FITC CAREER ALLIANCE ASSESSMENT OF EMPLOYER INTERVIEWS

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Introduction

The FITC Career Alliance Assessment project examines the education pathways of students in computing disciplines as they prepare for entrance into the information technology (IT) workforce. As a complement to the computing curriculum analysis and the computing job posting analysis, the research team conducted one-on-one interviews with employers who recruit and employ individuals in a variety of IT positions in companies from diverse domains. In conjunction with other Information Institute studies analyzing employer perceptions of entry-level IT employee profile needs, 16 employers were interviewed with data analyzed largely using the Association of Computing Machinery and the Institute of Electrical and Electronics Engineers (hereafter, ACM/IEEE) 2008 IT Curriculum Framework. The results are then compared to similar results from the Florida State University (FSU) IT curriculum analysis and the FSU Career Resource Center job posting analysis.

Research Questions

This phase of the FITC Alliance Assessment was developed to examine five questions:

RQ1: How do the IT competencies identified in the ACM/IEEE 2008 IT Curriculum compare to the desired IT competencies identified by a sample of employers in north Florida?

RQ2: What, if any, differences are there between the competencies needed for IT employees in nonmetropolitan and metropolitan areas?

RQ3: Which IT competencies emerge in the industry certifications desired by employers in entry-level employees?

RQ4: In what ways do employers value experiential learning activities that provide workplace competencies?

RQ5: How do the IT competencies identified in employer interviews compare to those identified in the FSU Career Resource Center job posting analysis?

Education and IT Competency

In order to ensure that IT/IS programs remain relevant and attractive to potential students, the curriculum must be reviewed and improved. The success of the program can be measured by its graduates' employability (Khan, 2011; Woodward, Imboden, & Martin, 2013). As the technology industry rapidly changes, IT/IS programs must frequently be evaluated and undergo revisions to make sure graduates are prepared to enter the dynamic industry. In order for the curriculum evaluation to be successful, it must be informed by industry knowledge (Hwang & Soe, 2010). Seeking collaboration with industry partners and understanding the skills that employers value in prospective employees is important in meeting regional industry employer needs (Woodward et al., 2013).

In providing up-to-date curriculum in a constantly changing policy environment that emphasizes the need for technology skills as 'essential skills' or 'critical skills', educators will be challenged to ensure that the skills provided are those that will advance students in the job market (Crews, 2004; Gordon, 2013; Hunt, et al., 2011). These skills are as dynamic as the innovative workplace needs they are designed to serve and this makes the integrity and value of an IT curriculum subject to constant scrutiny (Downey, McMurtrey, & Zeltmann, 2008). Evaluating IT/IS competency is difficult because there is "no generally accepted classification of IS knowledge/skills nor is there consensus on which knowledge/skills are the critical ones and some are more important than others in the IS profession" (Lee, Koh, Yen, & Tang, 2002, p. 52).

In another phase of the FITC study, the FSU IT program curriculum was compared to the AMC/IEEE 2008 IT curriculum framework for coverage of the knowledge units recommended for IT academic programs (Ma, et al., 2015). Python scripting language was used as a way to automatically extract relevant portions of the syllabi to compare program learning outcomes to the knowledge units. This analysis suggests the amount of coverage that students can expect in the relevant areas in preparation for their IT career path. While not an fully equivalent comparison, the curriculum analysis suggests areas that being covered well and also indicates competencies

Technical Skills Gap

Many studies document a discrepancy between the skills that IS/IT students have and the skills demanded by IS/IT employers (Hung-Lian, Lee, & Koh, 2000/2001; Davis, Siau, & Dhenuvakonda, 2003; Kim, Hsu, & Stern, 2006; Lee et al., 2002; Scott, Alger, Pequeno, & Sessions, 2002; Trauth, Farwell, & Lee, 1993). Davis et al. (2003) claim that "the Achilles' heel in this new economy is the lack of IT professionals with the right skill sets—a constant complaint from recruiters" (p. 167). Gaps emerged in studies of students' perceptions of IT skills needed in the industry, recommending that IT educational institutions need to determine the IT

technical skills taught in the curriculum based on IT industry demands (Medlin, Schneberger, & Hunsinger, 2007). In most cases, these studies make recommendations for changes in the curriculum to meet employer needs in specific technical areas. There is a consistent theme in the IT skills gap literature that calls for "continuous feedback from academia, employers, and end-users" for "effective implementation of IS curriculums" (Kim et al., 2006, p. 401).

Business Skills Gap

Studies have shown that students are not only unprepared for the technical side of working in the IT/IS industry, but lack the necessary business skills that the industry demands (Lee et al., 2002; Kim et al., 2006; Hung-Lian, et al., 2000; Trauth et al., 1993; Downey et al., 2008; Lee, 2005; Lee & Han, 2008). Lee et al. (2002) found a need for more emphasis on non-technical skills like interpersonal skills, personal traits, and industry understanding. Hung-Lian et al. (1993) also identified a knowledge/skills gap in the areas of Interpersonal and Personal Traits. Trauth et al. (1993) found gaps in interpersonal and business skill requirements between what students had and what IT/IS employers needed. These studies make it clear that there is a need for other business skills to be taught along with the IS/IT technical skills. They also make a call for further investigation to see how much IT/IS related business skills are part of IT/IS curricula alongside the technical skills. Kim et al. (2006) also found that project management is an essential skill not taught in the investigated curriculum.

Hunt et al. (2011) conclude that "the emerging information technologies are also requiring a new breed of IT professional—a person who understands the needs of the business as well as IT" (p. 5); these competing priorities further complicate the efforts of IT educators to prepare students for careers, not simply for their entry-level jobs, in a field that is highly dynamic and places great emphasis on innovation (Downey et al., 2008). This is complicated by the findings of studies of unprepared end users who interact with technologies integrated into business processes (McClure et al., 2011; Yellen, 2005), which find that this lack of preparation results in a "widening gap between a growing demand for and an insufficient supply of workers" (Hawk et al., 2012, p. 2). These business and behavioral skills, often termed 'soft skills,' are increasingly in demand as much as technical skills (Downey et al., 2008; Lee, 2005; Lee & Han, 2008). The shift in emphasis from technical skills to general skills is a demonstrated cycle (Todd, McKeen, & Gallupe, 1995).

Employer Expectations

Certifications. Studies report that IT certifications may not be as important in the hiring process as students think. Required certifications are found in only a few job posts, and employers may prefer formal education along with experience (Anderson, Barrett, & Schwager, 2005; Benham, 2006; Rob & Roy, 2013; Spears et al., 2015). IT professionals do not necessarily see a direct relationship between an IT certification and specific job skills and, often, certifications are more valued by human resource managers (Cegielski & Hall, 2009; Robin, 2011). However, the ideal situation is that an applicant possesses a combination of education, experience, and IT certifications (Al-Rawl, Lansari, & Bouslama, 2005).

Value of experiential learning. Researchers have examined the potential value of experiential learning, including work experience, internships, and on-the-job training, for undergraduate IT students based on three main stakeholder groups: students in computing disciplines, IT employers, and postsecondary academic institutions (Galloway, Marks, & Chillas, 2014; Ralevich & Martinovic, 2010; Venables & Tan, 2009). The research found that internships in particular give students the chance to develop soft skills in a workplace environment and enable students to gain hands-on experience with the technical skills they have learned in their courses (Vairis, Loulakakis, & Petousis, 2013). Internships also provide students with the opportunity to develop career goals or to determine if they feel well-suited to particular jobs before they enter the workforce while also making them more employable once they graduate (Shoenfelt, Stone, & Kottke, 2013; Vairis et al., 2013). Research shows that employers benefit from internship programs because student interns can offer a fresh, unique perspective and are likely to be familiar with the latest technologies (Galloway, Marks, & Chillas, 2014). Academic institutions that utilize internship opportunities are well-positioned to offer a curriculum that meets the needs of the IT industry (Ralevich & Martinovic, 2010). Internships may be the sole source of experience for students, and Robin found that up to 85% of IT employers desire that students have such experience (2011).

Method

The purpose of conducting employer interviews is to collect rich data about the perceptions of employers of the competencies of entry-level employees working in IT positions in a variety of organizations. These data enhance other findings from the IT job postings analysis and the FSU IT curriculum analysis.

Collection Procedures

The employer interviews were conducted in two phases, July 2014 – September 2014 (Stage I) and November – December, 2014 (Stage II). For Stage I data collection, the research team developed a convenience sample of 38 employers in nonmetro and metropolitan areas by collecting lists from college collaborators with existing relationships in which employers actively recruit at their schools and have hired their graduates. A separate sample of employers participating in an FSU career fair was employed for Stage II.

For each stage, interested employers were asked to participate in a three-step process that included a demographic survey, a semi-structured telephone interview, and an online post-interview survey. The demographic survey was conducted online during Stage I and on paper durng Stage II. The pre-interview survey included questions about individual demographic variables and questions about the respondent's employer. The interview comprised four sections: the role of IT positions in the respondent's organization, the organization's hiring process, the organization's relationship with local educators, and the respondent's perception of applicant/new professional job readiness. The post-interview survey asked respondents to rank a list of IT job competencies that had been compiled from the job posting data analysis

Stage I. In the first step in Stage I data collection a link to the online demographic survey was emailed to a representative of each employer in the convenience sample. The survey began with completion of an FSU Human Subjects Committee-approved informed consent agreement

that covered all three steps of the process (continuation to the survey was considered agreement). At the conclusion of the survey each participant was directed to a Doodle poll in which they were asked to select two interview date/time slots that would be convenient for a 30-minute telephone interview.

The researchers were alerted with Doodle notifications upon a participant's completion of the Doodle poll and each survey participant was subsequently emailed a confirmation of an interview appointment. Each telephone interview was conducted by one of the principal investigators or the research coordinator using the FSU Human Subjects Committee-approved employer interview instrument All completed interviews were transcribed during data collection Phase I.

Stage II. The second stage of data collection was conducted during the Fall FSU Career Fair held on October 7, 2014. All 75 employers participating in the career fair were solicited to participate in the research, which again included a demographic survey (many conducted at the career fair), an interview (which was conducted by telephone after the career fair). Twenty-six employers participated in the demographic survey; paper versions of the Stage I online consent form and pre-interview survey were used and employers were encouraged to provide contact information to schedule the telephone interviews. Ten respondents agreed to participate in the semi-structured telephone interview. The Stage I interview guide was used for the Stage II telephone interview and the 10 interviews were transcribed during data collection Stage II.

Data Analysis

The research team developed a codebook for the FITC employer interview analysis by combined ACM/IEEE 2008 IT Curriculum Framework *knowledge areas*, which specify details primarily for technical competencies, with the top 10 general IT competencies emerging from the job posting analysis conducted for the National Science Foundation Advanced Technological Education study (Lee et al., 2014) based on the U.S. Office of Personnel Management (OPM) IT competencies (Noll & Wilkins, 2002). The general competencies were included in the codebook to enable a comprehensive examination and description of the general competencies, or 'soft skills.' An in vivo approach also yielded two additional codes, *Business Fundamentals* and *Flexibility*, competencies that emerged from job posting analysis These general competencies were used to expand the one 'soft skill' knowledge area provided by the ACM/IEEE framework. The result was a codebook with 12 technical competencies and 10 general competencies.

During the coding process, "open" codes that described competencies or experiences not included in the original codebook but judged by the coder to be emergent in the data and relevant to the study's purpose and research questions could be assigned. One open code, "experiential learning" emerged during the initial coding process and through the inter-rater reliability checks (the code was developed from 90 mentions of internships and other types of experiential learning in the 16 hours of interviews). The literature was re-examined for background on the nature of experiential learning and the references were coded as the variable "experiential learning," with the attributes internships, work experience, on-the-job training (OJT), and service. The data were also examined for mentions of industry certifications; this yielded an additional 23 open codes. The context of the industry certification reference was also considered, and only those instances

in which an employer indicated that this was a requirement or preference for job competency were these counted into the competency total.

Sixteen interviews were conducted between August 2014 and December 2014. The recordings were transcribed and the data formatted for analysis using NVivo10 qualitative data management and analysis software. The original intent was to mimic the text mining process used in other phases of the FITC study. The interview transcripts were initially analyzed using Leximancer software but the nuances of qualitative data were missing in the initial analysis, so the team opted to code manually using NVivo 10 to manage the results. Two researchers coded all interview transcripts using the codebook. Each question in the survey was treated as a unit of analysis, and competencies were coded one time per unit (on the first mention of the competency). A second round of coding was completed after the 24 open codes were added to the codebook. Codes for competencies associated with each IT certification were noted if they had not been identified in an analysis unit during the first round of coding.

Findings

Over the two phases of data collection,16 interviews were completed and analyzed. Four members of the research team conducted recorded phone interviews and transcripts were created. From the transcripts, NVivo10 analysis software was used to code and query the results. The findings presented derive from the pre-interview demographic survey, the telephone interviews. Qualitative descriptions of respondents to the pre-interview survey were derived from their responses to the demographic questions and the questions about the respondents' organizations. These descriptions are representative of the pre-interview survey respondents, but may describe members of the Phase I and Phase II samples in a directional way. Competency analysis results are based on the competencies mentioned in the interview data (those coded in the first coding pass and the competencies connected to industry certifications that were coded in the second coding pass) and on the rankings of the four types of experiential learning segmented by type of experience.

Employer Demographics

Employer demographics and organizational characteristics are the results of the pre-interview demographic survey and are reported here in order to provide context for the subsequent analyses.

Individual characteristics. Survey respondents reported job titles that fall into a wide range of categories: Founder/Owner, President/CEO, CIO, Vice President, Director, Manager/Administrator, IT Staff, Sales, Human Resources, Office administration, Consultant, and Other. The majority of respondents have worked for their current employer for nine or fewer years, and many have been with their current employer three or fewer years (tenures range from less than one year to over 16 years).

The respondents also reported a wide range of occupational experience that includes management, operations, technical, sales/marketing/event planning, and human resources functions. Over one third (34.2%) of respondents reported holding a masters degree and at the

respondents' educational backgrounds include at least 13 disciplines. Over half (55.2%) of the respondents are members of professional associations related to technology or human resources.

Organizational characteristics. The majority of respondents work for private organizations, but public, non-profit, and hybrid organizations were also represented. These organizations offer a range of products and services: IT management/project management/administration/business development, web design and development/user testing/marketing, information/data management/databases, software development/network administration solutions, IT services/support/repair, communication services, IT recruiting, consulting, marketing/PR/advertising, startup support and non-IT-related products and services (e.g., healthcare).

The majority of organizations are small (10 or fewer employees), but they range to over 5000 employees. More than three-quarters of the organizations (76.3%) have ten or fewer office locations, but the number of locations ranges to 600 offices. Technology position types within the organizations include both entry level and management positions and include a range of types, including those dealing with hardware, software, desktop applications, programming and engineering, information management, networking, and websites. Over half (55.3%) of the organizations' technology needs are met using an in-house IT employee and over one-third (36.8%) of the respondents outsource their technology needs (three respondents did not respond to the question or gave another response).

These findings show that the subsequent analyses are based on interviews with a set of respondents that covers a range of demographic and organizational characteristics. Although the results of the employer interviews cannot be generalized to all employers in North Florida, the demographic and organizational characteristic analysis suggests that the results may be used directionally to describe the needs of North Florida employers.

Competency Results

Competency frequencies and rankings. The coded interview transcripts revealed a total of 336 competency mentions. Table 1 illustrates the competency frequencies split into the general and technical categories.

Table 1. General and Technical Competency Frequencies (n=336)

General Competency	Total Mentions	Technical Competency	Total Mentions
Self-management	33	Networking	43
Customer Service	19	System Administration & Maintenance	24
Problem Solving	19	Web Systems & Technologies	22
Business Fundamentals	18	Programming Fundamentals	21

Interpersonal Skills	18	Platform Technologies	19
Professional Communications (R,W,OC)	17	System Integration & Architecture	18
Teamwork Concepts & Issues	5	Information Assurance & Security	15
Accountability	3	Information Management	13
Flexibility	3	IT Fundamentals.	11
		Integrative Programming & Technologies	8
		Mathematics & Statistics for IT	7
		Human Computer Interaction	0
Totals	**135**		**201**

Table 2 reveals the competency frequency rankings, displaying the general and technical competencies together. Technical competencies are shaded.

Table 2. Total Competencies Ranking

Competency	**Rank**
Networking	1
Self-Management	2
System Administration and Maintenance	3
Web Systems & Technologies	4
Programming Fundamentals	5
Customer Service	6
Problem Solving	6
Platform Technologies	6
Business Fundamentals	7
Interpersonal Skills	7
System Integration and Architecture	7
Professional Communications (R,W,OC)	8
Information Assurance and Security	9
Information Management	10
IT Fundamentals.	11

Integrative Programming and Technologies	12
Mathematics and Statistics for IT	13
Teamwork Concepts & Issues	14
Accountability	15
Flexibility	15
Human Computer Interaction	16

Table 2 demonstrates how the competencies compare by classification and shows that the two categories of technical and general competencies are distributed evenly across the rankings.

Competency Results by Organization Type. Table 3 presents the competencies by organization type.

Table 3. Competencies by Organization Type (n=16)

Engineering (n=1)	Healthcare (n=2)	Financial (n=2)	Government (n=4)	Technology (n=7)
Business Fundamentals	Networking	Networking	Networking	Self-Management
Interpersonal Skills	System Administration and Maintenance	Programming Fundamentals	Professional Communications (R,W,OC)	Networking
Networking	Customer Service	Integrative Programming and Technologies	Business Fundamentals	Customer Service
Platform Technologies	Problem Solving	Mathematics and Statistics for IT	Self-Management	Problem Solving
Professional Communications (R,W,OC)	Self-Management	System Administration and Maintenance	Web Systems & Technologies	Business Fundamentals
Problem Solving	Platform Technologies	System Integration and Architecture	Interpersonal Skills	Information Assurance and Security
Self-Management	Interpersonal Skills	Information Management	Information Management	IT Fundamentals.
Information Assurance and Security	Professional Communications (R,W,OC)	Platform Technologies	Problem Solving	Programming Fundamentals
Integrative Programming and Technologies	Flexibility	Business Fundamentals	Customer Service	Web Systems & Technologies
System Integration and Architecture	Information Assurance and Security	Professional Communications (R,W,OC)	Information Assurance and Security	Interpersonal Skills
Accountability	IT Fundamentals.	Self-Management	IT Fundamentals.	Platform Technologies

Customer Service	Business Fundamentals	Information Assurance and Security	Platform Technologies	System Integration and Architecture
Flexibility	Information Management	Accountability	System Administration and Maintenance	Professional Communications (R,W,OC)
Teamwork Concepts & Issues	Programming Fundamentals	Problem Solving	Teamwork Concepts & Issues	Teamwork Concepts & Issues
Human Computer Interaction	System Integration and Architecture	Web Systems & Technologies	Integrative Programming and Technologies	System Administration and Maintenance
Information Management	Web Systems & Technologies	Flexibility	Programming Fundamentals	Accountability
IT Fundamentals.	Accountability	Interpersonal Skills	System Integration and Architecture	Mathematics and Statistics for IT
Mathematics and Statistics for IT	Teamwork Concepts & Issues	Teamwork Concepts & Issues	Accountability	Flexibility
Programming Fundamentals	Human Computer Interaction	IT Fundamentals.	Flexibility	Human Computer Interaction
System Administration and Maintenance	Integrative Programming and Technologies	Customer Service	Human Computer Interaction	Information Management
Web Systems & Technologies	Mathematics and Statistics for IT	Human Computer Interaction	Mathematics and Statistics for IT	Integrative Programming and Technologies

Each employer interview was classified by organization type, resulting in five general categories including engineering, health care, financial, government or public agency and technology firm. The table demonstrates how each competency ranked in terms of number of times each competency was mentioned in an interview.

Competencies expressed in industry certifications. Industry certifications were analyzed in a separate phase of the FITC study and an index created that maps each industry certification to the ACM/IEEE technical competency or competencies required to achieve it. Each industry certification mentioned as preferred or required in an interview was then converted into a competency and added to the overall competency totals.

Table 4 displays a ranked list of the competencies that emerge in the interviews as indicated by the industry certification named.

Table 4. Competencies in Certifications

Competency	Totals
Networking	25
Programming Fundamentals	17
Information Assurance & Security	14

Web Systems & Technologies	10
System Integration & Architecture	8
Information Management	6
Integrative Programming & Technologies	4
System Administration & Maintenance	3
Platform Technologies	2
Human Computer Interaction	2
*Project Management	2
IT Fundamentals.	0
Mathematics & Statistics for IT	0
Total	**93**

Industry certifications were mentioned 69 times as a preferred or required skill set. The certifications indicated amount to a total of 93 competencies, or 27.8% of the total competencies listed in Table 1.

Experiential learning. Experiential learning emerged as a frequent theme in each employer interview. Each interview was coded for mentions of experiential learning and the mentions were categorized by the contexts in which they were obtained, including internships, work experience, on-the-job training, and service experience. The mentions of each context are illustrated in table 5.

Table 5. Experiential Learning

Context	Total Mentions
Work experience	32
Internships	22
On-the-job training	15
Service experience	1
Totals	**70**

Work experience emerged as the desired context mentioned most frequently by employers (n=32), followed by internships (n=22) and on-the-job training (n=15). Service experience received only one mention. Experiential learning was also segmented by employer organization type; these types are listed in Table 6.

Table 6. Experiential Learning Contexts by Organization Type

Engineering (n=1)	Healthcare (n=2)	Financial (n=2)	Government (n=4)	Technology (n=7)
Internships	Work Experience	Internships	Work Experience	Work Experience
On-the-job training	On-the-job training	On-the-job training	Internships	Internships
	Internships	Work Experience	On-the-job training	On-the-job training
			Service Experience	

Table 6 classifies the types of experiential learning ranked most highly by employers. Work experience is listed by four industry sectors (all sectors except Engineering) as the context that best affords students with competencies valued in entry-level employees.

Competency Comparison: Employer Interviews and Job Postings

Comparison of the findings of competency totals from employer interviews with those that were revealed in the job posting analysis reveal a disparity between what employers state they need in entry-level IT employees and the competencies found in the job postings.

Table 7. Competency Comparison: Employer Interviews vs. Job Postings

Competency	Employer Interview (n=16)		Competency	Job Postings (n=93)	
Networking	43	12.80%	System Integration & Architecture	157	16.22%
SM Self-Management	33	9.82%	Programming Fundamentals	92	9.50%
System Administration & Maintenance	24	7.14%	System Administration & Maintenance	87	8.99%
Web Systems & Technologies	22	6.55%	Information Management	85	8.78%
Programming Fundamentals	21	6.25%	Human Computer Interaction	67	6.92%
CUS Customer Service	19	5.65%	BF Business Fundamentals	64	6.61%
Platform Technologies	19	5.65%	CUS Customer Service	57	5.89%
PS Problem Solving	19	5.65%	Web Systems & Technologies	56	5.79%
BF Business Fundamentals	18	5.36%	TC Teamwork Concepts and Issues	54	5.58%
IS Interpersonal Skills	18	5.36%	COM Professional Communications (R,W,OC)	42	4.34%
System Integration & Architecture	18	5.36%	Integrative Programming & Technologies	36	3.72%
COM Professional Communications (R,W,OC)	17	5.06%	SM Self-Management	35	3.62%
Information Assurance & Security	15	4.46%	FL Flexibility	33	3.41%
Information Management	13	3.87%	PS Problem Solving	31	3.20%
IT Fundamentals.	11	3.27%	Platform Technologies	23	2.38%
Integrative Programming & Technologies	8	2.38%	Networking	18	1.86%
Mathematics & Statistics for IT	7	2.08%	Information Assurance & Security	16	1.65%
TC Teamwork Concepts and Issues	5	1.49%	IS Interpersonal Skills	8	0.83%
A Accountability	3	0.89%	Mathematics & Statistics for IT	7	0.72%
FL Flexibility	3	0.89%	A Accountability	0	0.00%
Human Computer Interaction	0	0.00%	IT Fundamentals	0	0.00%
Total	**336**		**Total**	**968**	

Table 7 displays the total competencies derived from each sample as characterized by the codebook developed using the ACM/IEEE 2008 IT Curriculum framework. The results are rank sorted, and because of the large difference in sheer numbers of competencies found in the two samples, percentages are also displayed to demonstrate the ratio of individual competency to each total. Shaded competencies represent the technical skills. The results reveal a divergence in the competency ranking, with only two competencies shared among the top five (Programming Fundamentals and System Administration & Maintenance); Web Systems Technologies and Business Fundamentals are the only other two competencies shared in the top ten ranked competencies. While Networking is the top ranked competency in the IT employer interviews with 12.8% of the mentions, it is near the bottom of the list in the job posting ranking with less than 2% of the mentions. For the job postings, System Integration and Architecture is the top competency with 16.22% of mentions; it ranks 11th with employers and has 5.36% of the mentions.

Discussion

The employer interview analysis identified IT competencies employers perceive to be valuable when recruiting and hiring entry-level employees for IT-related positions. The competencies identified in the employer interviews were also analyzed in the context of the competencies identified in previous phases of the study, including the FSU IT curriculum analysis and the FSU computing job posting analysis. The FITC study used a mixed method, sequential design and the AMC/IEEE framework was transformed into a codebook that was modified with codes that emerged in the curriculum analysis and the job posting analyses. The researchers continued to revise the codebook by adding codes that emerged from the employer interview analysis. This iteratively revised codebook is reflected in the findings used to answer the research questions for analysis reported on here.

RQ#1. In answering research question one, the study examined how the IT competencies identified in the ACM/IEEE 2008 IT Curriculum Framework compare to the desired IT competencies identified by a sample of employers in north Florida. Sixteen interviews generated a total of 336 mentions of competencies identified by coding responses using the ACM/IEEE IT curriculum framework. Technical competencies made up 59.8% of the competencies mentioned, with Networking, System Administration & Maintenance, Web Systems & Technologies and Programming Fundamentals emerging as the top competencies. Less important technical competencies to employers include more complex programming skills and math and statistics skills; Human Computer Interaction was not identified as a desired competency.

Self-management was the overwhelming top identified competency with more than 24% of the general competency total; Customer Service, Problem Solving, Business Fundamentals, Interpersonal Skills, and Professional Communications all followed with a range of 12.5% to 14.0%. Teamwork concepts, Accountability, and Flexibility occurred infrequently in the employer discussions. This suggests that employers are more concerned with technical and general competencies connected to job performance than general competencies connected to organizational citizenship. In ranking the competencies all together, the top ten competencies are evenly split between the general and technical categories, demonstrating a balance between the two types of desired competencies in an entry-level employee.

The competencies were also stratified by organization types that include engineering (n=1), healthcare (n=2), financial (n=2), government (n=4), and technology (n=7). Three of the sectors, healthcare, financial and government, reported Networking as the most desired competency (the most desired competency for the technology sector is Self-Management—this may reflect a unique work environment that technology companies have or see themselves as having). Each of the sectors had at least three general competencies in the top five except for the financial sector, for which the top five competencies and eight of the top ten were technical competencies. In all five sectors, the top general competencies were Business Fundamentals, Self-Management, Professional Communications, Problem Solving and Customer Service.

RQ#2. Research question number two examined the differences between the competencies needed for IT employees in nonmetro and metropolitan areas. The sample of 16 employers only included two from a nonmetro area, therefore the stratified results are not reported here. Although this question cannot be answered from the results of the employer interview analysis, it is being examined by other Information Institute studies.

RQ#3. Research question number three addresses identification of the competencies connected to industry certifications employers want entry-level employees to have. A total of 23 industry certifications were mentioned that include CompTIA A+, CompTIASecurity+, and a variety of Cisco and Microsoft certifications, among others. Competencies were coded from each coded mention; this resulted in a total of 93 competencies. Often the employer comments about certifications were general, mentioning just "Microsoft" rather than "Microsoft MCSE" or "Microsoft MCSA", therefore the competencies for the general mentions were drawn from the context of the interview. A full discussion of certifications and competencies can be found in the FITC Alliance Industry Certification Report.

RQ#4. Research question four addresses employers' perceptions of experiential learning activities that provide desired workplace competencies. Over the 16 interviews, experiential learning activities were mentioned 70 times. Of the four types of experiential learning identified, work experience received almost half of the mentions (45.7%); internships received 22 mentions (31.4%); and, on-the-job training was mentioned 15 times (21.4%). The fourth activities, service experience, received only one mention. Work experience and internships were mentioned by respondents in every employer sector, with work experience ranked highest by the healthcare, government, and technology sectors; internships were number one for the engineering and financial fields.

RQ#5. Research question five compares the IT competencies identified in employer interviews to those identified in the FSU job posting analysis. The results demonstrate that there is a discernible difference between the competencies presented by employers in one-on-one conversations and those that are stated in job postings.

Limitations

The findings of this study are based on a convenience sample of North Florida employers who are connected to partner colleges. Although the findings are not generalizable to all North

Florida employers, the diverse nature of the set of interviewees suggests that the results may be used directionally to describe the needs of North Florida employers. However, results of future studies may not comport with these findings. An additional limitation is the nonmetropolitan-metropolitan distribution of the respondents, with only two interviewees representing a nonmetropolitan area. On a practical level this resulted in the inability to answer research question two from this study's findings; on a more general level, the relative lack of nonmetropolitan respondents may have influenced the findings in ways that are not readily apparent.

The employer interviews and the job posting samples are not specifically drawn from the same pool of employers. While they are all contacts of the FSU IT program, the job postings represent a wider range of employers; while all the job postings advertise computing positions, there is not a one-to-one match between employers and job postings. As the literature suggests, job posting language is often created by someone other than an IT proficient supervisor, and thus may be less focused on the specific needs of an IT position than an individual who is immersed in the technology.

Conclusions and Future Studies

Alignment of computing education with employer needs can be assessed in a number of ways. The FITC study employed multiple methods to examine how these needs are being met by a variety of education institutions in north Florida. This phase of the study analyzed 16 employers' perceptions of how employees working in IT roles in their workplaces can best be prepared for success on the job. Several concerns and shared beliefs emerged from these conversations:

- IT education must be constantly assessed to remain relevant to changing workplace needs, especially in dynamic technology fields. Most of the employers emphasized that those schools with "deep partnerships between the local industry and the colleges" are more adept at meeting the needs of employers. One employer suggested that his situation is so ideal that it "should be institutionalized across the state."

- Professional "soft", or general, skills must be incorporated into the curriculum, either in the formal environment or through some type of experiential learning mechanism. Business fundamentals skills ranked in the top five skills by three of the employment sectors; overall, general skill development is an invaluable outcome of experiential learning opportunities. Further, internships provide a context in which employers and students can 'test the waters' without any long term commitment, allowing employers to assess interns' 'fit' while allowing interns to gain a better understanding of the their interests and what will make them happy on the job.

- Employers overall were clear that professional industry certification in a technology their company values was a nice benefit for an applicant and, all other things being equal, would give an applicant marketability that others lack. However, applicants; job experience outweighed this competency, as most employers acknowledged that their

needs are constantly changing and that certifications generally provide proof of skill sets that may become quickly obsolete.

- One employer's view was that technology competency can be compared to a three-legged stool: education, certification, and experience, a profile that describes the ideal new employee. Not having participated in internships puts a graduate "at a disadvantage for a job."

- Many employers stated that the entry-level employees begin their careers in a customer service role, and therefore communication and interpersonal skills are "high on the list" of desirable competencies.

Many employers emphasized that good internship opportunities are challenging to provide, requiring structure and mentoring resources on the part of the employer. This is an even larger problem in a rural context: The two nonmetropolitan interviewees stressed that they do not have the means to provide internships except on an irregular basis. The need for further study into the challenges of the nonmetropolitan setting is demonstrated by the fact that very few nonmetro employers participated in this study.

Also, the codebook used for the employer analysis was modified based on previous, related studies in both the FITC assessment and a related National Science Foundation Advanced Technological Education study conducted by the Information Institute. Feedback from employers and educators on best practices and use of these types of curriculum guidance would be beneficial in establishing a process that supports a dynamic assessment tool for the computing disciplines that also meets the needs of stakeholders in diverse contexts.

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