

Although a school may realize the benefits of internship provision for students' employability, employer recruitment needs, and program competitiveness, academic institutions in rural areas may experience difficulty in finding industry placement opportunities for students (Elarde & Fatt-Fei, 2012). Further, internships in academic settings are often administered by a separate, dedicated department distinct from the academic program's department. This may be

[2] http://www.fscj.edu/academics/areas-of-study/information-technology/computer-information-technology-as

beneficial for each department because of the time consuming nature of generating and fostering industry partnerships and placing students, but the lack of input from specific academic departments may cause students to be placed in ill-fitting positions (Ralevich & Martinovic, 2010). Vairis et a. (2013) report on an internship program in which departmental internship committees exist within the broader internship department, which may allow for better placement.

3. Method

The purpose of an internship program is to facilitate student learning opportunities outside the classroom (Carnevale, et al., 2011). These experiences provide an opportunity to apply classroom theory to real world applications, thus enhancing students' academic and career goals. This study examines the technical skills and general competency skills a student acquires working in an organization as a part of internship. We conducted competency analyses from internship postings and employer interviews.

3.1 Internship Postings Analysis

3.1.1 Data Collection

During January 2015, a total of 166 internship postings between July 1, 2014 and December 15, 2014 were collected from the FSU Career center. The 166 internship postings collected included duplications. In the cases where the same posting was used for two or more programs (CS, IT, IS, CE), those postings were removed and only a single instance was maintained for analysis resulting in 82 unique postings. 20.5% of the internships were from Florida area, 70.5% are other U.S.-based and 9% are international.

3.1.2 Competency Analysis Using Codebook

From the sample internship postings, we identified the core IT competencies a student gains from hands-on experience during time spent in an internship program. We built a customized codebook from the ACM/IEEE IT 2008 curriculum guidelines to annotate the core IT job competencies in terms of general and technical competencies. This codebook is based on the knowledge units and topics/contents presented in the ACM/IEEE IT 2008 IT undergraduate curriculum. The codebook includes 13 technical competencies and 10 general competencies. The codebook, including full descriptions and examples of competencies in each category, is offered as Appendix A.

3.1.3 Characteristics of Internship Postings and Extracting Desired Competencies

The internship postings collected lacked standard formatting, and some postings provided incomplete details. For example, one internship posting offered two lines of information about the internship without specifying any technical or general competencies. Such postings were excluded from this analysis. The general introduction and the summary of job position, education requirements, location and contact information were removed from all the postings.

Sections of interest such as roles, responsibilities, and duties were mined using regular expression patterns. The mined text was further refined to extract specific technologies and general skills using the concept of *tokenization*. Tokenization is an act of breaking up sentences into segments such as words, keywords, and other elements, which are called tokens. These tokens can be individual words or phrases. In the process of tokenization, some characters, like punctuation marks, are discarded. Unigrams (one word) and bigrams (two words) were extracted from internship postings. Bigrams were extracted from text in order to identify certain words like "problem solving" or "interpersonal skills," which would otherwise make no sense if single words were considered. The tokens were used to map all technology skills and general competency skills to the specific competencies in the ACM/IEEE codebook and the skill frequencies were calculated. Python programming language was employed in the entire process to remove duplicate files, search required sections, conduct spell checking and tokenization, and extract skills by removing stop words.

4. Findings and Discussion

The number of unique internship postings analyzed was 82 (N=82). Based on the analysis, it was determined that internship postings more frequently listed technical competencies, by a ratio of more than 3:1, as opposed to general competencies.

4.1 Technical Competencies Observed in Internships

Figure 1 displays the technical competencies identified from internship postings.

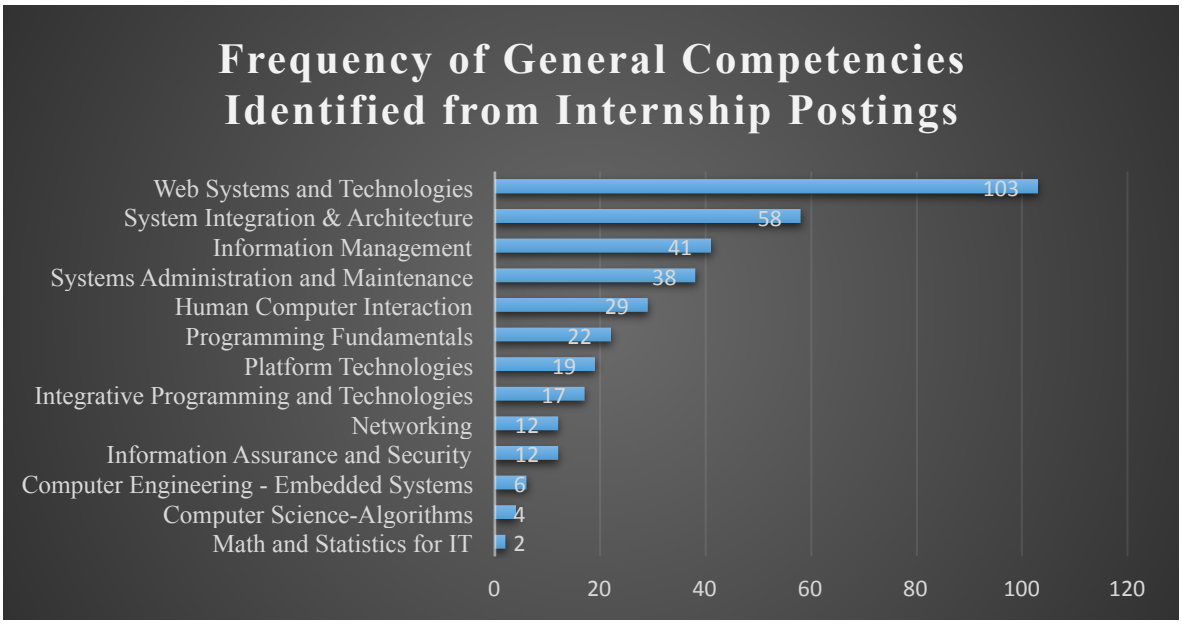

Figure 1. Technical competencies observed in internship postings

Figure 1 indicate the frequency of different technical competencies identified from the internship postings. *Web Systems and Technologies* was the most frequently identified competency identified in the internships advertised during this period. Specifically, out of 363

technology competencies identified from internship postings, the frequency of *Web Systems and Technologies* was 103 (28.3%) (Table 1).

Table 1. Frequency & Percentage of Observed Technical Competencies

	Technical Competencies	**Frequency(Percentage)**
WS	Web Systems and Technologies	103 (28.3%)
SIA	System Integration & Architecture	58 (14.6%)
IM	Information Management	41(11.3%)
SA	Systems Administration and Maintenance	38 (10.47%)
HCI	Human Computer Interaction	29 (7.98%)
PF	Programming Fundamentals	22 (6.06%)
PT	Platform Technologies	19 (5.23%)
IPT	Integrative Programming and Technologies	17 (4.7%)
IAS	Information Assurance and Security	12 (3.30%)
NET	Networking	12 (3.30%)
CE-ESY	Computer Engineering - Embedded Systems	6 (1.67%)
CS-ALG	Computer Science-Algorithms	4 (1.10%)
MS	Math and Statistics for IT	2 (0.55%)
	Total	**363 (100%)**

4.2 General Competencies Observed in Internships

In addition to technical competencies, the analysis also identified general competencies from the internship postings, which are illustrated in Figure 2.

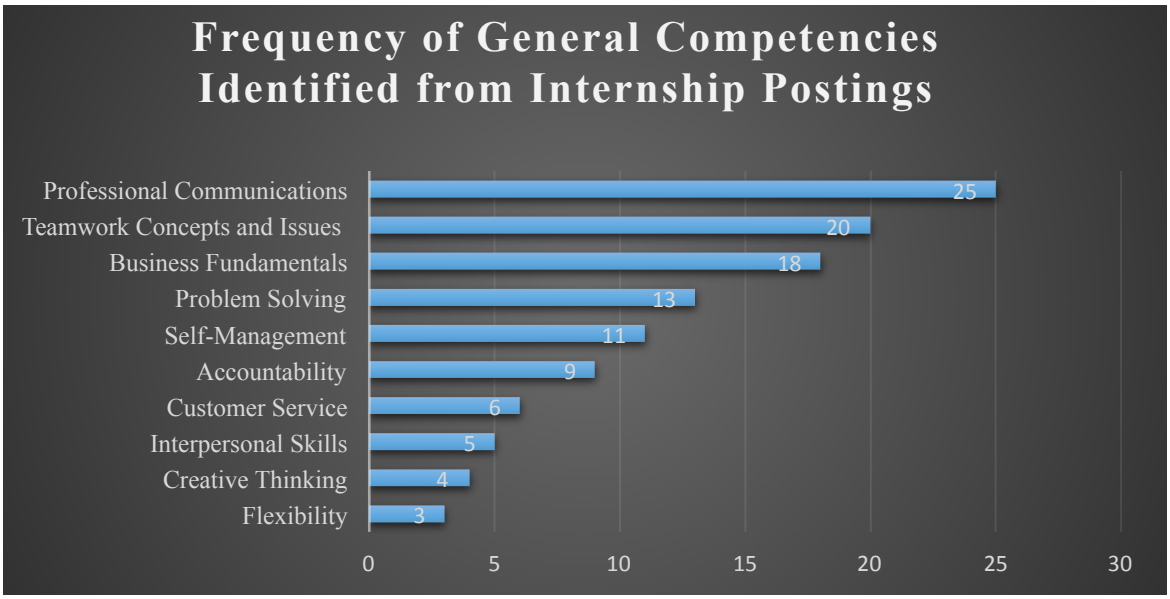

Figure 2. Technical competencies observed in internship postings

Figure 2 indicates the frequency of different general competencies identified from the internship postings. *Professional Communications* was the most frequently identified competency identified in the internships advertised during this period. Specifically, out of 114 general competencies identified from internship postings, the frequency of *Professional Communications* was 25 (21.9%) (Table 2).

Table 2. Frequency & Percentage of Observed Technical Competencies

General Competency	**Frequency (Percentage)**
Professional Communications	25 (21.9)
Teamwork Concepts and Issues	20 (17.54)
Business Fundamentals	18 (15.78)
Problem Solving	13 (11.4)
Self-Management	11 (9.64)
Accountability	9 (7.89)
Interpersonal Skills	5 (4.38)
Creative Thinking	4 (3.5)
Flexibility	3 (2.63)
Customer Service	6 (5.26)
Total	**114 (100%)**

4.3 Internship competencies

This portion of the FITC Assessment project answered one research question seeking the competencies that the FSU Career Resource Center internship postings suggest students will receive as a result of their experience. Twenty-six syllabi from the required classes in the FSU BS/IT program were analyzed. This analysis of internship postings found that students can expect to gain workplace experience and an exposure to technical and general competencies, which is consistent with previous research. Although much of the literature emphasizes the professional competencies (teamwork, communication, and professionalism skills, etc.), this analysis found that the internship postings greatly emphasized technical competencies over general competencies. From the 82 posts analyzed, 363 technical competencies were identified but only 114 general competencies were identified.

Web Systems and Technologies was the overwhelming most frequently identified technical competency. The job postings analysis found the share of this competency was 15.3% while the BS/IT curriculum analysis reported it as 12.43% (Ambavarapu, et al., 2015; Ma, et al., 2015). According to the ACM/IEEE 2008 IT curriculum guidelines that served as the codebook for this analysis, this knowledge area "covers the design, implementation, and testing of web-based applications including related software, databases, interfaces, and digital media. It also covers social, ethical and security issues arising from the Web and social software" (Lunt et al., 2008, p 123). Web System specific technologies like HTML5, CSS, JavaScript, JQuery, PHP, XML, ASP and AJAX were identified from internship postings. Even though course technologies like HTML5, CSS, JavaScript, PHP were covered as part of curriculum,

technologies like ASP, AJAX, JQuery were not part of BS/IT program. So, the internships analyzed provide an opportunity for students to work on various technologies that are not covered in curriculum.

Previous research highlighted the importance of communication and professional skills for computing graduates seeking employment. Our finding that *Professional Communications* was the most frequently occurring general competency is consistent with previous studies that identified positive employer and new professional perceptions of internships' ability to foster necessary communication skills.

4.4 Internship Management and Administration in School Settings

This analysis found that the internship postings available to students demonstrated varying levels of context and details. While some posts provided information about the organization as well as sections detailing what the intern would be learning and working on with a specific statement as to the skills that would be enhanced during the internship experience, some posts contained no organization information and provided a bulleted list of technologies the intern would potentially work with (e.g., "Excel, PowerPoint, Word") and a similarly brief list of tasks (such as "budgets, schedule, tasks, meetings"). The literature emphasizes the importance of accurately matching students to internships that are related to their interests and future career goals (Ralevich & Martinovic, 2010). Students relying on these postings to acquire an experiential learning opportunity may not have access to adequate information when seeking an internship to meet their specific needs.

4.5 Limitations

Limitations of this study include the inconsistent and sometimes incomplete nature of the internship postings. Further, postings often describe ideal situations that can be altered by the reality of job logistics, job site resource limitations, and the ability of the institution to effectively oversee the program. The findings are not generalizable because the study used a convenience sample of 82 unique internship postings from the FSU Career Resource Center. Therefore, the rankings of technical and general workplace competencies may change in future studies as they are affected by the discipline studies, institutional ability to support an internship program, and the specific needs of an institution's geographic region. This analysis of internship postings can only suggest the important competencies a student learns in the internship period in the computing technology programs offered by FSU.

An additional limitation is that this is a fairly homogeneous sample of internship postings: 29 of 82 (35.3%) of the internship positions were based on Web development opportunities, biasing the competencies identified toward this area. Also, internship is just one of the four types of experiential learning identified, and does not represent the entirety of the experiential learning environment nor the impact of other elements of a program's curriculum.

6. Conclusion

Previous studies suggest the benefit of experiential learning in supporting the preparation of students for computing technology careers, especially in providing competencies not covered in a traditional school setting. In other studies and other phases of this study, both employers and early career professionals indicated the value of internships as a means of transitioning successfully from school to job and for providing opportunities to apply skills and knowledge in on-the-job contexts, with supervision, training, and decreased performance expectations. Further studies of experiential learning components such as capstone coursework and apprenticeships and increased sampling of rural contexts may provide a greater understanding of the North Florida region's computing technology environment.

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