ASSESSING INFORMATION TECHNOLOGY EDUCATIONAL PATHWAYS THAT PROMOTE DEPLOYMENT AND USE OF RURAL BROADBAND

3rd Annual Report: NSF ATE (Award #1304382)

4/27/2016

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INTRODUCTION

This report describes the activities, findings and deliverables generated during Year 3 of the National Science Foundation Advanced Technological Education (NSF ATE) four-year study. The study collaborators include Tallahassee Community College (TCC) and Chipola College along with the Florida State University Information Institute, all located in northwest Florida.

PROJECT GOALS

The goals of this four-year project are to:

1. Understand the alignment of IT staffing with the needs of employers and employees working in IT positions;
2. Strengthen the employee pool of IT/broadband staffing (including general IT, broadband and network technicians);
3. Improve educational support related to broadband, telecommunications, and networks for future and current IT employees in non-metro Northwest Florida; and
4. Understand how to transfer this competency to other similar non-metro markets.

These goals are in the process of being accomplished by a collaboration between university researchers and community college program administrators.

RESEARCH QUESTIONS & SPECIFIC OBJECTIVES

The specific research questions addressed by this phase of the study include:

RQ 1 How do the IT/broadband skills graduates gain through two-year community college programs compare to the needs expressed by employers in nonmetro/metropolitan areas?

RQ2 How do the IT/broadband skills graduates gain through two-and four-year college programs compare to the skill sets new professionals identify they need after they are hired as IT employees in non-metro/metropolitan areas?
RQ3 What, if any, gaps exist between the skills non-metro/metropolitan employers report their IT/broadband employees need and the skill sets new professionals report they need to be successful as IT/broadband employees?
RQ 4 What, if any, differences are there between the skills needed for IT/broadband employees in nonmetro and metropolitan areas?
RQ5 How can two-and four-year college IT/broadband program curricula be modified to best meet the specific needs of employers and IT/broadband employees in non-metro/metropolitan areas?

The specific objectives for this project are:

1. Understand private sector and Community Anchor Institutions' (CAI; e.g., public libraries, schools, community centers) IT/broadband staffing needs to facilitate recruitment and placement activities available through Chipola, and TCC;
2. Identify skill sets IT employees need on the job as reported by new professionals and identify any gaps between these skill sets and the staffing needs reported by employers;

3. Determine if there are differences in the needed IT/broadband employee skill sets between metropolitan and nonmetro areas of Northwest Florida to understand what specific skill sets are needed for employees in nonmetro areas;
4. Recommend changes to existing IT/broadband curricula at the Chipola and TCC IT/broadband programs to best meet the IT staffing needs of employers in nonmetro Northwest Florida and as a guide for other nonmetro areas; and
5. Build on existing industry-education relationships and create a process to provide ongoing feedback for future curriculum considerations.

MAJOR ACTIVITIES

Phase III

Classroom Observations

Two classroom observations were conducted in February 2015 for this project: one each at Chipola College (Chipola) and at Tallahassee Community College (TCC). The courses observed included Chipola's Advanced Network Security (CTS 2127) and Introduction to Network Security (CNT 2401) at TCC; the full class time was observed on both occasions. A systematic process was employed for these sessions and two types of observations were conducted: observations of student and instructor activities, and observations of evidence of important technology employee competencies on the parts of the students and the instructor. Recordings of the observation sessions were coded based on technology employee competencies derived from the Florida Department of Education (FL DOE) Career and Technical Education (CTE) framework. Please see Appendix A for the preliminary results of the classroom observations.[1]

Compilation of Student Pathway Tracking and Establishment of Alumni Tracking by Chipola

In July of 2015, Information Institute research team members met with James Froh (Co-PI) and another partner at Chipola College to discuss different strategies and approaches to plot student-to-career pathways and tracking alumni as they begin their careers in IT. The student and alumni tracking sign-up sheets were also used to recruit new IT professionals to be interviewed, as described below. Alumni tracking efforts are ongoing at both Chipola College and Tallahassee Community College.

New Professional Interviews

From August 2014 to December 2015, Information Institute research team members conducted semi-structured interviews with 23 information technology (IT) graduates from Florida State University (FSU), Chipola College, and Tallahassee Community College (TCC) about their IT education and transition from being IT students to IT professionals. Interviews were conducted

[1] The *Preliminary Report of Classroom Observations* as well as all of the other preliminary reports referred to as appendices throughout this annual report can be found on our website at: http://ii.fsu.edu/Research/Projects/Assessing-Information-Technology-Educational-Pathways-that-Promote-Deployment-and-Use-of-Rural-Broadband-NSF

over the phone and lasted approximately 30 minutes each. Of the interviewees, 11 were from Florida State University, with 6 students each from Chipola College and Tallahassee Community College. Please see Appendix B for a full description of the data collection techniques used for the New Professional Interviews.

Employer Interviews

From July 2014 to December 2015, the research team conducted one-on-one interviews with 18 employers who recruit and employ individuals in a variety of Information Technology (IT) positions in companies from diverse domains across the Northwest Florida Region. Please see Appendix C for a full description of the data collection techniques used for the Employer Interviews.

Second Curriculum Analysis

The research team developed text-mining techniques to examine the relationship between relevant learning outcomes and the IT curricula based on syllabi from two colleges, Tallahassee Community College and Chipola College. Recent syllabi from the IT programs at both colleges were supplied by our Co-PIs and partners each institution. The syllabi contents were matched to relevant learning outcome standards listed in a codebook derived from the *Competencies Model for IT Program Management* (OPM, 2011) and *Career and Technical Education IT Frameworks* (FL DOE, 2013). Please see Appendix D for a full description of the text-mining techniques as well as the preliminary results of the second curriculum analysis.

Phase IV

New Professional Interviews

The transcripts from the new professional interviews were analyzed using a codebook developed from the *Competencies Model for IT Program Management* (OPM, 2011) and *Career and Technical Education IT Frameworks* (FL DOE, 2013). Important emergent themes, such as the importance of soft skills and internships, were also identified and discussed. Please see Appendix B for the preliminary findings from the new professional interviews.

Employer Interviews

The transcripts from the employer interviews were also analyzed using the updated codebook based on the *Competencies Model for IT Program Management* (OPM, 2011) and *Career and Technical Education IT Frameworks* (FL DOE, 2013). Important emergent themes (such as the importance of soft skills, internships, industry partnerships, as well as the challenges rural, nonmetro employers face) were also identified and discussed. Please see Appendix C for the preliminary findings from the employer interviews.

Virtual Focus Group

A methodology for the online focus group was developed, submitted to the Human Subjects Committee of the Institutional Review Board at FSU, and approved without any necessary revisions. The online focus group was scheduled for mid-February and recruitment took place in the weeks leading up to it. However, the research team was unable to recruit enough participants in order to justify hosting the online focus group. Nonetheless, the online focus group methodology may still be utilized at a later point in this project or as part of a supplemental grant project in the future. Please see Appendix E for the report on the focus group methodology.

Comparison of Syllabus Analysis with Phase 1 (NSF Recap) and with Employer Interviews
Since the second curriculum analysis utilized a different codebook than the first curriculum analysis in Phase I of this project and given the small sample sizes of syllabi, a statistical comparison would not have been valid or generalizable. However, the *Preliminary Report on Employer Interviews* (Appendix C) does discuss overlapping themes in the findings as the relate to those in the *Second Curriculum Analysis* (Appendix D) as well as identifies employers' views on IT education programs. The *Preliminary Report on Employer Interviews*, being the most recent analysis, relates the findings to similar work within and outside of this project as well as offers recommendations for IT curricula and directions for future research.

Third NSF ATE Annual Report

Preparation of the third annual report for this NSF ATE grant project has also been a major activity in first third of 2016. The research products of during the 3rd year of this 4 year project were compiled and synthesized to report our progress and identify significant findings.

SIGNIFICANT RESULTS

RQ 1 How do the IT/broadband skills graduates gain through two-year community college programs compare to the needs expressed by employers in nonmetro/metropolitan areas?

The results from the employer interviews indicate that just over half of the interviewed employers mentioned that recent graduates were lacking needed technical and general or soft skills. Experiential learning opportunities, such as internships, were often identified as effective ways for students to gain much needed hand-on experience and exposure to cutting edge technologies used in the industry that may not be reflected in the curricula of IT programs.

While employers emphasized soft skills and the value of experiential learning opportunities, some employers wanted to hire more specialized IT professionals. Employers stated that much of this specialized knowledge can be gained through internships or on the job training, but suggested it would be beneficial to them if recent graduates had more options to specialize their skill set during their education.

While employers stressed the importance of soft skills, these skills were not directly linked with internship or experiential learning experiences. Employers primarily placed value on internships because they can provide hands-on experience and exposure to technologies currently used in the

industry. As such, recent graduates with internship experience may require less training after they are hired to get up to speed with the specialized systems and technologies, especially if they are hired by the company where they interned. These findings suggest that internships and other experiential learning opportunities are a crucial part of the student to career pathways for new IT professionals. However, the potential for experiential learning opportunities to develop and promote soft skills should be further explored.

RQ2 How do the IT/broadband skills graduates gain through two-and four-year college programs compare to the skill sets new professionals identify they need after they are hired as IT employees in non-metro/metropolitan areas?

Some of the interviewed new professionals stated that everything they learned was important and that their coursework prepared them well for their jobs, while other participants were critical about how well classroom teaching can prepare students for the IT world due to the lack of hands on training. All participants agreed that internships were a strategy schools can use to increase hands on training in their IT programs while preparing students better for the IT workforce. This finding has important implications for program administrators as well as for students because it suggests that program administrators are well advised to build and maintain connections with local employers who offer internship opportunities and that students should be advised to include internships in their educational experience.

The new professionals strongly stated that interpersonal skills and soft skills were some of the most important skills needed on their job. However, these interpersonal and soft skills were not always taught in the formal learning activities in IT programs; to this end, internships offer an important complement to the classroom. The findings from these interviews are a crucial part in understanding the student to career pathways of new IT professionals.

RQ3 What, if any, gaps exist between the skills non-metro/metropolitan employers report their IT/broadband employees need and the skill sets new professionals report they need to be successful as IT/broadband employees?

The new professional and employers agreed that both technical and soft skills and hands-on work experience gained through internships are highly valuable to new professionals and sought after by IT employers. Both groups, employers and new professionals, identified soft or general skills as the most important skills needed by IT employers. Of particular note, employers and new professionals both stressed the importance of Interpersonal Skills and Self-Management. These findings also align with the results from the final report[2] of our *Florida IT Career (FITC) Alliance Pathways Assessment* grant project. Employers interviewed in that report stated they expected IT graduates to be prepared and ready to be "plugged into" existing teams in their businesses and that new hires and graduates needed to have interpersonal and communication skills in order to do so.

Employers also emphasized the importance of learning, often in relation to both soft skills and current technology skills on the job, more so than new professionals. While the new

[2] The FITC Assessment Final Report can be found on our website here: http://ii.fsu.edu/Research/Projects/IMLS-LB21-2014-Project-Summary

professionals valued their education and especially relished the experience and skills gained through internships, these findings suggest that new professionals might not consider the importance of learning and/or continuing education as they enter the workforce and develop their careers. As employers expect new hires to spend a great deal of time learning the responsibilities and skills needed for their position and to fit into the workplace, seeking potential employees that also value learning is a sound hiring strategy.

In regards to technical competencies, employers sought more specific skill sets, such as Infrastructure Design and Information Technology Architecture. As seen above, employers often wished graduates had more specific skill sets coming into new positions. This may also explain why employers seek new hires with the ability to learn new skills. Both new professionals and employers emphasized the importance of basic computer knowledge, such as Operations Support and Configuration Management. New professionals identified problem solving and troubleshooting skills, the latter referring to more practical abilities to fix specific technical issues, more so than employers. However, given the nature of problem solving and troubleshooting, what new professionals referred to as problem solving and troubleshooting could, in part, be what employers are suggesting when they mentioned learning.

RQ 4 What, if any, differences are there between the skills needed for IT/broadband employees in nonmetro and metropolitan areas?

Nonmetropolitan employers did not report any difference in the types of skills necessary for their IT employees. These employers did mention additional struggles they face when hiring IT workers like being unable to offer competitive wages, lack of broadband, and lack of qualified applicants.

Smaller, rural companies often do not have the funding or technological infrastructure to attract IT professionals to live and work in rural areas. While rural or nonmetro IT employers did not seem to suggest that rural IT professionals required a different skill set than metro-area IT professionals, they did mention it was difficult to attract and retain IT professionals that were well-qualified.

RQ5 How can two-and four-year college IT/broadband program curricula be modified to best meet the specific needs of employers and IT/broadband employees in non-metro/metropolitan areas?

As the results of this 2015-2016 academic year curriculum analysis suggest, there is now no significant difference between the curricula offered by Chipola College's Computer Information Technology Program and TCC's Networking Services Technology programs. The results indicated that graduates from Chipola College and TCC are prepared mainly in the technical skill areas of Configuration Management, Information Systems/Network Security, Infrastructure Design, Operations Support, IT Architecture, and Technology Awareness. However, the curricula from both schools lack emphasis in some technical skill areas, such as Compliance, Project Management, Coding/Programming, Product Evaluation, Systems Testing and Evaluation, Information Management, IT Performance Assessment, and Data Management.

Each institution's curriculum focus is heavily skewed towards the technical skills rather than general, soft, or employability skills. Given the U.S. Chamber of Commerce's (2012) findings, graduates from these and similar programs may be failing to meet the needs of employers because they did not complete coursework that emphasized general, soft, or employability skills.

As IT employers seek increasingly specialized new IT professionals and prefer applicants with soft skills and internship experience when making hiring decisions, IT curricula should be adjusted to incorporate more experiential learning opportunities into the requirements of their respective programs. As such, community college IT/broadband programs should strengthen existing partnerships with employers and continue to build new relationships with other employers in order to provide experiential learning opportunities, such as internships, service learning, volunteering, apprenticeships, etc. Additionally, IT curricula should more directly address and provide opportunities to learn and apply soft skills, as reported in our *Second Curriculum Analysis Report* (Appendix D).

Given the need for highly skilled IT professionals in rural communities, building partnerships with rural employers could be especially beneficial for all stakeholders involved. Experiential learning opportunities in rural areas would allow students to gain needed skills and experience as well as provide opportunities for rural communities and employers to demonstrate and fulfill their IT and broadband needs as well as chance to extol the benefits of living and working in nonmetro areas. New IT professionals that have internships in rural areas might be more likely to stay and work in the area, assuming some of the other challenges mentioned above are addressed.

KEY OUTCOMES

The team was able to identify the alignment of IT learning outcomes from two IT programs provided by TCC and Chipola in the second curriculum analysis (Appendix D); these were compared with the learning outcomes desired by employers as expressed in the employer interviews as well as with new professionals from the new professional interviews. Similarly the classroom observations provided insights into the different approaches to IT instruction in the classrooms at each institution (see Appendix A).

The team continued to identify key challenges with using syllabi as indicators of learning outcomes, including disconnects among state standards, school resources, instructor implementation, and student understanding (see Appendix D).

The team implemented and finessed the data management and analysis procedures and tools from the previous curriculum analysis, including the use of multiple text mining and natural language processing tools, that increased the team's ability to process larger amounts of data to be collected in the future phases of the study and related projects (see Appendix D).

The team identified challenges involved in implementing a digital focus group to gain more insight into employers' needs for their IT employees (see Appendix E). Due to these challenges, the team was unable to conduct the digital focus group.

Preliminary findings from the new professional interviews (Appendix B) and the employer interviews (Appendix C) suggest that general competencies such as communications, self-management and problem solving skills, are highly desired on job, though they are not emphasized in the curriculum. New professionals and employers indicate that experiential learning is a much greater factor in developing abilities to manage well on the job than the development of any particular technical skill learned in the classroom.

The new professional and employer interviews helped identify additional challenges, such as the lack of IT/broadband infrastructure, technology awareness and acceptance, and funding, that nonmetropolitan employers and communities face when attracting and retaining IT employees see Appendix C).

The study team has been successful in disseminating information about the study in a diverse number of settings, including local seminars and technology expos as well as library and information studies and national policy conferences.

Two journal articles are in the process of being edited for submission to publications.

OPPORTUNITIES FOR TRAINING AND PROFESSIONAL DEVELOPMENT

The process of implementing the research design has allowed the personnel at the participating community colleges to become more familiar with research data collection and analysis procedures. This has expanded to roles as data collectors, as the Co-PIs recruited students, new IT professionals, and IT employers for the study. They have contributed to the refinement of the faculty and student focus group protocol, and were responsible for setting up each session at their locations. Dr. Froh and Dean Stewart trained with the research team on the classroom observation protocol in early December 2014, with modifications to the coding instrument made based on their feedback. They served as the lead classroom observers in the classroom observations conducted in February 2015 and conducted post-observation interviews with faculty members.

The graduate students, both at the master's and doctoral levels, who have been working alongside the lead researchers have benefited from opportunities to increase their methodological knowledge as well as to present at respected conferences in the field. The have learned more about why data collection techniques are selected and implemented (including gaining experience in conducting focus groups and classroom observations), how data analysis procedures can be carried out (including learning how text mining techniques can be applied to the research problem of this project), and built familiarity with data analysis tools, such as SPSS and NVivo.

In the final year, the research team will be developing and hosting a regional workshop to share our results with and gain feedback from regional employers, IT professionals, educators, and researchers for training and professional development purposes.

DISSEMINATION TO COMMUNITIES OF INTEREST

In January 2015, a research team members presented two posters detailing the preliminary results from the project at the Annual Conference of the Association for Library and Information Science Education (ALISE) in Chicago, IL: Lee, J., Spears, L. I. & Ambavarapu, C. R., Mardis, M.A., & McClure, C.R. (2015). Between the IT curricula and job posting ads: Comparative analysis of IT job competencies for IT professionals in Northwest Florida. Poster presented at *the 2015 Association for Library Information Science Education (ALISE) Annual Conference*, Chicago, IL, January 27-30, 2015 and Spears, L. I., Ma, J., & Ambavarapu, C. R., Mardis, M.A. & McClure, C.R. (2015). Assessing North Florida information technology education to career pathways. Poster presented at *the 2015 Association for Library Information Science Education (ALISE) Annual Conference*, Chicago, IL, January 27-30, 2015.

At the 2015 iConference in Newport Beach, CA, research team members presented a paper which focused on the alignment between the IT learning outcomes in curricular materials at a particular Florida Panhandle area community college, the skills listed in regional job postings, and the perceptions of IT students and faculty members: Spears, L. I., Lee, J., Ambavarapu, C., Mardis, M. A., Alemanne, N. D., & McClure, C. R. (2015, March). Meeting the needs of IT stakeholders in a northwest Florida state college. Paper presented at the *2015 iConference*, Newport Beach, California. Available at: https://www.ideals.illinois.edu/bitstream/handle/2142/73446/187_ready.pdf?sequence=2

In April 2015, Dr. Mardis (Co-Pi) and the team also had the pleasure of presenting to the Florida Board of Governors at the TEAm grants annual event in Tampa. In her presentation, Dr. Mardis shared the educational and career pathways the team had discerned through their analysis. Many of the findings complemented and reflected findings emerging from the NSF ATE project. This presentation formed the basis for subsequent presentations to FITC stakeholders at events throughout the summer and early fall.

In October 2015, Co-PI Dr. Marcia Mardis and project evaluator Dr. Flora McMartin presented a showcase session featuring the research results to date at the 2015 NSF ATE Principal Investigators' Conference. Mardis and McMartin also convened a Birds of a Feather discussion centered on rural education. Over 20 people attended the session and contributed thoughtful and exciting ideas about helping students in rural communities grow and thrive.

In November 2015, Dr. Marcia Mardis moderated a panel for the 11th Annual Social Informatics Research Symposium at the 2015 Annual Meeting for the Association for Information Science and Technology (ASIS&T) in St. Louis, MO: Spears, L.I., Mardis, M. A., Alemanne, N., & McClure, C.R. (2015, November 7). IT education and iSchools: How to develop the scholarly layer? In H. Rosenbaum and P. Fichman. *11th Social Informatics Research Symposium: The Impacts of Social Informatics Research* presented at the 78th Association for Information Science and Technology (ASIS&T) Annual Meeting, vol. 51, St. Louis, MO, November 7-10, 2015.

Two articles are in currently in preparation to be submitted for publication in relevant journals.

ACTIVITIES PLANNED IN NEXT REPORTING PERIOD THAT ACCOMPLISH GOALS

Our activities in year 2016 will include:

1. Writing and submitting journal articles and/or conference papers that focus on: a) the multiple/mixed methodology of this project; b) the challenges faced by new professionals, employers, and colleges in rural, nonmetro areas and communities; c) preliminary findings from year 3; and d) IT curricular recommendations and educational frameworks as informed by the student-to-career pathways we have identified.
2. A synthesis and comprehensive analysis of the collected data and preliminary findings. In order to fully address each research question and accomplish the overarching goals of this project, a macro-level approach to understanding the emergent themes is required.
3. Final results will also be disseminated to project stakeholders, educators, employers, and researchers in related fields and disciplines at a regional workshop to be broadcasted online for professional development purposes.
4. We will be exploring additional research and funding opportunities based on the emergent findings of this project.
5. Draft and submit the NSF ATE final report.

The research team meets weekly to discuss preliminary findings and emergent themes as well as to explore opportunities for future research and new horizons for dissemination. We will continue to communicate regularly with the project evaluator, Flora McMartin, and request and use her feedback.

PRODUCTS

Books - None

Book Chapters - None

Conference Papers and Presentations (2015 only)

Lee, J., Spears, L. I. & Ambavarapu, C. R., Mardis, M.A., & McClure, C.R. (2015). Between the IT curricula and job posting ads: Comparative analysis of IT job competencies for IT professionals in Northwest Florida. Poster presented at *the 2015 Association for Library Information Science Education (ALISE) Annual Conference*, Chicago, IL, January 27-30, 2015. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Spears, L. I., Lee, J., Ambavarapu, C., Mardis, M. A., Alemanne, N. D., & McClure, C. R. (2015, March). Meeting the needs of IT stakeholders in a northwest Florida state college. Paper presented at the *2015 iConference*, Newport Beach, California. Available at: https://www.ideals.illinois.edu/bitstream/handle/2142/73446/187_ready.pdf?sequence=2. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

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Inventions – None

Journals – None

Licenses - None

Other Products – None

Other Publications

Patents – None

Technologies or Techniques

Graduate students who joined the NSF research team in early 2014 contributed stronger data management and analysis skills, resulting in the use of Natural Language Toolkit (NLTK) in which Python was deployed to conduct text mining on the syllabi and job posting documents. The NLTK was further refined in the second curriculum analysis by utilizing an updated codebook that was validated by external IT expert and research team members. Please see Appendix D for a full description of the revised text-mining and natural language processing approach.

Thesis/Dissertations – None

Websites
Project on Information Institute's website:
http://ii.fsu.edu/Research/Projects/Assessing-Information-Technology-Educational-Pathways-that-Promote-Deployment-and-Use-of-Rural-Broadband-NSF

PARTNERS AND COLLABORATORS (2015)

What other organizations have been involved as partners?

Nothing to report.

What other collaborators or contacts have been involved?

Nothing to report.

IMPACTS

What is the impact on the development of the principal discipline(s) of the project?

This project supports the goals of NSF ATE program through research into effective and sustainable preparation for IT/broadband technicians in Northwest Florida. Through its multiple methods pursuit of its research questions, this project is designed to address the dearth of collaborative research on the intersecting needs of IT educators, students, and employers concerning broadband.

Based on the preliminary findings generated thus far, impacts include:

Using the methodology identified in the NSF ATE study, the research team has collaborated with the Florida Information Technology Career (FITC) Alliance to assess a curriculum learning outcomes of a sample of high schools, two- and four-year colleges, and research universities (Florida A&M University and Florida State University) and to determine the extent to which these align with employer and workplace needs. This study is broader in scope with a greater range of participants, and is building on the findings of the NSF study. Between the two studies, the use of text mining and natural language text tools has been tested and provided findings that informed Phases 3 and 4 of this project. Relatedly, having completed an assessment role on the Florida Information Technology Career (FITC) Pathways Alliance project, the research team acquired, with permission, access to research data from the FITC project to supplement and expand on the data collected for this NSF ATE project as well as triangulate preliminary findings across both studies. The combined results of both studies could potentially extend to other related projects and provide insights to broader undergraduate STEM education beyond just IT. The final assessment report for the FITC project can be found here: http://ii.fsu.edu/content/download/296457/2025215/file/FITCInstituteFinalReport_AUG28_2015.pdf.

The preliminary findings in Year 3 continue to build on and expand the areas that require further research. In Year 2, these areas included the extension of the education-to-career pathway to begin with high school; the need to understand the role of guidance counselors, who may be underrepresented and lack the tools to provide guidance on such a dynamic and evolving field; the need to identify best practices for syllabi creation and use; and the need for dialogue on the standards being produced (or needing to be created) for the young IT discipline. Preliminary findings in Year 3 strongly support the need for students to have opportunities for experiential learning, exposure to current technology used in the industry, as well as to develop and hone soft skills, such as communication, interpersonal, self-management, troubleshooting, and problem-solving skills.

The project has heightened awareness and attention to the FLDOE Career and Technical Education frameworks on the parts of TCC and Chipola, including the instructors at each institution. Contacts have been identified with the Florida College System from which a dialogue can be generated with a wider group of college administrators about their use of the IT program frameworks. Based on feedback from interviews and focus groups with new professionals and employers, as mentioned above, soft skills and experiential learning were also identified as crucial for students' success. As such, incorporating the Office of Personnel Management's (2011) Competencies Model for IT Program Management into the revised codebook and allowing for emergent themes has allowed us to identify explore more nuanced factors beyond technological skills that will, in turn, provide more useful and practical recommendations for IT curricula. However, further research on how to best incorporate soft skills into the IT curriculum and how to create industry partnerships with employers, particularly in rural areas, to facilitate experiential learning opportunities is needed.

Preliminary and final research findings will be disseminated via a workshop with regional faculty and industry representatives and a final one-day seminar, broadcast online, to be held at FSU as part of the Eppes Professor Lecture Series. Additionally, research findings will continue to be disseminated through presentations at conferences and articles in journal, as well as made available on our project's website. All Co-PIs continue to present the findings to their stakeholders and communities.

In particular, the research team will attempt to submit proposals to present preliminary and final results at regional and national broadband and education conferences such as the National Career Development Association (NCDA), League for Innovation in the Community College (STEMtech, Innovations and Learning College Summit), and the American Association for Community Colleges' (AACC) Rural Community College Alliance (RCCA) conferences. Articles reporting project results will be submitted to journals such as *Community College Journal*, *Community College Review, Community College of Research and Practice, New Directions for Community Colleges, Educational Research Review*, and other community college and non-metro education journals. Policy conferences such as the Association for Public Policy Analysis (APPAM) and the Telecommunications Policy Research Conference (TPRC) will be targeted for presentations of findings. As stated in the Major Activities section, the research team has presented at three conferences in the last reporting period: the 2015 Association of Library and Information Science Education (ALISE) Annual Conference, 2015 iConference, and the 2015 Annual Meeting of the Association for Information Science and Technology. Moving into the final year of this project, we will continue to disseminate our findings to project stakeholders including community college educators and administrators, researchers, and employers in rural or nonmetro as well as metro areas.

This project reflects a true collaboration among academic, employer, and community stakeholders and should yield benefits for many schools around the state. This study will further define a field that requires a flexible worker who can manage the constant stream of new knowledge and can support work functions that are increasingly broadband dependent. This study will also establish the use of the term non-metropolitan (non-metro) to describe the areas of the study more inclusively as communities that are adjacent to metro or urban areas and comprise a population of both urban and rural residents.

What is the impact on other disciplines?

Conduct of the project's research activities will have profound effect in the capacity of information science faculty and doctoral students to conduct collaborative research into workforce development. This combination of research and practice is aided by the use of rigorous techniques such as content analysis, text extraction, and machine learning. This collaborative effort has expanded into other studies that encompass multiple institutions, including other universities, other two- and four-year colleges, and high schools and has extended into the disciplines of computer science and computer engineering.

At a more widespread level, project deliverables will be transferrable to other regions based on the comparative analyses that will be completed. In addition, the project team is positioned to annually attend, conduct research, or disseminate results on campus at the projected annual seminar and at regional industry expos, such as Tech Expo, which is produced by TalTech of Tallahassee, and Digitech, the school's digital technology expo which draws interest from the greater Northwest Florida industrial organizations. In addition, key advisory committee members are positioned to use results to influence curricula at all institutional levels.

What is the impact on the development of human resources?

Post-secondary educational programs designed to prepare highly qualified entry-level IT/broadband workers in non-metropolitan communities must provide a broad array of skills for those who are supporting institutions with employees who may possess below average technical skills but have strong needs for technology access. The findings of this study will align the efforts of educators directly with the needs of employers and industry and are informing the creation of a network and infrastructure by which each domain can articulate goals, objectives, needs and challenges.

Each of the partner institutions is gaining perspectives on employer needs and increased opportunity to gather feedback that is structured and balanced by the articulation provided by the study. The identification of opportunities and methods to better position the employers in non-metro communities to provide experiential learning is a key way that human resources can be deployed to benefit both employers and schools and provides a more robust pathway for students progressing into technology careers. These prospective impact statements are unchanged in Year 3.

What is the impact on physical resources that form infrastructure?

Because a key aim of this project is to identify the value of and need for broadband IT technicians in rural areas and is engaging community stakeholders, this project is likely to impact the resources rural communities allocate to enhancing their broadband availability through serving great demand for high speed connectivity. This prospective impact statement is unchanged in Year 3.

What is the impact on institutional resources that form infrastructure?

Because a key aim of this project is to identify the value of and need for broadband IT technicians in rural areas, this project is likely to impact the resources two and four-year colleges allocate to their own broadband and network infrastructure in order to educate these individuals. This prospective impact statement is unchanged in Year 3.

What is the impact on information resources that form infrastructure?

A major activity of this project is to compare employers' needs to curriculum content. A likely impact of this project will be the revision and reinvigoration of IT curricula at rural community colleges in the region. This project has also impacted a state-level study that has broadened the scope to include high schools and universities along with other discipline domains, creating a network for increased dialogue across North Florida and among education institutions at all levels. This prospective impact statement is unchanged in Year 3.

What is the impact on technology transfer?

Nothing to report.

What is the impact on society beyond science and technology?

This study of non-metro communities that have deployed broadband or are preparing to do so will support the efforts of ATE to facilitate economic development and connect the communities to global society. This study has the potential to influence the ongoing examination and adoption of IT standards for curriculum that are dynamic and responsive to the changing needs of industry. It also serves to extend the dialogue about the place of IT education beyond the scope of workplace training, in order to build a body of knowledge from which flow best practices. This research meets the challenge of the NSF ATE's goal of improving and supporting the dynamic education of technicians in the workplace who sustain these growing digital efforts and further defines IT/broadband skills needed in non-metropolitan labor markets in communities nationally. This prospective impact statement is unchanged in Year 3.

CHANGES/PROBLEMS

Changes in approach and reason for change
A second job posting analysis was not conducted because a preliminary review of the data collected revealed that there would be no significant differences from the first analysis.

Actual or Anticipated problems or delays and actions or plans to resolve them
A methodology for the online focus group was developed, submitted to the Human Subjects Committee of the Institutional Review Board at FSU, and approved without any necessary revisions. The online focus group was scheduled for mid-February and recruitment took place in the weeks leading up to it. Ultimately, the research team was unable to recruit enough participants in order to justify hosting the online focus group. While the focus group did not include a financial incentive for their participation, the benefits of better understanding how to

incorporate and facilitate experiential learning opportunities, such as internships and volunteering or mentoring programs, could potentially strengthen the workforce over the long term, benefiting both employers, students, and new professionals. Despite this setback, the online focus group methodology still has value as a data collection technique and may still be utilized at a later point in this project or as part of a supplemental grant project in the future. Please see Appendix E for the report on the focus group methodology.

Changes that have a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use or care of biohazards

Nothing to report.

SPECIAL REQUIREMENTS

Nothing to report.

APPENDICES

Appendix A: *Preliminary Report of Classroom Observations*
Appendix B: *Preliminary Report on New Professional Interviews*
Appendix C: *Preliminary Report on Employer Interviews*
Appendix D: *Second Curriculum Analysis Report*
Appendix E: *Online Focus Group Report & Methodology*

All preliminary reports are available on our website at:
http://ii.fsu.edu/Research/Projects/Assessing-Information-Technology-Educational-Pathways-that-Promote-Deployment-and-Use-of-Rural-Broadband-NSF