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Ref: Assessing IT Educational Pathways that Support Rural Broadband: Strategies for Aligning IT Curricula, Policy, and Employer Needs

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Editor in Chief, Community College Journal of Research and Practice
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Assessing IT Educational Pathways that Support Rural Broadband: Strategies for Aligning IT Curricula, Policy, and Employer Needs

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Assessing IT Educational Pathways that Support Rural Broadband: Strategies for Aligning IT Curricula, Policy, and Employer Needs

Abstract

In this National Science Foundation Advanced Technician Education program NSF ATE project, we aimed to strengthen the rural IT employee workforce and improve educational support related to broadband, telecommunications, and networks in rural settings. By using multiple methods to triangulate rural IT program curricula content with employers' perceptions and new professionals' on-the-job experiences, we gained an understanding of common general and technical competencies, perceived rural IT technician workforce readiness, and strategies to bring educational experiences in alignment with professional performance. We also offer findings concerning alignment of technician pathways and recommendations for how to transfer identified competencies to other similar rural markets, along with examples of extensions of this work for exploring and assessing IT pathways.

Keywords: *Information Technology, Competencies, Technicians, Curricula, Professional Standards, Rural, Alignment*

Introduction

With programs that allow citizens to build the expertise and community capital needed to respond to wide ranging regional factors, community colleges support the educational needs of the local community, prepare students for workplace success, and play a role in local economic development. Many community colleges, often with limited budgets and small staffs, rely upon informal relationships with local employers rather than market research for industry input for their curriculum. By collaborating with local employers, community colleges are able to guide their programs, time, and resources precisely and efficiently (MacAllum, Yoder, & Poliakoff, 2004); for example, community colleges foster regional solutions when they work closely with local employers to provide students with career pathway support and technical training.

Community colleges have a key role to play in helping rural communities meet their growing technology needs, yet rural education trends reveal that only 15.6% of persons 25 and older graduate from college and less than 30% of the rural population do not complete a college degree (U.S. Census Bureau, 2010). The educational challenges of rural areas are further compounded by these communities' lack of access to many online learning opportunities: About 39% of rural households lack broadband capability and rural, low-income minority households' broadband adoption lags behind all other groups (FCC, 2016). Low adoption rates in rural communities can be attributed in part to decreased availability of broadband service (Strover, 2018), expense of computers and Internet service, and a perceived lack of need for a household connection (Carnevale et al., 2011).

The educational and economic benefits of broadband reinforce one another. Attracting entrepreneurs and innovative industries have become important components of immediate rural economic development; reliable, fast broadband is important to these efforts' success (Conley &

Whitacre, 2016; Y. Kim & Orazem, 2017). Because a great number of rural students desire to stay in their communities after graduation and enrich local viability, technical education in a rural context faces different challenges that programs located in highly mobile urban areas (Schafft, 2016). For rural communities to capitalize on the benefits that broadband can bring for education and economic development, they need employees with advanced, diverse technology skills (Carmichael, McClure, Mandel, & Mardis, 2012).

By assessing the needs of rural employers and new professional employees, the Florida State University (FSU) Information Institute, Chipola College, and Tallahassee Community College (TCC) sought to define circumstances and develop strategies that would aid employers and community colleges in refining IT curricula, helping educators prepare graduates to address the employers' IT and broadband support needs, and ensure that new professionals were recruited into and retained in the rural IT workforce. The goal of the study was to provide an understanding of the unique broadband technology needs of rural employers, the graduates entering this workforce, and the pathways supported by existing community and state college program curricula. An additional benefit of the project was the development of a suite of useful techniques for assessing alignment among curricula, employer needs, and new professional experiences that may be useful for exploring the relationship between rural communities and other industry sectors such as manufacturing.

Project Strategy

Guided by the main research question, "How do IT and broadband support skills graduates gain through rural two and four-year IT programs compare to the need expressed by rural employers," we collected data from key sources. Early in the research process, we realized that while we were primarily interested in IT activities that supported broadband implementation and maintenance, rural IT workforce scarcity results in IT professionals needing to have a range of expertise (Spears et al., 2014). Therefore, we widened our focus to examine all types of IT curriculum, employers, and new professionals. We assessed the alignment between rural two and four-year community and state college curricula, rural new professionals' valuable IT competencies, and rural IT employers' workforce needs using a multi-method approach that included qualitative and quantitative methods. Data collected for this project were coded using a combined codebook derived from the *Competencies Model for IT Program Management* (OPM, 2011) and *Career and Technical Education IT Frameworks* (FLDOE, 2013). The coded data were compared to identify areas of alignment between the skills needed by new IT professionals, requested by employers, and those taught in regional IT degree programs.

Step 1. Two and Four-Year IT Curricula. In this step, we analyzed IT course syllabi from FSU's undergraduate IT program as well as Chipola and TCC's IT programs. Syllabus analysis is a subset of curriculum analysis, a process commonly used to examine academic program content via efficient and non-obtrusive means (Apigian & Gambill, 2008; Madson, Melchert, & Whipp, 2004; Veltri, Webb, Matveev, & Zapatero, 2011). A course syllabus, which contains information such as class schedules, assignment descriptions, student learning objectives, subject content, and grading criteria, is often considered a "contract" between the instructor and the student, a permanent record for academic institutes, and a reference tool for students (Parkes & Harris, 2002).

Step 2. Employer Requirements and Expectations. We began this step by analyzing regional rural IT job descriptions and distilling lists of position requirements. Because job postings are often written by human resources professionals instead of subject matter experts, we wanted to compare the results of this analysis to the viewpoints of the professionals who actually make employment and supervision decisions (J. Kim & Angnakoon, 2016). Then, we conducted semi-structured interviews with IT employers in rural Northwest Florida. Our purposive sample of 20 Northwest Florida employers was developed with the help of IT program faculty, internship placement coordinators, and industry advisors. Our interview participants all had IT hiring and management responsibilities. In the interviews, we asked questions relating to preferred employee skills and used a skills card sort developed from the results of the syllabus and job posting analysis.

Step 3. What New Professionals Actually Do. Recognizing that employers' expectations and curriculum content may vary from actual day-to-day responsibilities (Kennedy & Abell, 2008), we conducted several focus groups with new IT professionals in Northwest Florida. From the employer interview protocol, we developed a focus group discussion guide and analyzed the transcript of each of the six focus groups. We asked employer interview participants to help us develop two purposive samples of IT their employees.

What the Data Say

From our data, we derived general competencies and technical competencies shown in the Table.

[Table here]

As the Table summarizes, the general competencies that all three datasets included writing, teaching others, problem solving, professional learning, interpersonal skills, and customer service, and compliance. While job postings and employers emphasized some general competencies such as teamwork/collaboration, self-management, oral communication, flexibility, and accountability, those competencies did not appear in the IT syllabi. This absence suggests a notable gap between employers' perspectives and college programs' perspectives. While employers stressed the importance of general competencies, they did not mention whether they expected students to gain these skills in coursework, internships, or other experiential learning, despite employers' stated value for these experiences for hands-on application and exposure to the cutting-edge technologies currently used in industry. From our data, we concluded that, in the employers' view, recent graduates who had interned required less training and were more likely to quickly learn specialized systems and technologies (especially in the company where they interned). These findings suggest that internships and other experiential learning opportunities are a crucial part of new IT professionals' career pathways (Hollister et al., 2017). The general competencies coming solely from job postings, such as attention to detail, creative thinking, conflict management, decision making, external awareness, influencing, integrity, leadership, managing human resources, negotiating, planning and evaluating, reasoning, and vision, suggested additional topics to be considered for IT curriculum.

Employer and education perspectives are more aligned in relation to technical competencies. Our data revealed that 12 competencies were well covered in all three datasets: technology awareness, project management, product evaluation, operations support, IT performance assessment, IT architecture, information system/network security, information management, infrastructure design, data management, and configuration management. In addition, the technical competencies that were found only in job postings were highly specialized: stakeholder management, systems life cycle, systems engineering, risk management, requirements analysis, quality assurance, IT program management, information resources strategy and planning, information assurance, financial management, financial analysis, enterprise architecture, capital planning and investment assessment, contracting/procurement, change management, cost-benefit analysis, acquisition strategy, and accessibility. This list suggests that IT program faculty may wish to consider how they can integrate more opportunities specialization into the general IT curriculum; often, these opportunities can be delivered outside of the classroom in internships, apprenticeships, and other hands-on learning experiences (Lee et al., 2014).

Though industry and employer needs included both general and technical competencies, our research suggested that the focus of current IT curricula in two and four-year colleges is concentrated on technical competencies. This finding implies that IT educators and program administrators have an opportunity to modify IT curricula to reflect increasing the breadth of graduates' general and technical competencies by implementing more internships and hand-on learning experiences so that students can build both diversity and specialize their skill sets during their education.

Conclusion

Our aim in this paper was to provide a high-level overview of a four-year NSF ATE research project that was centered on the relationship between IT curriculum, employers' needs, and new professionals' work experiences.

We have also identified several directions for research on rural IT workforce preparation:

1. *IT Curricula and Professional Standards.* While researchers have already conducted several studies assessing alignment between the ACM/IEEE professional standards to undergraduate IT curricula (see, for example, Mardis et al., 2017), new ACM/IEEE standards (ACM & IEEE, 2017) provide a fresh opportunity to discern the extent to which students are being prepared to meet these new standards.

2. *High School Curricula and State Standards.* As national education priorities increasingly focus on secondary schools' efforts to prepare students for technology-rich college and career experiences (National Research Council, 2012), a fertile area for research is exploring the alignment between policies that address IT education in high schools and the extent to which those policies have been implemented (Mardis et al., 2017). Continued studies that document the alignment between secondary IT curricula and state career and technical education (CTE) standards are also prime for investigation.

3. *Internship Postings and Experiences.* By comparing the *IT Body of Knowledge* (ACM & IEEE, 2008) to internship postings at two universities, a team of researchers assessed the competencies that students could expect to receive as a result of their IT internships (Jones et al., 2017). Their findings revealed that internship postings often focus more on technical competences and lack focus on general competencies, even when employers express the importance of skill-sets such as leadership, communication, and ability to work in teams. These early results would benefit from deeper exploration through qualitative methods such as interviews and focus groups with internship participants and mentors.

4. *IT Curricula and Industry Certifications.* Several researchers (Fedak et al., 2011; Wierschem, Zhang, & Johnston, 2010) have assessed the alignment between IT curricula and industry certifications. While these studies concluded that certifications held wide ranging workplace value although most IT programs adequately covered certification content, deeper exploration of how certifications do function in the IT hiring process and how IT programs can better prepare students to utilize certificates in their career pathways are examples of two promising directions for future research.

Discoveries concerning the alignment of IT pathways often provide useful information that can be used to make adjustments or changes to policies, standards, curricula, and even job postings, although acting on these findings (particularly when there are misalignment issues) are often more difficult to implement. As a result, these studies are best conducted by policy-makers, administrators, or curriculum committees who are able to directly make or recommend policy changes.

While this study was conducted at in a single rural locale, scaling the methods of this study to statewide or regional level can make a significant impact for assessing adherence to educational policy or exploring ways that policy itself can be changed.

The methods we used in this project to assess curriculum content and participant perspectives have strong potential to be useful for similar triangulations in other industry sectors. The methods may also be useful for extending understanding of career pathways from secondary school curriculum to employment as well as for gaining a greater understanding of the specific competency contribution of experiential learning experiences. In a sector as dynamic as IT, ongoing monitoring and adjustment is critical for ensuring a robust workforce able to support workplace IT, lead technological innovation, and help communities to maximize broadband's benefits.

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Table. Competencies Common to Syllabi, Employer, and New Professional Data Sets

General Competency	Technical Competency
Compliance	Configuration management
Customer service	Data management
Interpersonal skills	Infrastructure design
Problem solving	IT performance assessment
Professional learning	Operations support
Teaching others	Product evaluation
Writing	Project management
	Technology awareness