Meeting the Needs of IT Stakeholders in a Northwest Florida State College

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Abstract
Many studies support the important role that two and four-year college programs can play in certification training and as a gateway to the four-year IT degree. In an effort to determine if one Florida Panhandle community college was delivering its intended IT education goals and meeting the needs of local employers, the researchers performed five comparative analyses that stemmed from the overarching research question, "How do IT program learning outcomes compare to the requirements of IT job postings as well as to IT student and faculty perceptions of what is learned and what is taught?" The results of this study, when contextualized with extant literature, suggest that schools are challenged in aligning curricula with IT employers needs especially in clarifying the value of certifications and obtaining meaningful experiential learning opportunities for students as they manage their education and career pathways.
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1 Introduction

The Bureau of Labor Statistics (BLS) reports that the computer and information technology occupations are some of the fastest growing in the American workforce, ranging from increases of 8% annually? for computer programmers up to 37% for information security analysts. (2014a). In Florida, computer and mathematical occupations account for 1.5% (n=164,480) of the total jobs available (BLS, 2014b). However, these numbers do not reflect the overall pervasiveness of technology skill needs in all occupations, (DeSanctis, 2003; Hunt, Crews, Feather-Gannon, Hunt, & Smith, 2011) as innovation increasingly replaces low and middle skill jobs with more complex work environments with increasingly technical demands (Carnevale, Smith, Stone, Kotamraju, Steuernagel, & Green, 2011).

1.1 Statement of the Problem

Two and four-year college programs play an important role in information technology (IT) education, providing access to professional certifications and creating a gateway to the four-year degree (Bailey, Jenkins, & Leinback, 2005; Compton, Laanan, & Starobin, 2010; Laanan, Hardy, & Katsinas, 2006).
IT degrees dramatically impact an individual's earning capacity, some resulting in a 40% increase over a five-year period (Compton, et al., 2010). In Florida, two- and four-year institutions have received high marks for student access, program completion, and cost effectiveness with statewide average higher retention and completion rates than the national average (U.S. Chamber of Commerce, 2012).

However, the *Leaders and Laggards* study suggests these institutions have less remarkable records in graduating students that are prepared to *meet employer needs*, as the performance of graduates with a general Associate of Arts (AA) degree barely surpasses the performance of a high school degree in the areas of wage and unemployment gaps (U.S. Chamber of Commerce, 2012). Tracking student and graduate data is rudimentary and it is not clear how an IT program's graduates fare after they emerge from IT programs. Further, it will take time to assess how programs are influenced by nationally supported institutional intervention initiatives such as Achieving the Dream and Complete College America (Ewell, 2010).

Disaggregating national data by locale suggests that non-metropolitan (non-metro) communities,

which are counties with communities that exhibit "a combination of urban and rural populations" (USDA, 2012) are particularly subject to this disparity. Non-metro education trends reveal that only 15.6% of persons 25 years and older have graduated from college compared to 26.6% in metropolitan areas; less than 30% percent of the non-metro population attends some college (US Census Bureau, 2010). These trends result in a less skilled non-metro workforce unprepared to capitalize on technology advances in their communities, specifically the benefits that broadband can bring for economic development. Non-metro areas need employees with advanced, diverse technology skills to support and exploit the advantages of new digital technologies like high-speed Internet service and its associated benefits like electronic health records, e-commerce, interoperable public safety networks, telecommuting, digital education and smartgrid home energy monitoring, among others (McClure, Mandel, Alemanne, Saunders, Spears & Bishop, 2011a; McClure, et al., 2011b).

This paper addresses emerging findings in early phases of a four-year National Science Foundation Advanced Technological Education (NSF ATE) IT workforce study that suggests that while IT educators in two and four-year colleges perform the bulk of career and technical education instruction, especially in non-metro communities, their institutions are tasked with addressing continuing distressing economic conditions that undermine their efforts to provide educational experiences that closely align to rapidly changing IT workforce needs. Experiential learning, in the form of internships, part-time employment, or employer mentoring are far less prevalent in non-metro communities, according to the study's preliminary data, but have the potential to have great impact on graduates whose job chances are based on having established performance in the IT field (Mpofu, 2007).

This mismatch between curricula, experiential learning opportunities, employer needs, and local accessibility will only become increasingly important as colleges and universities are forced to balance funding priorities with the need to provide up-to-date and innovative computing and IT education (Brewer, Harriger, & Mendonca, 2006). This problem may be particularly relevant to the iSchool community since of the 55 schools listed in the iSchools member directory, almost half (n=25) have a Master's Degree in IT program, and three-quarters (n=18) also offer a Bachelor's of Science in IT (iSchools, 2014). If, as DeSanctis suggests, effective IT education is about managing the force of innovation rather than developing new 'artifacts' of learning (2003), then the iSchool community is well positioned to extend the work of the American community college technical education programs and build standards and a body of knowledge that will support student career aspirations and the study of human interaction with technology.

1.2 Background

The dual missions of two and four-year colleges, which operate under open door policies, accepting students at any level of preparation, are to support the needs of the local community by preparing students for workplace success while also playing a role in the development of local economic opportunities (FLDOE, 2014). Regional factors vary and colleges respond to local needs with a variety of practical applications. By seeking the input of local employers, college officials and curriculum designers can gain access immediate and accurate information that can allow program and priorities to be adjusted to maximize community impact (MacAllum & Yoder, 2004). As regional anchor institutions, two and four-year colleges are well positioned to provide tailored solutions to employers' and students' workplace needs.

The NSF ATE study is collaboration between three post-secondary institutions: a community college, a four-year state college and a university. This paper presents the preliminary findings about the four- year state college located in a non-metro region of northwest Florida. College A, is an exemplar of two and four-year colleges' ability to serve unique local needs and serves five Florida non-metro Panhandle counties. Originally established in 1947 as a community college, it is the third oldest of Florida's 28 state-supported colleges. When College A opened its doors in 1946, it was a private institution with six full-time teachers and 65 students. College A now serves between 2,800 and 3,300 students annually in its regular degree and certificate programs and about 1,000 through public service and non-credit training. As a member of the Southeast Carnegie geographic region, College A is a Title IV postsecondary institution and is classified as a small four-year, 'Primarily Associates' degree institution with a urban designation of 'Town' that serves between 1000-4999 students.[1] In 2003, the institution's

[1] An institution with a formal agreement with the Secretary of Education that allows the institution to participate in all of the Title IV federal student financial assistance programs. (Source: National Center for Education Statistics, Integrated Postsecondary Education Data System at http://nces.ed.gov/ipeds/glossary/index.asp?id=847)

name was changed to designate its new status as a college able to offer selected baccalaureate degrees that reflected the documented workforce needs in the region (College A, 2011).

1.3 Research Questions

In an effort to explore the relationship between stakeholder perceptions of workplace needs and two and four-year colleges' attempts to meet IT workplace needs in their programs, the researchers investigated one overarching question in the context of College A and the non-metro Panhandle:

> RQ: How do IT program learning outcomes compare to the requirements of IT job postings as well as to IT student and faculty perceptions of what is learned and what is taught?

Drawing on data from the larger research study, the researchers used five separate analyses to compare the results of focus groups designed to gather college student and faculty perceptions of the skills provided in a two-year IT program as well as the skills students and faculty expect entry-level IT jobs to require with an text mining analysis of the IT program curricula and online IT job postings.

2 Selected Related Literature

2.1 Non-metro Communities

Almost 20% of Americans reside in non-metro communities, defined as any area that is *not* included in an urban area which is made up of at least 2500 people or more comprising a densely settled census tract or block (U.S. Census Bureau, 2013). Non-metro communities in Florida have, on average, 25% lower per-capita income ($30,327 vs. $40,267) and a higher poverty rate (20.8% non-metro vs. 16.8% urban). Only 15.6% of the non-metro population in completed college between 2007 and 2011, while 19.5% did not even complete high school (USDA-ERS, 2013).

Table 1 identifies the economic distress indicators faced by many of the counties in the Northwest Florida Rural Areas of Critical Economic Concern (RACEC), in which College A is situated.[2] These indicators include: percent of population with less than a high school diploma, median household income, unemployment rates, weekly wages below state average, percent of residents receiving public assistance, percent of population below the poverty level, and median housing values[3].

	2010 Population	Less than High School Diploma (%)	Median Household Income ($)	Unemployment (%)	Weekly Wages ($)	Population Receiving Public Assistance (%)	Population Below Poverty Level (%)	Median 2009 Housing Value ($)
Florida Average	18,802,690	14.5	47,827	11.3	765	9.8	14.7	182,400
Calhoun	14,625	28.1	31,142	9.2	504	19.5	25.2	75,532
Gadsden	47,746	23.7	33,453	10.7	561	20.4	29.4	82,870
Holmes	19,927	28.0	33,510	8.5	490	16.9	22.0	69,576
Jackson	49,746	20.9	39,869	7.8	549	12.0	15.1	83,992
Washington	24,896	20.3	37,036	11.1	552	11.6	20.3	88,999

Table 1. Non-metro Counties Economic Distress Indicators

As Table 1 shows, in comparison to state averages, a sample of five non-metro Panhandle counties served by College A has far fewer high school graduates, much lower median income, lower weekly wages, higher rates of pubic assistance and poverty, and lower home values, although unemployment is at or below the Florida average. These data suggest that Florida's non-metro Panhandle in a very high need area.

[2] http://www.floridajobs.org/business-growth-and-partnerships/rural-and-economic-development-initiative/rural-areas-of-critical-economic-concern, para. 1.

[3] American Fact Finder at http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml and Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages at http://www.bls.gov/cew/

2.2 Computing Workforce Needs

Broadband connectivity is an essential affordance that requires a skilled IT workforce for planning, implementation, and maintenance. One of the key barriers to adding broadband connectivity or increasing existing connection speeds is the availability of specialized IT/broadband personnel. This and other identified barriers ultimately relate to a lack of resources and expertise to analyze and solve individual organizations' IT needs. The IT/broadband professional who performs this job in nonmetro settings, in both public and private sector settings, may require a broader set of professional skills and abilities to perform in an environment that is already challenged by limited or no access to broadband technology and a less technologically-oriented workforce.

Florida's Workforce Investment Act Annual Report for 2009-2010 identified unique problems educating nonmetro Floridians because of the nature of nonmetro markets—they are low density, often at a distance from training and education facilities, and have minimal (or no) deployment of or access to broadband Internet. The report notes that "Rural Florida faces unique challenges, especially in meeting transportation and infrastructure needs" (2010). Low adoption rates in nonmetro communities can be attributed in part to decreased availability of broadband service, expense of computers and Internet service, and a perceived lack of need for a household connection (Carnevale, et al., 2011). But if nonmetro communities are going to capitalize on the benefits that broadband can bring for economic development, they will need more employees with advanced, diverse technology skills. Broadband is but one of many examples of the IT needs of non-metro communities that can be met with a resident, well-educated IT workforce.

2.3 IT Education

The pace of technological change demands students 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 a vigilance to the needs of all stakeholders including students, communities, and employers (Brewer, et al., 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. Professional and industry certifications are curriculum elements that can be quickly adapted to all varieties of experiential learning (Dirkx, Kielbaso, & Smith, 2004).

2.3.1 The Value of Experiential Learning

Experiential learning is defined as…all programs that are designed to expand the setting of learning experiences beyond the traditional school environment to occupational and community settings and these programs use 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 rather than passive learning;
- Student-based, rather than teacher based perspective;
- Subjective experiences and personal growth;
- Learning through evaluation and reflection;
- Perception-based, rather than theory based;
- Participative rather than passive; and
- Exploration, invention and application (Kolb, 1983).

Experiential learning 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 expanded 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); 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., two and four-year colleges are 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 at the same time that the academic focus is in applied learning and occupation specific skills. Further, "earning while learning" (Geel & Gellner, 2012, p. 313) or the engagement in industry related occupations while in school resulted in lower unemployment trends; decreased job search duration; relatively higher wages; and increased job responsibility once employed in a career-focused occupation.

2.3.2 Professional Certifications

Certifications are ancillary credentials focused on specific skills or platforms with immediate applicability to the workplace that students and professionals can earn exclusive of or in addition to a degree. Researchers have indicated conflicting viewpoints on the value of professional IT certifications (McGill & Dixon, 2008). Divisions occur along the lines of types their applicability to job types (e.g., to entry-level versus middle or upper level positions); respondents who are IT supervisors and value experience over credentials; and human resources managers who benefit from ready means to recruiting and selecting applicants (Cegielski, 2004; Randall & Zirkle, 2005; Robin, 2011; Rothberg, 2006). Researchers often describe the "market forces, not the education system, as driving the creation of industry based certifications" (Carnevale, et al., 2012, p. 20) as a means to implement reliable credentialing. But when employers are forced to choose between certifications and experience, however, past behavior that has demonstrated that applied skills are generally favored for all position types, whether entry-level or advanced, but experience and certifications together can supplant the need for a particular degree (Randall & Zirkle, 2005). Randall and Zirkle (2005) also stated that many educators lacked the necessary data to understand the impact of certifications on student success, although they indicate that the point at which a student obtains professional certification is an important consideration.

2.4 The Role of the Community's College in Technical Education

The American community college is acknowledged as the premier delivery mechanism for higher education, enrolling more than half of the nation's undergraduate population (AACC, 2012). Data presented in *The 21st-Century Initiative: A Commission on the Future of Community Colleges* completed by the American Association of Community Colleges (AACC), showed that in 2009, over 13 million students were enrolled in some type of community college offering. More than 60% of these represent credential-seeking students, with over 58% of these attending part-time (AACC, 2011). Koricich recently described the historical trend of community college attendance as the only institution to which students from non-metro areas have the means to attend (as cited in Cunningham, 2014). Hagedorn and Purnamasari (2012) contended that this opportunity is not only important for non-metro communities but also is key to alleviating the shortage of science, technology, engineering and mathematics (STEM) scholars as well.

2.5 IT Technician Roles

The National Center for Education Statistics (NCES) defines IT as "a program that focuses on the design of technological information systems, including computing systems, as solutions to business and research data and communications support needs" (2010, para. 1). The Society of Cable Telecommunications Engineers (SCTE) defines the position more specifically to include elements of broadband skillsets for technicians who install broadband services at residential and commercial premises (2010). Non-metro IT studies identified a need for individuals who combine elements of both of these definitions but were also called upon to exhibit management, administrative, supervisory, training, and development skills as well (authors, 2011a; authors, 2011b). Based upon these studies, an IT technician is an individual who is required to apply basic technical, engineering, broadband communication, and data networking skills to a work environment that may also demand a broad range of other computer technology skills.

3 Methods

As part of an early phase in this four year, mixed-method study, we met with a group of seven non-metro community college information technology (IT) program students, three IT faculty and two administrators, during April 2014 on site in non-metro northwest Florida. We then analyzed the curriculum of the

Networking Technology Services IT program and collected 225 job postings using a purposive sample of online job referral programs. We compared alignment of student and faculty perceptions with learning outcomes extracted from the course syllabi and job posting results.

3.1 Data Collection

During October 2013, researchers collected a purposive sample of job posting ads (N=225) from thirteen locations using fifteen online and offline sources to obtain a non-representative sample of job announcements in the northwest Florida areas served by College A. We derived the list of search terms for the job posting data collection from the Florida Department of Education's (FLDOE) Career and Technical Education (CTE) Program's *Information Technology Career Cluster Curriculum Frameworks*[4], which is one of eleven curriculum categories classified under the "Computers and Information Systems Managers" Standard Occupational Classification (SOC)[5]. The National Center for Education Statistics (NCES) provides 'crosswalks' which map Classification of Instructional Programs' (CIP) titles to each occupational classification. The FLDOE then described each program's resulting SOC-CIP mapping and describes the purpose of the curriculum assignments. These descriptions provide the initial set of search terms and include:

1. PC Support Technician
2. Help Desk Technician
3. Computer Repair Technician
4. Network Technician
5. Network Systems Technician
6. WAN/LAN Technician
7. Broadband Technician

We used these job titles as search terms because they are currently used by the FLDOE as part of their 2013-2014 Curriculum Framework for Information Technology and Florida two and four-year colleges are compelled to adhere to these frameworks. The FLDOE has recognized this CIP cluster as providing a coherent and rigorous set of academic standards that map to relevant technical knowledge required for career preparation in computer technology support positions. We only included titles if they referred to technician, specialist or analyst, each of which connotes a quantitative level of expertise in that particular area. Eliminated from the list were positions suggesting supervisory competency, as this is an examination of curricula that focus on early career employees; also removed were any reference to sales, marketing or human resource specialists.

One other term added to the search was *broadband* since it is a recognized technical position for which the Society of Cable Telecommunications Engineers[6] provides technical education. By using these search terms, we collected 225 job postings from both metro and non-metro areas of northwest Florida.. Future phases of the larger NSF ATE study will repeat the job posting collection and analysis and will incorporate an inductive approach when creating search terms for the data collection.

For the curriculum analysis, the research team collected IT course syllabi that had been prepared in accordance with the Computer Information technology (CIT) framework of FLDOE. Seventeen course syllabi retrieved from the College A websites were used for curriculum analysis.

Next, focus groups with current IT students and faculty members at College A were conducted to explore their perceptions and expectations of core IT job competencies based on their IT curricula/education. In April, 2014, two separate focus groups were conducted at College A with seven current IT students and three full time faculty. Conversations were recorded and extensive, verbatim notes taken. Each focus group was open coded for prominent themes and emerging issues; an extensive literature and policy review were conducted to further identify issues.

3.2 Text Analysis

The goal of the text analysis of job postings and the program curricula was to identify the alignment and or gap between the learning outcomes of FLDOE frameworks and the key IT competencies of the job description texts. The researchers conducted the text mining with syllabi from College A curricula and job posting ads from northwest Florida.

[4] http://www.fldoe.org/workforce/dwdframe/it_cluster_frame13.asp
[5] http://nces.ed.gov/ipeds/cipcode/resources.aspx?y=55
[6] http://www.scte.org/professional_development/BroadbandPremisesGuidebook/

The comparative analyses included a stratification based on metropolitan (metro) and non-metropolitan (non-metro) classifications and seven different job search terms. The working hypothesis of this analysis was that if the IT job competencies from the job description texts closely matched the expected learning outcomes from the FLDOE curriculum frameworks, then the curriculum outcomes are well aligned with IT employers' needs and expectations.

3.2.1 Text Mining IT Program Curricula

The research team identified learning outcomes from College A's Associate's of Science degree in Computer Information technology (CIT, CIP Number 1511010305) that attempts to prepare the students for entry level positions as microcomputer support specialists, help desk representatives, and software application technicians. The research team examining 17 IT course syllabi retrieved from College A's website (Appendix A). The FLDOE designed computing curricula to assist faculty in curriculum preparation and this framework was used to create the analysis codebook.

A syllabus generally follows a standard format to maximize its usability to students and faculty (Smith & Razzouk, 1993). For the purpose of our assessment, we focused on "Course Description" and "Learning Objectives". Relevant keywords derived from the FLDOE curriculum standards became the codebook against which these sections that represent the topic/contents of the course are compared. The codebook relevant keywords were chosen by the research team and validated by IT faculty and IT experts.

Since the amount of data collected is large, to increase the precision of analysis, we employed text-mining techniques based on custom written Python Script. Python is a widely used general-purpose, high-level programming language. Python's extensive standard library covers many programming needs

NLTK (Natural Language Toolkit) is an external library for Python that can do a vast amount of text processing and analysis. It includes a suite of libraries for classification, tokenization, stemming, tagging, parsing, and semantic reasoning. The PlainTextCorpusReader class of NLTK accesses our text files and treats them as regular Corpora. There are many methods associated with this class such as paras (), sents (), raw () etc., that can be used to list paragraphs, sentences and to access all the text of the corpus.

Our corpus is formed by a series of syllabus files in one directory. The function corpus.raw () lists unprocessed syllabi contents.

1. Using the function corpus.paras (), the paragraphs or the contents that are required for analysis are identified and stored locally with other file names.
2. There is a corpus of stopwords, high-frequency words like *the*, *to* and *also,* that we filtered out of a syllabi. What remains are the words that have a role to play in this analysis.
3. Regular expressions (called Res or regex patterns) are essentially a tiny, highly specialized programming language embedded inside Python and are made available through the re-module, a specialized sequence of characters that help to find other strings or sets of strings, using a specialized syntax held in a pattern. In our analysis, the keywords derived from the FLDOE framework are maintained as a list and are identified in the syllabi corpus. Whenever a match occurs, the local count variable is incremented which indicates that the keyword/phrase exists in the syllabus.

3.2.2 Text Mining Job Posting Ads

Using a sample of 225 job postings, we examined the IT skills considered most important for IT personnel, stratified by metropolitan/non-metropolitan (metro/non-metro) location. The objective of the job postings analysis was to develop a list of job requirements, desired skill sets, and employment availability. Skill sets identified from the job postings analysis also informed the development of an interview guide for the semi-structured interviews with computing and IT hiring managers and the focus group discussion guide for computing and IT employees conducted in other phases of the NSF ATE study.

To increase the precision of the analysis, we employed the same text-mining techniques used for the IT program curricula employing the NLTK library and PDFMiner, a tool used for extracting information from PDF documents. Automated text analysis allowed us to efficiently and accurately identify important themes in job description texts representing the fundamental requirements for entry level IT employees, and examine the alignment of these requirements with the aspirational learning outcomes described in College A syllabi. Automated text analysis assumes that the most important themes are displayed in the texts by frequent use of keywords representing key competencies, and by the placement of job skills into the typical structure of a job posting format (e.g., required and preferred KSAs, experience, understanding, familiarities subheadings).

The coding results presented show how the expected curriculum learning outcomes taken from the FLDOE framework, Computer Information Technology (CIT, CIP Number 1511010305) overlap with the IT job competencies and requirements from the job description texts. Table 2 shows that 3 out of 7 search terms and 147 out of 225 jobs (65%) are covered by FLDOE curriculum framework (CIT).

Search Terms	Number of Jobs (n=225)	DOE Framework
PC Support Technician	87	CIT
Network Technician	44	N/A
Computer Repair Technician	37	CIT
Help Desk Technician	23	CIT
Network Systems Technician	16	N/A
WAN/LAN Technician	14	N/A
Broadband Technician	4	N/A

Table 2. Jobs by Search Term

4 Findings

4.1 Descriptive Analysis

The descriptive statistics describe 225 unique IT jobs obtained using seven search terms (i.e., seven different job categories), thirteen locations, and fifteen online and offline sources. Of the 225 jobs, 84.9% resulted from four search term categories: PC Support Technician (38.7%), Network Technician (19.6%), Computer Repair Technician (16.4%), and Help Desk Technician (10.2%). Jobs for Network Systems Technician (7.1%) and WAN/LAN Technician (6.2%) occupy up to 13.3% of the total. Broadband Technicians are wanted by only four jobs (1.8%). Table 3 shows the number of jobs by locations (metro, non-metro, and other) and job search terms. Other refers to jobs with the unknown locations or multiple locations such as work at home. Two-hundred (88.9%) of the 225 jobs are classified as metro, 13 (5.8%) are classed as non-metro (i.e., rural), and 12 (5.3%) are classed as Other (e.g., unknown and multiple places such as work from home).

Nine out of the thirteen job locations accounted for the 225 jobs while four counties (Wakulla, Liberty, Calhoun, Washington) did not return any job openings.

	Metro	Non-Metro	Other	Total
Network Systems Technician	12	4	0	16
Computer Repair Technician	33	3	1	37
Help Desk Technician	19	2	2	23
Network Technician	40	2	2	44
WAN/LAN Technician	10	2	2	14
PC Support Technician	82	0	5	87
Broadband Technician	4	0	0	4
Total	200	13	12	225

Table 3. IT Jobs by Location and Job Search Terms

Figure 1 shows the number of jobs (N=225) from the nine locations. The five biggest job markets are: Out-of-state (32.9%), followed by Leon (20%), Pensacola (19.6%), other Florida (13.3%), and Panama City (9.8%). Except for Dothan, AL, which provided seven jobs, the counties of Gadsden, Jackson, and Holmes only provided one job each.

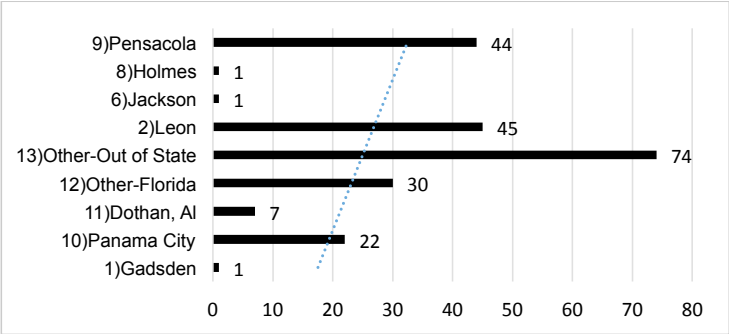

Figure 1. IT Jobs by Locations in Northwest Florida (N=225)

4.2 Analysis 1: Alignment of Learning Outcomes between IT Curricula and Job Postings

Table 4 shows the frequencies and percentages of the seventeen learning outcomes coded from the seventeen College A course syllabi. The five macro standards with asterisks reveal the most pronounced learning outcomes from the seventeen course syllabi at College A: Windows Applications (9), Windows-based Client and Network Computer Systems (12), Networking Hardware (8), Desktop Applications (13), and Micro-computing Operating System (6).

Macro Standards	Count	%
9.Windows Applications *	13	76.5
8.Networking Hardware *	10	58.8
12.Windows-based Client and Network Computer Systems *	10	58.8
13.Desktop Applications *	9	52.9
6.Microcomputer Operating Systems *	8	47.0
1.Productivity Software	7	41.2
2.Computer Hardware	7	41.2
3.System and Device Driver Software	7	41.2
14.Windows Users	5	29.4
4.Internet	3	17.6
13-1.Computer Information Systems Analysis	3	17.6
12-1.Computer Information Systems Monitoring	2	11.8
15.Help Desk Support Activities	2	11.8
7.Database	1	5.9
10.Project Management	1	5.9
11.Customer Service Skills	1	5.9
5.Websites	0	0.0

Table 4. CIT Code Results (N=89) from the College A Curriculum

Table 5 shows all jobs (N=225), the list of the seventeen macro standards, the accumulated frequencies (counts), and percentages from the three categories. The five macro standards with asterisk present the most pronounced learning outcomes from the job posting ads. It shows that local IT jobs highly demand IT job competencies in the areas of Networking Hardware (n=8), Computer Hardware (n=2), System and Device Driver Software (3), Windows Application (n=9), and Windows-based Client and Network Computer Systems (=12).

	All Jobs (N=225)		Metro (N=220)		Non-Metro (N=13)	
Macro Standards	**Count**	**%**	**Count**	**%**	**Count**	**%**
8.Networking Hardware *	132	58.7	114	57.0	8	61.5
2.Computer Hardware *	100	44.4	89	44.5	5	38.5
3.System and Device Driver Software *	96	42.7	88	44.0	3	23.1
9.Windows Applications *	74	32.9	65	32.5	3	23.1
12.Windows-based Client & Network Computer Systems *	67	29.8	60	30.0	3	23.1
10.Project Management	35	15.6	32	16.0	2	15.4
12-1.Computer Info. Systems Monitoring	27	12.0	24	12.0	2	15.4
13.Desktop Applications	66	29.3	60	30.0	2	15.4
1.Productivity Software	12	5.3	10	5.0	1	7.7
4.Internet	14	6.2	12	6.0	1	7.7
7.Database	39	17.3	36	18.0	1	7.7
11.Customer Service Skills	63	28.0	58	29.0	1	7.7
13-1.Computer Information Systems Analysis	31	13.8	28	14.0	1	7.7
14.Windows Users	31	13.8	27	13.5	1	7.7
5.Websites	16	7.1	15	7.5	0	0.0
6.Microcomputer Operating Systems	54	24.0	50	25.0	0	0.0
15.Help Desk Support Activities	39	17.3	37	18.5	0	0.0

5 Table 5. CIT Code Results of Job Posting Ads (N=225)

Figure 2 shows the difference between the expectations from IT job competencies and learning outcomes from the College A course syllabi.

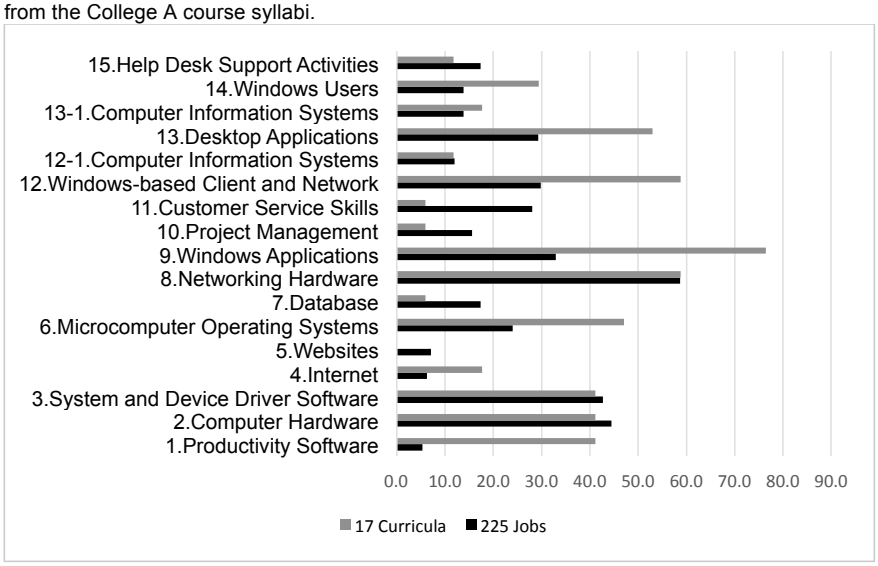

Figure 2. CIT Code Overlap between IT Jobs and the College A Curriculum

Both College A IT program curriculum and job posting ads stress the job competencies in Networking Hardware (n=8), Windows Applications (n=9), Windows-based Client and Network Computer Systems (n=12). But Desktop Application (n=13), and Micro-computing Operating System (n=6) emphasized in

College A courses are not pronounced in job posting ads. Jobs, instead, require more competencies in the area Computer hardware (n=2) and system and Device Driver Software (3).

The areas of Database (n=7), Project Management (n=10), Customer Service Skills (n=11), and Help Desk Support Activities (n=15) are less emphasized in the College A curricula than the IT job posting descriptions are desired by employers. The syllabi at College A curriculum do not contain the learning outcomes in the topic area of Websites (n=5).

5.1 Analysis 2: Students Perception Compared to IT Learning Outcomes of College A Curriculum

5.1.1 Student Focus Group Results

The College A student focus group participants were asked to assess the skills being provided by the program that will help them face the challenges of an IT position. Their responses were categorized into:

- Computer Technology Basics
  - Installation, configuration and administration of PCs, laptops, and related hardware;
  - Basic technician skills such as cable installation, network installation and help desk skills such as troubleshooting; and
  - Ability to fix computer hardware and basic desktop repair.
- Fundamental skills in Network Administration
  - Set up, configure, administer and troubleshoot a basic network infrastructure design; and
  - Working with MS, Linux and iOS operating systems and some mobile operating systems.
- Fundamental skills in Network Security
  - Cybersecurity and system security certifications such as CompTIA Security+ which claims to assess the fundamental concepts in network security and risk management.
- Miscellaneous Skills
  - Work Ethic: Demonstrate the ability to be a hard worker;
  - Continuing Education: Demonstrate a current knowledge and skill set; and
  - Experience: Gain hands-on experience with the software and hardware used by the employer/industry.

5.1.2 Comparison between Student Focus Group and IT Curriculum Analysis

The themes that emerged from the student focus group discussion suggested that:

1. Topics discussed by students in the four categories covered the top five curriculum learning outcomes including those related to Windows Applications, Windows-based Client and Network Computer Systems, Networking Hardware, Desktop Applications, and Microcomputer Operating Systems as well as Computer Hardware, System and Device Driver Software, Windows Users and Help Desk Support Activities.
2. Topics not covered by the student responses but that emerged from the curriculum analysis included Productivity Software, Internet, Websites, Database, Project Management, Customer-Service Skills, Computer Information Systems Monitoring, and Computer Information Systems Analysis.
3. Topics that emerged from the student discussions that are not reflected in the curriculum learning outcomes included the miscellaneous topics of work ethic, continuing education, and on-the-job experience.

5.2 Analysis 3: Faculty Perceptions Compared to Learning Outcomes from College A Curriculum

5.2.1 Faculty Focus Group Results

The College A faculty focus group participants also assessed the skills being provided by the program to help graduates face the challenges of an IT position. Responses to this query mirrored students' responses and are categorized into Computer Technology Basics, Network Administration, and Network Security. However, the faculty Miscellaneous category responses were more varied and the faculty also cited two additional categories, Microsoft Fundamentals and Broadband Knowledge. Themes included:

- Computer Technology Basics
  - Installation, configuration and administration of PCs, laptops, and related hardware.
  - Basic technician skills such as cable installation, network installation and help desk skills such as troubleshooting; and
  - Ability to fix computer hardware and basic desktop repair.

- Fundamental Skills in Network Administration
  - Set up, configure, administer and troubleshoot a basic network infrastructure design; and
  - Working with MS, Linux and iOS operating systems and some mobile operating systems.
- Fundamental Skills in Network Security
  - Cybersecurity and system security certifications such as CompTIA Security+ that claims to assess the fundamental concepts in network security and risk management.
  - Microsoft Fundamentals that meet the MCSA level of certification
  - This certification indicates an entry-level qualified information technician and is a prerequisite for advanced knowledge and certifications.
- Broadband Knowledge
  - Understand the mix of technologies involved and the technical requirement and applications of each; and
  - Be able to design and install an Ethernet cabling system.
- Miscellaneous Themes
  - Mobility to move to where the jobs are located;
  - Realistic salary expectations;
  - Increased numbers of certifications;
  - Become career-oriented rather than simply job-oriented;
  - Basic literacy skills that are satisfied in the developmental education component of the school's overall curriculum;
  - Interpersonal skills that allow them to communicate and provide customer/helpdesk support; and
  - Credentials provided by certifications in lieu of experience are tough to obtain in the local region as most local employers do not have the resources to support an internship that may not result in a permanent employee.
  - Available internships are usually located too far from the town for students to reasonably commute.

5.2.2 Comparison between Faculty Focus Group and IT Curriculum Analysis

Marcia Mardis 1/5/2015 9:34 AM

Comment [1]: See previous comment about moving interpretation to the discussion

A comparison of the themes emerging from the student discourse demonstrated that:

1. Topics discussed by faculty in the six categories cover the top five curriculum learning outcomes including Windows Applications, Windows-based Client and Network Computer Systems, Networking Hardware, Desktop Applications, and Microcomputer Operating Systems as well as Computer Hardware, System and Device Driver Software, Windows Users and Help Desk Support Activities.
2. Topics not covered by the faculty responses that are included in the curriculum analysis include Productivity Software, Internet, Websites, Database, Project Management, Customer-Service Skills, Computer Information Systems Monitoring, and Computer Information Systems Analysis.
3. Topics that emerged from the faculty discussions that are not reflected in the curriculum learning outcomes include the miscellaneous topics of employability; basic literacy skills, certifications and interpersonal skills.

5.3 Analysis 4: Student Perceptions Compared to Learning Outcomes from Job Postings

5.3.1 Student Focus Group Results

The College A student focus group was asked to assess the skills being provided by the program that will help them face the challenges of an IT position, resulting in responses categorized by Computer Technology Basics, Network Administration, Network Security and Miscellaneous.

5.3.2 Comparison between Student Focus Group and IT Job Postings Analysis

- Topics discussed by students in the four categories cover the top job five posting competencies that include Networking Hardware, Computer Hardware, System and Device Driver Software, Windows Applications, Windows-based Client and Network Computer Systems, and Desktop Applications. Other learning outcomes include Microcomputer Operating Systems, Windows Users and Help Desk Support Activities.
- Topics not covered by the student responses that are strong results in the job posting analysis include Customer-Service Skills, Database, Project Management, Computer Information Systems Analysis, Windows Users and Computer Information Systems Monitoring.

5.4 Analysis 5: Faculty Perceptions Compared to Learning Outcomes from Job Postings

5.4.1 Faculty Focus Group Results

The College A faculty focus group addressed curriculum learning outcomes based on a the same query posed to students requesting that they assess the skills being provided by the program that will help students face the challenges of an IT position. This query resulted in Computer Technology Basics, Network Administration, and Network Security, Microsoft Fundamentals and Broadband Knowledge. The faculty Miscellaneous responses include employability skills such as the ability to relocate, salary expectations that fit the entry-level position, increasing numbers of certifications and a career-orientation rather than a job-orientation. Also, faculty mentioned "soft skills" (Goles, Hawk, & Kaiser, 2008, p. 180) such as interpersonal skills and maturity.

5.4.2 Comparison between Faculty Focus Group and IT Job Postings Analysis

A comparison of the themes emerging from the faculty focus group demonstrates that:

- Topics discussed by faculty in the six categories cover the top five job posting competencies including Networking Hardware, Computer Hardware, System and Device Driver Software Windows Applications, Windows-based Client and Network Computer Systems, and Desktop Applications, as well as, Customer-Service Skills, Microcomputer Operating Systems, Help Desk Support Activities Project Management and Windows Users.
- Topics not covered by the faculty responses that are included in the job posting analysis include Database and Computer Information Systems Analysis.
- Topics that the faculty covered that are not reflective in the job posting analysis include the Broadband competencies and the soft skills such as interpersonal skills and maturity.

Overall, more themes emerged from the faculty focus groups than that of the student focus groups. Neither the students, the faculty, nor the job posting analyses indicated a need for Internet or Website competencies.

6 Discussion and Conclusion

IT skills are an increasingly important requirement for today's workplace. Because IT is a fast-moving field, a number of studies have sought to determine how best to prepare students to join the IT workforce. The preponderance of research suggests that two and four-year colleges are effective institutions to deliver this preparation because their missions center on being embedded in the workplace and immersed in the social fabric of their communities. However, research has also suggested that non-metro communities are particularly challenged to prepare and retain IT professionals to support communities that face economic, geographic, and cultural factors that often lead to few jobs and low local retention. In an effort to determine if one Florida Panhandle community college was delivering its intended IT education goals and meeting the needs of local employers, the results of this study, when contextualized with extant literature suggests a number of conclusions:

6.1 Non-Metro Communities Are Challenged to Match Employer Needs to Learning Outcomes

The literature emphasizes the value of experiential learning for IT skill development but in a non-metro location that is relatively new to broadband deployment and still experiences erratic Internet quality, limited economic development contributes to scarce employer resources and constrains the opportunity for industry to collaborate with educators. Faculty expressed frustration at their efforts to develop enough local relationships for their IT students and readily admit that their program could benefit greatly from increased student access to employers as trainers and mentors. The opportunities that exist in the northwest Florida region are too far to travel for many of the students who are already juggling personal, student and professional demands.

The lack of experiential opportunities can be conflated with the low number of job posting results from non-metro areas (n=13) and reveals a cycle in which diminished economic development contributes to decreased opportunity and student are compelled to move out of the area to pursue fruitful employment. Thus the non-metro region loses a resource by which it may build an attractive area for future economic development.

6.2 IT Education is Challenged to Provide Meaningful Credentials

There exists a lack of clarity in what counts in the IT education program, credentials or skills, as students consistently referred to learning what they need to pass certification exams rather than the types of skills presented in the curriculum. Further, based on analysis of job postings compared to the curriculum alignment, there may be an overreliance on the value of certifications as credentials that may replace the value of experiential learning like that received on the job or through industry-sponsored internships.

While future phases of the NSF ATE study will focus on certification assessment and alignment, this phase clearly indicates that both students and faculty at College A perceive that certifications are critical elements in an IT graduate's employability. In fact, both groups characterized the possession of skills desired by employers purely in terms of the certifications, rather than by job descriptions or job postings. However, the job postings results on certifications reveal that less than half (46.7%) of the postings mentioned certifications and only eight job postings of the total 225 actually stated that it was a requirement (3.6%).

For example, when completing the state-required curriculum revisions for a Fall 2014 network technology course, faculty consulted the professional product certification criteria so that curriculum changes could accommodate any revisions made in the scope of the certification exam. Certifications "impact our courses…the delivery of our courses" according to one faculty member. In the view of a student "It's all about the *certs*."

Miscellaneous skills identified by faculty indicated that they know that various 'soft skills' such as interpersonal skills, career-orientation and realistic job expectations regarding salary and job location, will be important to employers and would like to address this by instituting a business communications class. However, the faculty's greatest concern is with basic literacy skills, about which they are concerned, especially in light of recent changes to Florida's college-readiness legislation. Florida lawmakers recently made optional the requirements for remediation in math, reading and writing skills for incoming students with a high school diploma. Faculty indicated that although students are competent in a variety of basic and advanced IT skill sets, "They can't pass math."

State education policy changes that impact curricula in the two and four-year college system occur frequently and along with the dynamic nature of IT and the influence of product certification revisions, curricula stability, currency and faculty expertise will remain a yearly challenge.

7 Conclusion

The lure of the two and four-year college educational pathway is its affordability compared to costs of a higher education completed exclusively in the traditional university environment. While two-year institutions' prices for undergraduate tuition, room, and board increased over 59% since 2007, universities have seen increases as high as 73.5%. Two and four-year tuition and fees are usually less than half the cost of universities and often offer flexibility to pursue a two-year or four-year diploma. Overall, the value of the four-year degree offers up to 61% greater income than a high school degree, whereas the two-year degree provides over 32% greater income than a high school degree, demonstrating the evident value of increased education (USCC, 2012). Beginning with a two-year degree and transitioning into a four-year institution is a way for students to maximize their educational benefits while controlling their costs. Many studies support the important role that two and four-year college programs can play both in certification training and as a gateway to the four-year degree (Bailey, et al., 2005; Compton, et al., 2010; Lanaan, et al., 2006). IT degrees demonstrate significant impact on an individual's earning capacity, some up to 40% over a five-year period (Compton, et al., 2010).

As universities increasingly respond to the call by funding stakeholders to respond to the science, technology, engineering and mathematics skills' shortage, the need for an IT student pathway that extends from secondary grades all the way through postsecondary studies and into the career and workplace, will require curricula that are as flexible as the discipline it serves but steeped in fundamentals that serve an industry in which self-sufficient, lifelong learning is inherent. Future studies that would benefit this purpose include ongoing assessment of IT curriculum standards in place at all levels of education; an understanding of how prototype, high quality career planning and placement services such as the AIM Careerlink[7] can enhance the extension of the State Postsecondary Data Systems (Garcia & L'Orange, 2012) that are increasingly tied into workforce data to improve and complement the collaborative activities provided by robust data-sharing; and understand the value and complexity of certifications at all levels of the education pathway. These research initiatives need to be flexible and

[7] See AIM Careerlink at http://aimforbrilliance.org/careers/

ongoing to continue to align with the needs of the IT stakeholders.

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Appendix A.
17 Syllabi

CIS 1000	Introduction to Computing Systems
COP 1700	Introduction to Database Management
CTS 1110	Microcomputer Operating Systems
CTS 1111	Introduction to UNIX/Linux System Administration
CTS 1120	Introduction to Network Security
CTS 1131	Introduction to Microcomputer Maintenance and Repair
CTS 1155	IT User Support
CTS 1163	Microsoft Desktop Systems Configuration
CTS 1345	Microsoft Server Active Directory
CTS 1346	Introduction to LAN and Server Management
CTS 1347	Microsoft Server Network Infrastructure
CTS 1650	Introduction to Networking and Communications
CTS 1651	CISCO Router Technology
CTS 2652	CISCO Advanced Router Technology
CTS 2653	CISCO Wide Area Network Routing
CTS 2939	IT Certification Prep Review
GEB 2214	Business Communications