Preview of Award 1104214 - Final Project Report

Cover

Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	1104214
Project Title:	Successful Academic and Employment Pathways in Advanced Technologies
PD/PI Name:	William T Tyson, Principal Investigator Marie Boyette, Co-Principal Investigator Lakshmi Jayaram, Co-Principal Investigator
Recipient Organization:	University of South Florida
Project/Grant Period:	09/01/2011 - 08/31/2015
Reporting Period:	09/01/2014 - 08/31/2015
Submitting Official (if other than PD\PI):	William T Tyson Principal Investigator
Submission Date:	12/01/2015
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	William T Tyson

Accomplishments

* What are the major goals of the project?

"Successful Academic and Employment Pathways in Advanced Technologies" (PathTech) is a collaboration led by interdisciplinary researchers from the University of South Florida (USF) and the Florida Advanced Technological Education Center (FLATE) at Hillsborough Community College. Our project aims to better understand pathways into technician education at both the secondary and community college levels as well as the occupational trajectories into the manufacturing industry that this training facilitates. We have collected data at high schools, community colleges, and with industry partners in the Tampa Bay area as well as continue to analyze education and employment administrative data. Using multiple methodologies and data sources allows us to develop a deep and broad understanding of the experiences of students and workers in technician fields. As the global economy moves forward in our high-tech world, this knowledge is vital to sustain necessary workforce development as well as improve the life chances of individuals and the stability of their local communities. Perhaps the hallmark of the PathTech project is partnering with various stakeholders in education and industry. These partnerships create opportunities for local and state-level research and to continuously share our findings with our partners as we aim to empower positive social change.

This study contributes to the overall ATE mission by addressing the following goals:

1. Understand recruitment and pathways into engineering technology programs
2. Improve the education of engineering technology programs
3. Recommend interventions at high schools to increase the visibility of engineering technology programs at local community colleges
4. Produce more qualified science and engineering technicians to meet workforce demands

There are several audiences for this project that include high school students, teachers, local community/technical colleges and local industries. This project seeks to inform these stakeholders at each level about the efficacy of local engineering technology (ET) programs in order to promote ET pathways. We also hope to better equip FLATE and partner community colleges with information based on the personal experiences of students who are enrolling and not enrolling in these programs. With this information, we will work with FLATE to develop recommendations on how best to serve these audiences.

* What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?

Major Activities: In total, we have completed interviews with 174 unique key informants:

Community College ET Programs

- 67 ET A.S. degree students at four community colleges
   Community college student interviews include two rounds of interviews with the six women students interviewed for the study.

- 4 ET A.S. degree faculty and administrators

Industry

- 27 Employers in Tampa Bay area technology and advanced manufacturing businesses

High Schools

- 70 students enrolled in engineering or engineering technology career academies at four high schools
- 7 high school career academy teachers and district administrators in charge of STEM curriculum

These interviews were audio recorded, transcribed, and thematically coded. Coding trees were developed based on a priori and emergent themes (see Attachment 1A). We developed case studies to comprehensively describe the experiences of the community college women (see Attachment 1B) and profiles of industry companies and employers (see Attachment 1C). These analytic methods in qualitative research are well-established protocols for the identification of both emergent and saturated themes in the data. These approaches allow us to better understand both the specifics of particular issues as well as gain a broad understanding of the trajectories ET students experience and processes used by ET employers to recruit and hire workers in this field.

Additionally, we administered short surveys to community college student interviewees in order to learn more about their socio-demographic backgrounds. The questions included their age, marital and caregiving status, education attainment, funding sources of their ET degree, and parental education attainment. We analyzed these data to provide descriptive statistics (see Attachment 1D). Manuscripts in progress based on these analyses can be found in Attachment 2.

Quantitative Data Collection and Analysis:

We worked with the 1997 National Longitudinal Study of Youth data (NLSY97). NLSY97 tracks a cohort of high school students in 1997 through early adulthood by collecting data on their schooling, employment, and personal histories. Our research determines how educational experiences and employment background influence who gets jobs in STEM and Health (STEMH) fields with a focus on technician jobs across

several fields including engineering technicians, life and physical science technicians, and health technicians. The resulting research, "A Longitudinal Analysis of Young Adult Pathways to STEMH Occupations" was presented at the 2015 Annual Meetings of the American Educational Research Association and is currently under review at the *American Educational Research Journal*. This paper is a longitudinal analysis of how demographic characteristics and high school background as well as the timing of life course transitions (i.e. marital status, childbearing) and post-secondary schooling and degree attainment influence the likelihood of entering STEMH technician and professional occupations through young adulthood (Attachment 1F).

Specific Objectives: The specific objective of Year 4 was to continue analyses and publish findings from qualitative and quantitative components of this study.

Significant Results: In interest of space, this section includes findings from qualitative analyses of community college student interviews and quantative analysis of NLSY97 data. Manuscript drafts from both are included in Attachments 4 and 6.

Rebuilding Things, Rebuilding Self: The Transformative Nature of Technician Education

Hands-On Habitus: The Childhood Self

In our analyses of ET student interview transcripts, we identified four profiles of ET students based on their primary motivations and goals for entering the program: (1) learning, (2) credentialing, (3) re-skilling, and (4) empowering as described above. Students do not necessarily belong exclusively in one group; however, this is useful framework for understanding the motivations and goals of students who bring diverse experiences into their programs. The quote from Brian below reflects the theme of transformation that cuts across these profiles and the three emergent themes we uncovered to help us understand how enrollment in these ET programs is a culmination of a lifelong search for educational contexts with the right cultural capital to fit their unique habitus.

"…I've always enjoyed watching engineering shows and stuff and just I've always liked to tinker with things and figure out how they work... as I grew up [enrolling in engineering technology] kind of [made sense to me]… I don't want to have to push buttons or wrench on something just to get a paycheck. I want to do something I enjoy, so that's why I came into engineering." (Brian)

Renowned sociologist Pierre Bourdieu defined habitus as the physical embodiment of cultural capital demonstrated by the habits and skills acquired through life experiences. For these technician education students, this need to design and figure out how things work is a personally felt disposition, something they have always enjoyed. Brian's example of habitus was watching engineering-themed TV shows and tinkering with things. Students described needing hands on activities and opportunities provided by engineering technology courses, even before they knew such educational programs existed. Enrollment in technician education programs is a manifestation of long-held interests and the need to pair informal knowledge of these interests with corresponding credentials.

Tangible Results: Transforming Skills and Desires into Credentials

"I enjoy [the ET program] because it's the aspect of just the creation of things… You get to see something tangible that you designed that is implemented on something…" (Nicholas)

The transition to adulthood did not diminish the childhood desire to build and create. It did, however, lead several students to frustration at the difficulty of finding secondary, higher education, and employment experiences that allowed them to apply skills developed in their childhood informal hands-on play and tinkering. Students describe work and educational experiences in which they felt stifled. For some, such experiences included enrollment in engineering bachelors degree programs at four-year universities. These students drew contrasts between engineering experiences and aspirations and their hands-on experiences in engineering technology. All students also described the specific skills and abilities they have acquired or hope to acquire from the program. Students sought to transform their childhood desires and skills developed in adolescence and adulthood into credentials that would allow them to continue to fulfill their desires in subsequent educational and employment experiences.

Rebuilding Self: Personal Transformation Through Technician Education

Carl was working part-time as an electrician by trade, job he had held for almost 30 years. He had been transitioning into energy efficiency. Carl enrolled in CCET to earn certificates across multiple programs in order to get a "wide variety of what's available." Earning certificates gave him more flexibility than pursuing a degree and the ability reskill in order to stay his own boss in a changing world.

"So if I'm my own boss I have the availability to do multiple things. It opens up more avenues other than just electricity. That's kinda why I stopped doing electricity so much and got into the energy efficiencies such as self-generation, power generation, solar wind, ground sink air conditioning, LED lighting, you know I gotta switch to the future, not dwell on the past." (Carl)

Carl also recycles computers and collected precious metals, including gold, silver, and palladium. He bragged that he was even able to pay for a costly medical procedure using what people threw away. Carl's side job of rebuilding and reusing computer parts reflects his desire to rebuild his life and transform his skills into a stable, secure future.

This feeling of personal transformation beyond the credential was manifest in three ways. First, students reported a specific sense of fulfillment and personal gratification. Second, students believed the program improved their personal and professional communication with others. Finally, technician education improved their life options, not simply their job options.

Community Colleges as a Pathway for Low Income Women to Enter the Engineering Technology Workforce

This chapter presents the analysis of interviews conducted with six women enrolled in engineering technology programs at community colleges. These interviews provide insight into the challenges that women encounter as they pursue engineering technology degrees and the strategies that they use to overcome obstacles and achieve their academic and career goals. The chapter also discusses the policy implications of this research.

Quantitative Analyses Using National Data

A Longitudinal Analysis of Young Adult Pathways to STEMH Occupations

In this study, we determined the educational pathways and key life course transitions of young adults who enter Science, Technology, Engineering, Mathematics, and Health (STEMH) technician and professional jobs using the National Longitudinal Survey of Youth (NLSY) dataset, tracking high school students from 1997 to adulthood in 2009. Using hierarchical linear modeling (HLM), findings underscored gender, ethnic and racial background, high school achievement and career and technical education (CTE) participation, earning high school industry certifications, postsecondary enrollment (2 year and 4 year), and degree attainment as factors contributing to the attainment of STEMH technician and professional careers. In light of the findings, we recommend that strategies to broaden the participation of minorities and women in STEMH fields include strengthening high school career and technical education programs and emphasizing career guidance in high schools to promote career awareness as a means to attract and retain students in STEMH pathways.

Schooling and Occupational Status Attainment: Learning from Longitudinal Data

The purpose of this research study was to explain income obtained in 2011 based on individuals' demographic characteristics, high school curriculum program participation, high school academic achievement, degree attainment, and employment factors. The research design for this study was ex-post facto (causal-comparative) in nature, and was based on a national, random sample of U.S. households. Multiple regression was used to explain income obtained in 2011 based on individuals' demographic characteristics, high school curriculum program participation, high school academic achievement, degree attainment, and employment factors. This study reveals individuals who participated in dual tracks in high school had the most promising long-term labor market outcomes as it relates to earnings potential. To that end, high school reform efforts, such as the implementation of career academies, to integrate core academics and CTE curricula as well as the push for students to be both college and career ready are promising strategies for increasing long-term status attainment.

Key outcomes or Other achievements:

In interest of space, this section includes findings from interviews with high school career academy students and teachers as well as local employers. These findings can be found in a draft report in Attachment 5.

Skills Desired, Skills Developed: Bridging Skills Gaps Between Local Employers and High School Career Academy Students

High School Overview

Analysis of the high school interview data suggests that students taking ET classes in high school enjoy hands-on learning and using technology. Most of these students expect to continue to four year colleges while others expect to work or join the military after high school. The main factors that separate these two groups is that the students aiming to attend four-year colleges are often concurrently completing high-level math and sciences course, receive encouragement to pursue careers in engineering from their families, often have STEM-related experiences in and out of school, as well as receive advice and summer/afterschool/internship opportunities from teachers and other mentors. In particular, curricular and extra-curricular activities (e.g. robotics clubs/camps, industry tours, SolidWorks certification) further motivate high school ET students to continue on to four-year engineering programs rather than entering the ET industry or pursuing two-year ET degrees. We anticipate that students who are more likely to attend the two-year programs are likely to be the ones who have not had the opportunity to take ET classes in high school and participate in related curricular/extra-curricular activities.

Industry Overview

Comprehensive analysis of the industry data found in Attachment 1C contains information about the companies, employers, and primary themes discussed in the interviews. The most prominent finding is that employers rarely include community college education as a primary pathway into ET careers. More often, employers seek workers with solid high school credentials who also have "soft skills" such as loyalty and reliability, and usually use their personal social networks or those of their employees to identify potential hires. Employers are confident they can teach skills necessary to perform the work required on the job if the student has a solid academic foundation and the right attitude. Some employers did indicate a preference for hiring workers with industry certifications rather than just a high school diploma, but did not discuss seeking to hire workers with AA/AS degrees in ET fields. Employers also discussed an interest in hiring veterans but noted veterans have problems in "translating" their military experience to the civilian skill set desired.

Florida manufacturers recommend hands-on internships as part of the education of students in community college engineering technology programs. However, few employers interviewed offer such internships. Most employers who did have interns or who employed students, were providing those opportunities to students whose goal is a bachelor's degree in engineering at a university. Furthermore, while in the internships, some of these university-bound students are actually *doing* the jobs for which the community college students are being trained, thus reducing job and training opportunities for future technicians.

Part A: Bridging Technical Skills Gaps

Three papers compare skills desired by local employers with skills taught by high school career academy teachers and skills developed by career academy students. Employers describe the urgent need for CNC machinists and operators in the Tampa Bay area as well as workers with skills using computer-aided drafting (CAD) and computer-aided manufacturing programs such as Solid Works and Pro/ENGINEER. Teachers describe how their programs are both college prep and career prep, meaning they prepare students for the workforce, two-year colleges, and four-year universities, and steer students toward the pathway they believe best fit the students' needs. Teachers prioritize acquiring equipment such as industry-quality CNC machines in order to provide that preparation. Teachers attempt to conduct classes in a format so students will be prepared to situations they would encounter in industry. Students describe their enjoyment using CNC machines and earning Solid Works certification including the their personal delight at expressing their creativity and the practical benefits.

Part B: Bridging Work Ethic and Problem Solving Skills Gaps

Employers believed academic skills and proficiency in mathematics and science were preferred and technical skills were important. However, the overwhelming majority of employers said what the skills they were really looking for with respect to employee recruitment or retention could be characterized as soft skills, employability skills, or 21st Century skills such as the right personality, attitude, and communication skills. Employers demonstrated a willingness to train workers in order to make up for gaps in technical skill, but few described any in-house training to help workers develop what

they considered to be the right attitude or to aid in their acculturation into the company. Employers used their perception of workers' work ethic and personal responsibility as a primary factor in recruitment and held the workers themselves responsible for fitting into the company and developing the necessary personal skills to do the job.

Teachers describe the specific activities including individual, team, and group projects they use to develop students' problem solving skills. Teachers also describe how the self-directed nature of these activities and the open format of courses encourages student responsibility and builds work ethic. Students describe how they have overcome challenges in their career academy courses and how they adapted to the increased responsibility in career academy courses compared to their traditional courses.

Part C: Bridging Teamwork and Interpersonal Skills Gaps

The majority of employers described teamwork and interpersonal skills as something that was missing among their workers. The key question for employers was "Are they gonna work well with others?" Employers stressed the need for interpersonal skills and a positive personality in order to interact with clients and co-workers alike. This was especially true among employers from small firms and employers hiring for sales jobs that required a technical background. Employers described their workplaces as collaborative spaces in which quality interpersonal interaction is necessary for success.

CAPE students developed interpersonal skills comparable to those identified by employers as crucial to the local technician workplace. Teachers created a collaborative space that valued communication and encouraged helping behaviors. Students described the classroom environment as friendly, cooperative, and congenial, similar to the small, family oriented companies described by employers. High school CAPE programs are also unique in their emphasis on group projects that allow students to learn and practice their technical skills within a collaborative group atmosphere. Students described group projects as self-directed exercises in which students determine their own projects. Students across the four schools described three different methods for determining groups and projects: (1) Teachers picked projects and students were grouped by their mutual interest in the same project; (2) Teachers picked groups and students developed their own project; and (3) Students could pick their own group or work alone and generate a project idea. Each project format emphasized working well with others. Students described their projects and the experience of group collaboration very positively. The only negatives experiences students mentioned involved working with students who were not hard workers.

* What opportunities for training and professional development has the project provided?

Graduate students on the Qualitative Research team were trained in fundamental interview techniques that were used when they conducted interviews in the field. They were also trained in appropriate field data collection methods that include securing data and assuring confidentiality of participants. Both graduate students and post doctoral scholars actively conducted qualitative interviews with participants. They are currently completing the coding of data, preparing data matrices, identifying saturated themes, analyzing emerging findings, and writing up preliminary reports that will used to guide the authorship of scholarly articles. This hands-on active experience in doing research made the process transparent and provided students an important complement to their book knowledge.

The graduate students and post-doctoral scholar also collaborated on presentations at conferences and professional meetings as well. When asked, the graduate students say the aspect of their training they have appreciated the most is learning how to effectively be part of a collaboration and gaining experience in how to think, work, and write together.

Quantitative Investigator, Dr. Eddie Fletcher has been training PI Dr. Tyson on how to use national datasets such as NLSY97. Dr. Fletcher has several years of experience using this data and his experience complements Dr. Tyson's experience working with state administrative datasets.

* How have the results been disseminated to communities of interest? If so, please provide details.

Project team members led by Dr. Tyson participated in local, regional, and national events in order to share project findings and perspectives with a range of stakeholders who would otherwise by unaware of our research.

High schools

- Dr. Tyson has served for three years on the Middleton High School STEM Advisory Board
- Dr. Tyson was the keynote speaker at the Middleton High School 5th Annual STEM Professional Event. The purpose of this event is "to connect Tampa Bay area students, parents, educators and professionals in order to promote student interest in science, technology, engineering and math (STEM) careers."

http://www.eventbrite.com/e/5th-annual-stem-professional-association-event-tickets-13091345567

Community Colleges

- The PathTech project team were regular attendees and presenters at the Florida Forum on Engineering Technology hosted by FLATE (aka ET Forum). The ET Forum is a bi-annual attended by faculty and administrators from community college Engineering Technology programs from around Florida along with vendors and other representatives from local industry.
- Dr. Tyson participated in a webinar titled "Evaluation & Research in the ATE Program" hosted by EvaluATE hosted on December 10, 2014. The audience for this webinar event was ATE Centers and ATE Projects. The webinar can be viewed at: http://youtu.be/QoIZMreQ60I
- Dr. Tyson wrote a blog post titled, "Building Effective Partnerships to Conduct Targeted Research on Student Pathways" aimed at community college faculty and administrators. The blog post can be found here: http://www.evalu-ate.org/blog/tyson-mar15/

Industry

- Dr. Tyson presented at the Fall 2014 FLATE Industry Advisory Council meeting. The FLATE IAC is a tri-annual meeting with representatives from local industry.

Scholarly Presentations

- PathTech team members presented findings at the following annual conferences:
- American Sociological Association
- American Educational Research Association
- Society for Applied Anthropology
- Southern Sociological Society
- PathTech team members also presented findings at a USF colloquium sponsored by the USF STEM Education Research Group of which Dr. Tyson is a member.

Supporting Files

Filename	Description	Uploaded By	Uploaded On

Filename	Description	Uploaded By	Uploaded On
Attachment 1 - Years 1-3 Data Management and Analysis.pdf	Attachment 1 includes completed qualitative data analyses with tables and graphics, letters of agreement to access quantitative course-taking data, paper presentations, and Florida Department of Education data requests compiled from Years 1-3.	William Tyson	11/30/2015
PathTech_ExternalEvaluationReport_Final_8-27-15.pdf	External Evaluation Report from ICF team	William Tyson	12/01/2015
Attachment 2 - Year 3 Conference Presentations (reduced).pdf	Attachment 2 includes PowerPoint Presentations from Year 3 Presentations.	William Tyson	12/01/2015
Attachment 3 - Representative Year 4 Presentations.pdf	Attachment 3 includes PowerPoint Presentations representative of all Year 4 presentations.	William Tyson	12/01/2015

Products

Books

Book Chapters
Chrystal A.S. Smith (2016). Community Colleges as a Pathway for Low Income Women to Enter the Engineering Technology Workforce. *Gender (In)equality: Stalled Revolutions and Shifting Terrains in the 21st Century* Shannon N. Davis Sarah Winslow David J. Maume. University of California Press. Berkley, CA. . Status = OTHER; Acknowledgement of Federal Support = Yes ; Peer Reviewed = No

Inventions

Journals or Juried Conference Papers
Edward C. Fletcher, Jr. Will Tyson (2015). A Longitudinal Analysis of Young Adult Pathways to STEMH Occupations. *American Education Research Journal*. . Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Licenses

Other Conference Presentations / Papers
Will Tyson Edward C. Fletcher, Jr. (2015). *A Longitudinal Analysis of Young Adult Pathways to STEMH Occupations.*. American Educational Research Association. Chicago, IL. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Will Tyson (2015). *Keynote Address*. 5th Annual STEM Professional Event. Middleton High School (Tampa, FL). Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Heppner, Rebekah (2014). *Pathways into High-Tech Manufacturing Careers: Where do Internships in Engineering Technology Really Lead?*. 74th Annual Meeting of the Society for Applied Anthropology,. Albuquerque, New Mexico. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Cox, E. Daniel, Victor Hernandez-Gantes, & Edward Fletcher (2014). *Predictors of career academy enrollment in a local school district.*. American Educational Research Association Annual Meeting. Philadelphia, PA. Status = OTHER; Acknowledgement of Federal Support = Yes

Will Tyson (2015). *Rebuilding Things, Rebuilding Self: Transforming the American Technology Workforce*. Southern Sociological Society. New Orleans, LA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Tyson, Will and Lakshmi Jayaram (2014). *Understanding Engineering Technology Education and Career Pathways through Research and Community Engagement*. 74th Annual Meeting of the Society for Applied Anthropology,. Albuquerque, New Mexico. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Smith, Chrystal A. S. (2014). *Women Forging Ahead in Traditionally Male Dominated Engineering Technology Fields*. 74th Annual Meeting of the Society for Applied Anthropology. Albuquerque, New Mexico. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Tyson, Will, Lakshmi Jayaram, and Margaret Cooper (2013). *"PathTech Update."*. Florida Forum on Engineering Technology: Opportunities with Industry. St. Petersburg College, Clearwater, Florida. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Tyson, Will, Lakshmi Jayaram, Margaret Cooper, David Zeller, and Pangri Mehta. (2013). *"PathTech: Building Partnerships with Community Colleges to Study Pathways to Advanced Technology Degree." (see attached PowerPoint slides)*. 76th Annual Meeting of the Southern Sociological Society. Atlanta, GA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Tyson, Will, Lakshmi Jayaram, Margaret Cooper, David Zeller, and Pangri Mehta (2013). *"PathTech: Building Partnerships with Community Colleges to Study Pathways to Advanced Technology Degrees"*. The STEM Research Group Brown Bag. USF College of Education. Tampa, FL. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Tyson, Will (2012). *"Summary of Educational Patterns in Community Colleges."*. Florida Forum on Engineering Technology. State College of Florida, Venice, FL. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Other Products

Other Publications

Patent Applications

Technologies or Techniques

Thesis/Dissertations

Websites or Other Internet Sites
Supporting Files

Filename	Description	Uploaded By	Uploaded On
Attachment 4 - Quantitative Papers Using NLSY97 Data.pdf	Attachment 4 includes one paper under review and one paper in progress, both utilizing NLSY97 data to understand differences in educational and employment pathways among students who enrolled in high school CTE programs as well as STEM coursework and degree attainment at 2-year colleges.	William Tyson	12/01/2015
Attachment 5 - High School-Industry Skills Gaps.pdf	Attachment 5 includes working drafts of four papers within the Skills Desired, Skills Developed comparing the occupational skills desired by employers to the skills taught by high school career academy teachers and learned by the students.	William Tyson	12/01/2015
Attachment 6 - Personal Transformation among CC Students.pdf	Attachment 6 includes papers on themes of personal transformation from interviews with community college engineering technology students.	William Tyson	12/01/2015

Participants/Organizations

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Tyson, William	PD/PI	8
Boyette, Marie	Co PD/PI	2
Jayaram, Lakshmi	Co PD/PI	0
Cooper, Margaret	Faculty	0
Fletcher, Edward	Faculty	2
Smith, Chrystal	Postdoctoral (scholar, fellow or other postdoctoral position)	0
Heppner, Rebekah	Other Professional	0
DiCicco, Michael	Graduate Student (research assistant)	1
Mehta, Pangri	Graduate Student (research assistant)	4
Zeller, David	Graduate Student (research assistant)	0
Abrahams, Michael	Other	0
Hagelin, Katherine	Other	0

Full details of individuals who have worked on the project:

William T Tyson
Email: wtyson@usf.edu
Most Senior Project Role: PD/PI
Nearest Person Month Worked: 8

Contribution to the Project: Principal Investigator responsible for overseeing all project activity.

Funding Support: N/A

International Collaboration: No
International Travel: No

Marie Boyette
Email: mboyette3@hccfl.edu
Most Senior Project Role: Co PD/PI
Nearest Person Month Worked: 2

Contribution to the Project: Co-Principal Investigator. Led FLATE activities in project. Coordinated communication between FLATE and USF based PathTech research team. Helped the research team identify key informants with whom to conduct interviews including high school teachers and administrators, community college administrators, and employers.

Funding Support: None.

International Collaboration: No
International Travel: No

Lakshmi Jayaram
Email: ljayaram@usf.edu
Most Senior Project Role: Co PD/PI
Nearest Person Month Worked: 0

Contribution to the Project: Former Co-PI and Qualitative Lead Investigator. Lead all qualitative research efforts on the project.

Funding Support: None.

International Collaboration: No
International Travel: No

Margaret Cooper
Email: mcooper5@usf.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 0

Contribution to the Project: Dr. Margaret Cooper is a Post-Doctoral Scholar and adjunct faculty in the Department of Sociology. She has conducted interviews and assisted with their analysis. She is also a member of the literature review team and is contributing to manuscripts on our research findings.

Funding Support: None

International Collaboration: No
International Travel: No

Edward Fletcher
Email: ecfletcher@usf.edu
Most Senior Project Role: Faculty
Nearest Person Month Worked: 2

Contribution to the Project: Dr. Eddie Fletcher is an Assistant Professor in the College of Education in the Department of Adult, Career, and Higher Education. He has an extensive experience in Career and Technical Education and has strong quantitative skills. He works closely with Dr. Tyson on the quantitative component of our research. He also requests FLDOE data and other course-taking data for high school and community college students, analyzes the data, and co-authors manuscripts.

Funding Support: None

International Collaboration: No
International Travel: No

Chrystal Smith
Email: casmith5@usf.edu
Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)
Nearest Person Month Worked: 0

Contribution to the Project: Dr. Smith is an anthropologist with extensive experience in qualitative research. She administers the grant on a daily basis which includes addressing IRB and budget issues and administrating the PathTech Web site, and co-authoring correspondence and reports. She also works closely with Drs. Tyson and Jayaram as they

develop instruments, conduct field work, data analysis, meet with the external evaluators, and produce manuscripts. She also trains graduate students and team members in effective field methods.

Funding Support: None

International Collaboration: No
International Travel: No

Rebekah Heppner
Email: rsheppner@gmail.com
Most Senior Project Role: Other Professional
Nearest Person Month Worked: 0

Contribution to the Project: Dr. Rebekah Heppner is a Qualitative Investigator. She earned her PhD in Anthropology and has an MBA and is a small business owner in the Tampa Bay area. She has an extensive background in local Florida industry. She is leading the industry component of the grant. She assists in the development of interview protocols for ET employees and employers. She also conducts these interviews and assists with their analysis.

Funding Support: None

International Collaboration: No
International Travel: No

Michael DiCicco
Email: mdicicco@usf.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 1

Contribution to the Project: Michael DiCicco is a graduate student in the Department of Secondary Education. He is also a member of the qualitative team that conducted interviews and has assisted in the qualitative data analysis.

Funding Support: None

International Collaboration: No
International Travel: No

Pangri Mehta
Email: pmehta3@mail.usf.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 4

Contribution to the Project: Pangri Mehta is is a graduate student in the Department of Sociology. She is also a member of the qualitative team that conducted interviews, has assisted in the qualitative data analysis. and is contributing to manuscripts on our research findings.

Funding Support: None

International Collaboration: No
International Travel: No

David Zeller
Email: davidzeller@mail.usf.edu
Most Senior Project Role: Graduate Student (research assistant)
Nearest Person Month Worked: 0

Contribution to the Project: David Zeller is a graduate student in the Department of Sociology. He is also a member of the qualitative team that conducted interviews, has assisted in the qualitative data analysis. and is contributing to manuscripts on our research findings.

Funding Support: None

International Collaboration: No
International Travel: No

Michael Abrahams
Email: mabraham@usf.edu
Most Senior Project Role: Other
Nearest Person Month Worked: 0

Contribution to the Project: Michael Abrahams is the Webmaster of the College of Arts & Sciences at University of South Florida. He designed the PathTech Web site and assists Dr. Smith in its administration.

Funding Support: None

International Collaboration: No
International Travel: No

Katherine Hagelin
Email: lpmkate@yahoo.com
Most Senior Project Role: Other
Nearest Person Month Worked: 0

Contribution to the Project: Katherine Hagelin is the project transcriptionist. She transcribes the interview recordings and provides written transcripts to the project team.

Funding Support: None

International Collaboration: No
International Travel: No

What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
Community College Research Center (CCRC) at Teachers College	Academic Institution	New York, NY
Florida Advanced Technological Education Center (FLATE)	Academic Institution	Tampa, FL
Sarasota County Schools	Academic Institution	Sarasota, FL
St. Petersburg College	Academic Institution	Clearwater, FL
State College of Florida	Academic Institution	Venice, FL
Hillsborough Community College	Academic Institution	Tampa, FL
Hillsborough County Public Schools	School or School Systems	Tampa, FL
ICF International	Industrial or Commercial Firms	Fairfax, VA

Name	Type of Partner Organization	Location
National Academy Foundation	Other Nonprofits	New York, NY
National Academy of Engineering	Other Nonprofits	Washington, DC
Pinellas County Schools	School or School Systems	Largo, FL
Polk County Public Schools	School or School Systems	Bartow, FL
Polk State College	Academic Institution	Lakeland, FL

Full details of organizations that have been involved as partners:

Community College Research Center (CCRC) at Teachers College

Organization Type: Academic Institution
Organization Location: New York, NY

Partner's Contribution to the Project:
Collaborative Research

More Detail on Partner and Contribution: Dr. Will Tyson is coordinating with a colleague at the Community College Research Center (CCRC) at Teachers College at Columbia University to combine efforts to analyze state longitudinal data from community college technician education programs outside of Florida. CCRC is the leading independent authority on two-year colleges.

Florida Advanced Technological Education Center (FLATE)

Organization Type: Academic Institution
Organization Location: Tampa, FL

Partner's Contribution to the Project:
Collaborative Research

More Detail on Partner and Contribution: PathTech has established a partnership with FLATE. We collaborate closely with Dr. Marilyn Barger, Executive Director, and Dr. Marie Boyette, Associate Director, on recruiting students, faculty, and administrators for interviews. Drs. Barger and Boyette also facilitates PathTech's contact with local industries and relevant community college data. FLATE has a subcontract with PathTech.

Hillsborough Community College

Organization Type: Academic Institution
Organization Location: Tampa, FL

Partner's Contribution to the Project:
Collaborative Research

More Detail on Partner and Contribution: PathTech has established a partnership with Hillsborough Community College. We collaborate closely with Dr. Alessandro Anzalone, Engineering Technology, Instructor and Program Manager, on recruiting students, faculty, and administrators for interviews.

Hillsborough County Public Schools

Organization Type: School or School Systems
Organization Location: Tampa, FL

Partner's Contribution to the Project:
Collaborative Research

More Detail on Partner and Contribution: PathTech has established a partnership with Hillsborough County Public Schools. With the assistance of the district's ET officials, we are in the process of identifying a high school with an ET career academy that acts as a feeder school for Hillsborough Community College to conduct student interviews and focus groups along with faculty and administrator interviews. We conducted our pilot with Middleton Magnet High School in Hillsborough County. PathTech Principal Investigator, Dr. Will Tyson, serves on the Middleton High School STEM Advisory Board.

ICF International

Organization Type: Industrial or Commercial Firms
Organization Location: Fairfax, VA

Partner's Contribution to the Project:
Collaborative Research
Other: Evaluation

More Detail on Partner and Contribution: Thomas Norwood at ICF International is our external evaluator for program assessment. His team has also collaborated with us on FLDOE quantitative data requests. The Year 2 external evaluation report is attached to Accomplishments section of this annual report.

National Academy Foundation

Organization Type: Other Nonprofits
Organization Location: New York, NY

Partner's Contribution to the Project:
Collaborative Research

More Detail on Partner and Contribution: Dr. Eddie Fletcher is leading efforts to coordinate with representatives from the National Academy Foundation (NAF). The NAF is an acclaimed network of 546 career-themed academies in 39 states with a model based on high standards which provides students - particularly those in large urban settings - with access to industry-specific curricula, work-based learning experiences, and relationships with business and industry. They focus on five career themes – engineering, finance, health sciences, hospitality and tourism, and information technology. The primary objective of this collaborative effort is to analyze longitudinal national, state, and regional student level data collected by NAF from their school sites. Data include student academic performance, student demographic characteristics, and academy assessments. Analyses could include descriptive and inferential data on the recruitment, enrollment, retention, and prospects of students participating in high quality career academies, particularly those students in STEM-related areas.

National Academy of Engineering

Organization Type: Other Nonprofits
Organization Location: Washington, DC

Partner's Contribution to the Project:
Other: Collaboration

More Detail on Partner and Contribution: We are collaborating on workshops and sharing research findings with Greg Pearson, Senior Program Officer for K-12 Engineering Education and Public Understanding of Engineering, National Academy of Engineering.

Pinellas County Schools

Organization Type: School or School Systems
Organization Location: Largo, FL

Partner's Contribution to the Project:
Facilities

More Detail on Partner and Contribution: PathTech has established a partnership with Pinellas County Schools. With the assistance of the district's ET officials, we have identified high schools with STEM career academies. We will conduct student interviews and focus groups along with teacher and administrator interviews.

Polk County Public Schools

Organization Type: School or School Systems
Organization Location: Bartow, FL

Partner's Contribution to the Project:
Facilities

More Detail on Partner and Contribution: PathTech has established a partnership with Polk County Public Schools. With the assistance of the district's ET officials, we are in the process of identifying a high school with an ET career academy that acts as a feeder school for Polk State College. At our initial meeting, high school administrators agreed to participate in our study. However, our research request was denied by district personnel because of the school's heavy testing burden.

Polk State College

Organization Type: Academic Institution
Organization Location: Lakeland, FL

Partner's Contribution to the Project:
Facilities

More Detail on Partner and Contribution: PathTech has established a partnership with Polk State College. We collaborate closely with Dr. Eric A. Roe, Director of Applied Technology, Manufacturing Talent Development Institute (Manufacturing TDI).on recruiting students, faculty, and administrators for interviews. Dr. Roe also facilitates PathTech's contact with local industries and the feeder high schools.

Sarasota County Schools

Organization Type: Academic Institution
Organization Location: Sarasota, FL

Partner's Contribution to the Project:
Facilities

More Detail on Partner and Contribution: PathTech has established a partnership with Sarasota County Schools. With the assistance of the district's ET officials, we are in the process of identifying a high school with an ET career academy that acts as a feeder school for State College of Florida Manatee-Sarasota to conduct student interviews and focus groups along with faculty and administrator interviews.

St. Petersburg College

Organization Type: Academic Institution
Organization Location: Clearwater, FL

Partner's Contribution to the Project:
Facilities

More Detail on Partner and Contribution: PathTech has established a partnership with St. Petersburg College. We collaborate closely with Dr. Bradley E. Jenkins, Associate Dean, Engineering Technology & Building Arts, on recruiting students, faculty, and administrators for interviews. Dr. Jenkins also facilitates PathTech's contact with local industries and the feeder high schools. Dr. Will Tyson, PI has offered assistance to St. Petersburg College research personnel on an NSF S-STEM grant proposal. He also participated in a workshop on Pinellas County STEM career pathways in Summer 2012.

State College of Florida

Organization Type: Academic Institution
Organization Location: Venice, FL

Partner's Contribution to the Project:
Facilities

More Detail on Partner and Contribution: PathTech has established a partnership with State College of Florida. We collaborate closely with Adrienne Gould-Choquette, Program Manager, Engineering Technology, on recruiting students, faculty, and administrators for interviews. Ms. Gould-Choquette also facilitates PathTech's contact with local industries and the feeder high schools.

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?

PathTech research findings impact knowledge about student pathways from high school through community college to industry in the Tampa Bay area. These findings meet NSF ATE's goals of improving the education of students in engineering technology and in addition produce more graduates to meet labor demands.

One of the essential components of the PathTech study has been collaboration between USF and FLATE as well as the other community college, high school, and industry partners. This type of collaboration allows for organic development of research objectives and processes where knowledge is constructed and produced through interface and interaction with those experiencing technician educational and occupational pathways as administrators, teachers, students, employers, and policy makers. Most importantly, such collaborations also allow for real-time sharing of emerging findings and developing knowledge, which allows all collaborative members to benefit from the research.

What is the impact on other disciplines?

In addition to STEM research, our research findings make a significant impact to the disciplines of sociology of education and educational anthropology. These disciplines explore the societal factors that contribute to the students' education and learning experiences. Our research findings elucidate the experiences of community college students in the STEM fields.

As local economies have experienced significant shifts and dramatic changes in recent decades, the movement of jobs and people has grown, and new industries have emerged. Central to these dynamics has been the role of technology, particularly

in production processes. While bodies of literature have examined these phenomena, these studies largely reside within disciplinary boundaries and within the towers of the academy. The PathTech research model utilizes interdisciplinary frameworks and multiple methodologies, with a focus on collecting and analyzing data from various sources and levels, all in shared partnership with schools, industry, and community. This approach provides a bold and innovative way of doing social science research on workforce topics crucial to our society that moves beyond disciplinarity and academia and into classrooms, boardrooms, and policy conversations.

What is the impact on the development of human resources?
Nothing to report.

What is the impact on physical resources that form infrastructure?
Nothing to report.

What is the impact on institutional resources that form infrastructure?
Nothing to report.

What is the impact on information resources that form infrastructure?
Nothing to report.

What is the impact on technology transfer?
Nothing to report.

What is the impact on society beyond science and technology?

Our research findings contribute knowledge about community colleges as a student pathway into engineering technology careers. This makes a positive impact on the employment strategies and decisions made by ET industries seeking qualified technicians from the U.S. labor market.

Social science research has long noted that as individuals transition from school to work they are often simultaneously experiencing other life transitions as well. Furthermore, societal expectations for the degrees and jobs one holds are influenced by factors such as social class, race/ethnicity, gender, geography, and what is considered normative given the specific confluence of such individual characteristics. This space, where one's educational and occupational transitions meet with life course transitions, all shaped in many ways by social and cultural forces, is the area of inquiry that can be broadly understood as "pathways" research. This type of work is especially important in the contemporary moment, as fewer and fewer students experience a linear progression from school to work; rather, it is a winding road characterized by fluid movement between school and work as "re-skilling" has become often necessary to survive the current economy and its demands for a highly skilled technological workforce.

Technician education, preparing students for entry into jobs across industries, is especially important for individuals who are not part of the service or knowledge economy, or in other words, those who are not pursuing graduate degrees or manual labor fee-for-service jobs. Occupations as technicians can provide a family wage, secure stable employment with opportunities for promotion, and a genuine possibility for accomplishing important social milestones and achieving middleclass status. Studies that consider one dimension, such as the educational training students receive, or the experiences on the job, or work-life balance, cannot fully examine the intersections between school, work, family, the economy, and the life course, or the ways that individuals are nested in each of these spheres. It is this type of holistic examination that we call "pathways" research and that reveals both the complexities and subtleties of becoming educated, getting and keeping a job, providing for families, all while growing and maturing as individuals in a dynamic and evolving global economy. Better understanding the confluence of these many social forces will allow us to improve the life chances and well-being of individuals in our societies, make progress as an educated and skilled nation, and contribute to positive change related to policies supporting education and employment.

Changes/Problems

Changes in approach and reason for change

We did not conducting qualitative data collection from high schools or district high school administrators in Polk County. The Principal and ET instructor at Bartow High School agree to participate in our study, but district officials from Polk County rejected our request to conduct the research because of testing and other activities at the school. Consequently, we decided to move forward on completing the analysis of our high school data that we had collected at four high schools which met the goals established in the proposal.

After data collection was completed, qualitative team members, Michael DiCiccio, Rebekah Heppner, and Margaret Cooper stepped down from the project. Their primary responsibilities were conducting project interviews. Co-PI and Qualitative Lead Investigator Lakshmi Jayaram stepped down from the project at the end of Year 3.

Quantitative analyses using Florida Department of Education PK-20 Education Data Warehouse data was limited to descriptive statistics of post-secondary destinations of high school career academy students. EDW did not include race data therefore data was insufficient for publication and further analysis. EDW did not respond to additional formal data requests; therefore, we stopped attempting to use FLDOE administrative data. We established a partnership with the National Academy Foundation (NAF) that included a data-sharing agreement that ended when a third-party vendor in charge of data went out of business.

Actual or Anticipated problems or delays and actions or plans to resolve them

Qualitative analyses have yielded more potential manuscripts than anticipated. Drs. Tyson and Fletcher will continue to work on publications utilizing project interviews after the end of the project.

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

Responses to any special reporting requirements specified in the award terms and conditions, as well as any award specific reporting requirements.
Nothing to report.