# PROJECT SUMMARY

## Overview:

A poll conducted by Gallup for the Business-Higher Education Forum reports that by 2021, 69% of employers expect candidates with Data Science and Analytics skills to get preference for jobs in their organizations, yet only 23% of college and university leaders say their graduates will have those skills. The Data Science Technician is predicted to be one of the fastest growing jobs in 2030, as employers embrace velocity, volume, value, variety and veracity of Big Data that inundates businesses. Florida State College at Jacksonville (FSCJ) proposes Data Science Technician Education & Careers (DataTEC) to develop educational and career pathways to prepare Florida students for an array of data science roles, particularly in entry and middle-skill Data Science jobs. In partnership with Florida Workforce Development Board, CareerSource Northeast FL, the Florida Department of Education, and several industry partners, DataTEC will: 1) Develop the state's first A.S. degree in Data Science Technology with two embedded technical certificates containing industry-recognized credentials, 2) Increase nontraditional and underrepresented students' access to the program by updating coursework for full online delivery, and 3) Provide Data Science professional development for college faculty for replication at other institutions.

## Intellectual Merit:

While Florida has bachelor and graduate degree programs covering data science, informatics, and business analytics, DataTEC fills the growing void for Data Science skills training at the two-year associate's degree and technical certificate levels. DataTEC will create the first Data Science technical certificate in Florida, and will enroll 100 undergraduate students who will have the opportunity to receive up to six industry-recognized certifications and two college credit certifications in Data Science as they move towards completing their A.S. degree. DataTEC courses will advance students' knowledge and competencies in core foundational Data Science skills including statistical software; data management and analysis; and data visualization. A total of sixty (60) college faculty will participate in 40 hours of faculty development in Data Science. The PI team will measure the impact of the DataTEC courses on student learning as well as determine its effectiveness in meeting industry partners' needs for qualified Data Science technicians. The FSCJ Works initiative will engage the project's Business and Industry Leadership team to support DataTEC sustainability and institutionalization efforts.

## Broader Impacts:

Through the assessment of workforce needs, the DataTEC project design has benefited from intensive input from its partner employers on the growing shortage of skilled Data Science Technicians. To address the region's current and future Data Science workforce needs, DataTEC will advance the knowledge base related to technician education and enhance the state's educational infrastructure by establishing a new A.S. Data Science Technology framework. Once approved by FLDOE, the training program can be accessed by all 28 institutions in the Florida College System. The project team will develop online formats and resources for each course to expand access for students and provide distance learning options for rural technician education. DataTEC will recruit nontraditional student populations who often work full-time while attending the institution and underrepresented students including veterans, women, students of color, and individuals from lower socioeconomic backgrounds. Project activities will include a series of professional development workshops and resources to help promote faculty discovery and understanding related to Data Science in addition to training on broadening participation through unconscious bias, equity vs. equality, and stereotype threat. All project information and best practices will be disseminated through the NSF Center for Convergence Technology and their established national network of 67 institutions across the nation. DataTEC deliverables, products and evaluation results will help advance Data Science program development at primarily undergraduate and teaching-focused institutions.

# PROJECT DESCRIPTION
## *Data Science Technician Education & Careers (DataTEC)*
## RESULTS FROM PRIOR NSF SUPPORT

Florida State College at Jacksonville (FSCJ) has successfully administered 14 NSF awards totaling $6,021,205 over the past 12 years directly impacting over 1,500 college and high school students including a large percentage of students from underrepresented

*Figure 1 FSCJ's Location*

populations. These NSF funded opportunities have resulted in advanced IT professional development for approximately 250 college faculty and high school teachers. Our track record of success illustrates the College's enthusiasm, passion, and commitment to improving STEM education and changing the economic trajectory for nontraditional and underserved college and high school students. Two **S-STEM** grants awarded 122 scholarships (#0630880) and 79 scholarships (#0965756), respectively. Proposed *DataTEC* Co-PI Ernie Friend served as PI along with Dr. Ladonna Morris on the **NSF ITEST Tri-Regional Information Technology program (#0833628; 10/01/2008 to 9/30/2012; $1.5M).**
<u>Intellectual Merit</u>: The Tri-IT program provided after school technology experiences for African American and low-income girls within three Florida counties. Findings revealed that girls gained both knowledge and confidence in their IT competency. An analysis of the TechLiteracy survey revealed that girls in the treatment group had greater gains in technology skills than girls in the control group. Differences were statistically significant. The number of girls who enrolled in upper level STEM courses increased. There were more girls showing interest in IT careers that involved web design, graphics and animation than in other STEM careers like scientist, engineer, or computer programmer. <u>Broader Impact</u>: There were 360 African American and low-income girls in the Tri-IT program. The program created 16 IT curricula modules that are being used across Florida. Major publications include: Morris, L.K., Austin, L. J., & Davis, A. M. Sparking Girls' Interest in Technology: The NSF Tri-IT Project submitted and approved for publication in 2012 in the *National Social Science Technology Journal*. John Vail and Ernie Friend served as PIs on the Network Virtualization, *iNoVATE*, **project (#1104234; 10/1/2011-9/30/2015; $860,989**). *iNoVATE* was designed to create a network virtualization technical certificate. <u>Intellectual Merit:</u> *iNoVATE* created an innovative curriculum development and training program for undergraduate and high school students majoring in emerging technology fields. The project was a collaborative effort between FSCJ, four community state colleges in Florida, the National Center for Convergence Technology, the Florida Department of Education, and industry professionals with virtualization expertise. The *iNoVATE* program created online curricula modules for ten courses that aligned with industry network virtualization standards. The project provided a hybrid learning environment via NETLAB+; enabling college and high school students remote access to curricula modules and labs to substantiate learning experiences particularly for students attending rural community colleges. Course content included instruction in computer literacy; software application support; basic hardware configuration and troubleshooting; networking technologies, troubleshooting, security, and administration; and customer service and human relations skills. <u>Broader Impacts</u>: There were 474 college students who received Network Virtualization certifications. There were increases in underrepresented high school students' (n=96) interests in studying computer science or IT in college. The change was statistically significant. These same high school students' computer literacy scores increased. The increase was statistically significant. Over 100 community college faculty completed professional development in network virtualization. The project received the 2015 Florida College System Chancellor's Best Practice award. John Vail, Ernie Friend, Leon Portelli and Keith Whitehead served as PI and Co-PIs for the *iNoVATE-X* **project (#501359; 10/1/2015-9/30/2019; $819,979).** *iNoVATE-X* was designed to build on the successful *iNoVATE* project. <u>Intellectual Merit:</u> The *iNoVATE-X* project developed curriculum for the Network Enterprise Administration college credit certificate framework to improve accessibility of rural and underserved counties in Florida to technician education. Certification courses were created as a solution to provide students and industry workers with networking and

problem-solving skills necessary to run a modern data center, with expertise in identity management, systems management, virtualization, storage, and networking. <u>Broader Impacts</u>: *iNoVATE-X* was designed to increase student's knowledge, skills and abilities to install, configure, administer and maintain a server using Microsoft Server 2012. The outcomes are showing a positive societal and economic impact particularly for underrepresented populations. There were 178 college students enrolled in the *iNoVATE-X* Server Configuration (CTS 1334) course as of summer 2018. Approximately 22% were African American/Black, 6% were Asian. Approximately 41% of the students were between the age of 21-30, 32% between the age of 31-40, 16% between the age of 41-50, Sixteen percent of participants were women. In a longitudinal study to measure the impact of *iNoVATE-X* courses on college students' problem-solving abilities, students were asked to respond to the Problem-Solving Inventory survey. An analysis of data shows pre-post increases in students' confidence, approach, and personal control. This finding revealed that students' problem-solving confidence increased and that they perceived exerting more personal control while engaged in problem solving especially when they encountered challenging problems. Pre-post responses from 24 high school students in a computer-based summer camp, revealed increases. On the pre-survey, 33% percent of students responded "strongly agree" to the question asking whether they felt prepared to install a Windows Server System, while on the post survey, 53% responded "strongly agree" to this same question. *iNoVATE-X* has also impacted three rural colleges, College of Central Florida, Florida Keys Community College and Pensacola State College. Through training provided to rural college IT instructors, students have access to the network server configuration curricula modules. Job placement data on the first cohort to complete the Network Enterprise Administration certificate will be available in one more year after these students complete the program. The program's website is https://www.fscj.edu/academics/workforce-education/grant-programs/inovate.

## INTRODUCTION

A recent report by Dell Technologies and the Institute for the Future (2017) revealed that 85% of jobs that will exist in 2030 have not been invented yet, as the landscape of organizations dramatically shifts with emerging technologies and human-machine partnerships. These workforce innovations are transforming the way companies do business. Jobs at all levels are now requiring employees to possess digital literacy, the ability to interpret, create, and strategically use digital information. The Data Scientist occupation that was identified in the past decade (Davenport & Patil, 2012) with educational requirements of STEM *graduate level education* has now evolved due to industry growth – employers are no longer focused on the top high-skill Data Scientist "specialist" positions, but now seek generalists with a Data Science technician role serving as an integral part of a business' IT team (Oceans of Data, 2016). The **Data Science technician** will likely be one of the fastest growing jobs in 2030, as employers embrace velocity, volume, value, variety and veracity of **Big Data** that inundates a business on a day-to-day basis. A pol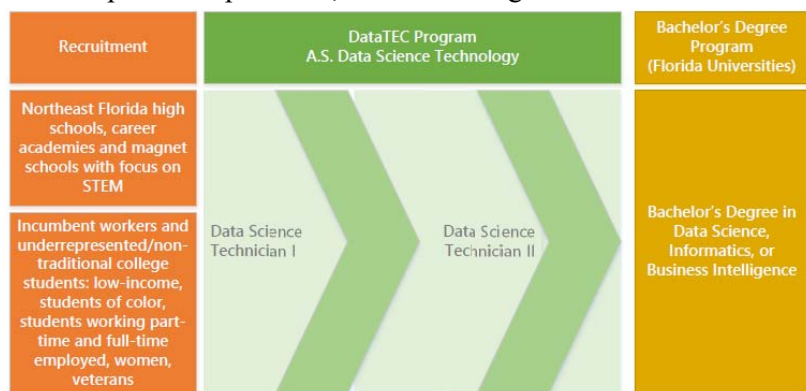l conducted by Gallup (2017) for the Business-Higher Education Forum reported that by 2021, *69% of employers expect candidates with Data Science and Analytics skills to get preference for jobs in their organizations, yet only 23% of college and university leaders say their graduates will have those skills*. Recent studies (National Academies, 2018b) found that even though Data Science academic programs are being developed and offered in bachelor's, master's, and doctoral levels, **graduates will still need to come from community colleges in order to fill the pipeline of data talent.** With growth in *finance, health care, insurance, logistics and supply chain sectors*, the Northeast


*Figure 2 DataTEC Project Design*

Florida **"data heavy" region has yet to address this workforce need that joins these economy building lifelines as it relates to Big Data** (Robinson, 2018). The demand for fundamental skills using cutting-edge analytics involving artificial intelligence and machine learning have outpaced supply. **Major employers like those serving on FSCJ's IT Industry Advisory Board (Figure 3) have recently recommended to Florida State College at Jacksonville (FSCJ) to create a new 2-year program and complementary technical certificates that will develop the skillset of college students in preparation for entry level positions as Data Science Technicians.** FSCJ's IT Industry Advisory Board includes representatives from Florida Blue, the largest and oldest health plan insurer in the state of Florida; CSX, a leading supplier of rail-based freight transportation in North America headquartered in Jacksonville; and Bank of America, with regional headquarters in Jacksonville employing over 8,000. *The Advisory Board has said that hiring Data Science Technicians and Analysts has been tough since new hires lack applied practice with industry-used data management tools and programming.* But there is currently **no local or regional state-approved associate's degree or short-term technical certificate program in Data Science.**

> *Figure 3.* **FSCJ IT Advisory Board Members**
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> ***Florida Blue**, **CSX**, **Bank of America,*** *CareerSource Northeast Florida , Locked.com, Converged Communications, Teksystems, ABS Associates, CirrusUp, Business Technology Group, Inc., Corporate One Federal Credit Union, Enterprise Integration, Agile Thought, Citizens Property Insurance, Secure Data Consortium, Beeline.com*

To meet this need, FSCJ proposes **Data Science Technician Education & Careers *(DataTEC)*** to develop coursework with resulting educational and career pathways to prepare Florida students for an array of roles, particularly in entry and middle-level Data Science jobs. In partnership with CareerSource Northeast Florida, the Florida Department of Education – Florida College System, and industry professionals with Data Science subject matter expertise, *DataTEC* will: **1) Develop Florida's first A.S. degree in Data Science Technology with two embedded technical certificates containing industry-recognized credentials, 2) Increase nontraditional and underrepresented students' access to the program by updating coursework for full online delivery, and 3) Provide Data Science professional development to college faculty for replication at other institutions.** The project will meet increased industry demand, preparing individuals for positions in a variety of industries including finance, health care, insurance, logistics and supply chain, while also contributing to the diversity of the Northeast Florida workforce by offering **affordable and accessible curriculum** for those who lack representation in the Data Science field. *DataTEC* will help these students begin on an academic pathway towards a lifetime career within this high-growth STEM field (Figure 2). *DataTEC* includes undergraduate curricula and sequence development for a 60-credit A.S. Data Science Technology program. One hundred (100) undergraduate students will have opportunities to receive up to six industry-recognized certifications and two college credit certificates (Data Science I/II) as they move towards completing their A.S. degree. Through the program, faculty will teach key knowledge and skills found on the following industry certification exams: CompTIA Security +, CompTIA Network +, Java Programmer I, Microsoft Office Specialist Excel Expert, LPI Linux Essentials and SAS Certified Base Programmer. A total of sixty (60) college faculty will individually participate in 40 hours of professional development in Data Science.

*DataTEC's* industry partners – including leading IT staffing firms **Modis, Robert Half Technologies, and Matrix, in addition to international logistics company Crowley Maritime** – and the Jacksonville IT Council (JITC), which represents over 100 local companies including cross-sector employers such as **Citi, TIAA Bank, Black Knight, Landstar, and CSX**, were involved in the project design and have agreed to assist with curricular modifications, recruit students to the program, and hire graduates for entry and mid-level Data Science positions. The project contributes directly to the central ATE goal to produce more qualified science and engineering technicians to meet 21st century emerging workforce demands. It also aligns with the NSF-funded study by the National Academies of Science "Data Science for Undergraduates: Opportunities and Options" May 2018 report by: 1) offering certificates at the two-year level, 2) sharing educational resources supporting undergraduate science

experience, 3) creating educational opportunities to expose faculty to the breadth of the field; and 4) creating a forum for dialogue across institutions on all aspects of Data Science education, training, and workforce development. *DataTEC* also addresses the study's findings by creating an undergraduate experience catering to and promoting diversity in the students it serves (National Academies, 2018a).

**Intellectual Merit:** While the Florida State University System has *bachelor and graduate degree programs* covering Data Science, Informatics, and Business Analytics, *DataTEC* fills the growing void for Data Science skills training at the *two-year associates and technical certificate levels*. The team will meet the following project goals: 1) Develop Florida's first A.S. Data Science Technology degree with two embedded technical certificates containing industry-recognized credentials, 2) Increase nontraditional and underrepresented students' access to the program by updating A.S. Data Science coursework for full online delivery, and 3) Provide Data Science professional development for college faculty for replication at other institutions. The project will provide professional development to 60 college faculty members throughout the state of Florida and 100 students will enroll into the new A.S. Data Science courses at FSCJ, producing qualified Data Science technicians to meet workforce demands and preparing teachers.

**Broader Impacts:** *DataTEC* will advance the knowledge base related to technician education and enhance the state's educational infrastructure by establishing a new A.S. Data Science Technology framework. Once approved by the Florida Department of Education, the degree program can be accessed by all 28 institutions in the Florida College System. The project team will develop online formats and resources for each developed course to expand access for students and provide distance learning options for rural technician education. *DataTEC* will seek to recruit nontraditional student populations who often work full-time while attending the institution, in addition to underrepresented students including veterans, women, students of color, and individuals from low socioeconomic backgrounds. Project activities will include a series of professional development workshops and resources to help promote faculty discovery and understanding related to Data Science in addition to training on broadening participation through unconscious bias, equity vs. equality, stereotype threat, and culturally relevant curriculum. All project information and best practices will be broadly disseminated through the NSF Center for Convergence Technology and their established national network of 67 institutions across the nation. While there are significant programs in Data Science under development at research-oriented institutions of higher education, progress in program development at primarily undergraduate, teaching-focused, and minority-serving institutions is lagging in the national conversation (Rawlings-Goss, 2017). It is imperative that state and community colleges implement academic programs to ensure that those underrepresented and nontraditional students who have diverse life experiences are represented in and served by the future of Data Science education through affordable and accessible educational offerings.

## PROJECT'S MOTIVATING RATIONALE

*DataTEC* **will address the widening skills gap resulting from the Fourth Industrial Revolution, Industry 4.0, which is disrupting almost every industry in the country.** Big Data is the "new electricity" -- the power source of driving change, in the way that steam revolutionized energy, digital technology is expanding the capability of Big Data (Matthews, 2017). Companies are currently facing growing shortages of talent as Data Science becomes an integral part of many industries. NSF and the National Academies of Science research (National Academies, 2018b) indicates the demand to manage, analyze, and extract knowledge from data will create more nuanced Data Science roles, requiring workers to possess beginning and intermediate levels of skills like those identified in Table 1.

| Table 1. Core Foundational Data Science Skills |
|---|
| *Business Intelligence & Analytics:* data warehousing, data transmission & modeling, data architecture |
| *Statistical Software:* proficiency in statistical software such as SAS, R, SPSS; use of statistical methods |
| *Data Management and Analysis:* collecting, cleaning, and synthesizing data from different sources |
| *Cloud Computing:* use and apply cloud computing techniques and tools to manage and analyze big data |
| *Open Source Technologies:* proficiency in technology and navigating typical challenges (reliability, efficiency) with technologies such as, Python, R (statistical programming), Apache (cloud computing) |
| *Data Visualization:* communicating results of data analysis through tools like Tableau, Power BI |

| *Machine Learning*: Data mining, text mining, predictive analytics |
| --- |

**According to EMSI's Job Analyst (2018), the Computer and Information Research Scientist field will grow 69% within 2017-2025 in Northeast Florida.** The urgent need for basic Data Science skills goes beyond the Northeast Florida region: In 2016, there were over 60,000 job posting across the state that mentioned data analytics (FL Chamber of Commerce, 2017). The Florida Department of Economic Opportunity identifies the Computer Systems Analyst occupation as the 16th fastest growing occupation in the state (2018). Just as these related occupations grow statewide, the Jacksonville IT Council (JITC) told the *DataTEC* team the Northeast Florida **"region is scrambling"** to 1) hire new graduates with **Data Science core foundation knowledge and 2) upskill current employees on Data Science abilities.** Mike Russo, JITC President stated **"*We need our local institutions of higher education to develop students' data acumen including foundations in mathematics computations and statistics, while using specialized skills with statistical software, open source technologies, data management and data visualization tools."* Although the College recently developed Data Science coursework to embed into the existing A.S. Computer Information Technology degree as an elective where students take up to three Data Science-themed courses**, FSCJ's IT Advisory Council (Figure 3) and JITC are both requesting a complete program for Data Science that is substantive in providing a core foundation of industry skill instruction and application. Oceans of Data Institute (2016) found that a **Data Science Technician or "practitioner"** requires the teaching of multiple skills in different learning contexts, as well as a good blend of theory and work-related training. Müller and Ferreira (2003) state that vocational training colleges and industry are confronted with the need to develop and integrate theoretical and practical learning sequences to fulfill the demands for multi-skilled technicians and skilled workers. Hands-on Data Science training coupled with an introduction to mathematics, computation, or statistical concepts that undergird Data Science systems provides students with high quality experiential and collaborative learning opportunities. This aligns with the constructivist paradigm, where students are immersed in learning situations to engage in concrete experiences in an environment that mimics the workplace.

Composed of industry experts, JITC and the FSCJ IT Advisory Board are both requesting workers with entry and mid-level skills identified in Table 2 that directly aligns with the Oceans of Data Institute's "Profile of the Data Practitioner" (2016). The *DataTEC* program will provide stackable technical certificates with industry-recognized credentials critical to develop these skills. Training will be flexible for four types of students: 1) those who need to gain fundamental introductions to Data Science tools, 2) those seeking employment immediately after an associate's degree, 3) students seeking to transfer to a four-year institution with a bachelor's level Data Science program, and 4) students seeking a certificate program for professional development. Students graduating from the newly design program with complementary technical certificates will: Apply knowledge of data-intensive processes to address problems in a specific application context; Effectively communicate data related analysis to both technical and nontechnical audiences; Apply concepts of data integrity and reliability to analysis; Demonstrate proficiency in tools and techniques for data collection, management, and analysis; Solve real world problems using a variety of tools and technologies; and Apply programming skills to manage data and carry out analysis.

| Table 2. Data Science Skills, Knowledge, Tools from Oceans of Data "Profile of the Data Practitioner" (Oceans of Data Institute, 2016) Integrated into *DataTEC* Curriculum | | |
| --- | --- | --- |
| **Skills in:** | **Knowledge of:** | **Proficiency in Equipment/Tools Such As:** |
| Analytical and Critical Thinking | Business Acumen | Data/Database Tools (e.g., Excel, Access, SQL Server, Oracle) |
| Applying Statistical Methods | Computer Modeling | Data Mining Tools (e.g., Microsoft SQL Server Data Tools including SSRS, SSAS, SSIS, SSIS, numpy, scipy, tidytext) |
| Basic Security | Data Modeling | |
| Chart/Visualizations | Databases | |
| Coding Languages: R, Python, Java, JavaScript | Data Discovery Data Lifecycle Management | |

| Data Entry | Data Quality | Data Analytics and Visualization |
|---|---|---|
| Data Manipulation | Data Stewardship | Software (e.g., Tableau, Power Bi, |
| Documentation | Data Structures | Teradata, Presto) |
| Extract, Transform, Load | Ethics | Languages: R, Python, Java, |
| (ETL) | RDBMS Database | Statistics Packages (e.g., SPSS, R, SAS, |
| Operating Systems | Systems (SQL Server, | SASJMP) |
| Statistics - Descriptive and | Oracle, MY SQL, NoSQL) | File system processing/distributed |
| Inferential | Research Methods | computing (Hadoop, Hive, Pig, Spark) |

## GOALS, OBJECTIVES, AND ACTIVITIES

Goal 1: Implement and disseminate curriculum for new A.S. Data Science Technology program with embedded Technical Certificates.

- Objective 1.1 Develop new curriculum frameworks and provide course sequencing in year 1.
- Objective 1.2 Work closely with the Florida Department of Education and the Florida College System to notify the college system of updated frameworks through the Chancellor's Office. A.S. program proposal submitted to Florida DOE for updated statewide frameworks by end of year 1.
- Objective 1.3 Create a state-approved A.S. Data Science program by end of year 2.
- Objective 1.4 Develop curriculum proposal submission for FSCJ Curriculum Committee recommendation and the regional accreditation organization, Southern Association of Colleges and Schools Commission of Colleges (SACSCOC) prospectus, and FSCJ Provost approval by end of yr 2.
- Objective 1.5 Utilizing practices from current and former NSF Data Science projects, develop underrepresented student recruitment plan and deploy efforts by end of year 1.
- Objective 1.6 By end of project period, increase enrollment of underrepresented populations by 5% including nontraditional students and those underrepresented including women, veterans, and students of color to create a diverse Data Science Technician workforce.
- Objective 1.7 Enroll 100 FSCJ undergraduates into Data Science program by end of project period.

The PI team, David Singletary, Pamela Brauda, and Ernie Friend, will lead a Content Development Team (CDT) to create two new courses (Java Programmer 1 and Data Visualization) and sequence 13 existing courses (including the recently developed Data Science track in the A.S. Computer Information Technology) to develop the A.S. Data Science Technology program (Table 3). The overall frameworks for the proposed Data Science courses have not been established at the state level; the curriculum must be adapted for statewide dissemination. Content developed will focus on introductions to statistical programming, data warehousing, data visualization, and data analytics. All courses will contain opportunities to analyze sample datasets with an emphasis on industry-used tools and skills such as file system processing/distributed computing with Hadoop; database tools (e.g., Excel, SQL Oracle); data visualization software (e.g. Javascript, PowerBI, and Tableau); statistics packages (e.g. SPSS, SAS) and programming languages (e.g.R, Python, Java) required of Data Science professionals. Assessments and activities will be embedded in the curricular modifications. The CDT team will include other IT and statistics faculty members and industry professionals who will assist with course development. The CDT team will construct assessments, performance-based rubrics, quizzes, and tests, so that faculty can track changes in students' knowledge and skills over time. The A.S. Data Science Technology program coursework (Table 3) will be structured with two technical certificates so they may be taken as a standalone certificate or lead towards the A.S. Data Science Technology program. This flexibility means that the courses can be accessed by first-time students, returning students, as well as workers wishing to acquire new skills. After receiving the core Data Science fundamentals offered through *DataTEC*, students can move through the career pathway and enter the workforce or continue the academic pathway onto a baccalaureate Data Science degree at a Florida university. The CDT team will work on incorporating skills to prepare students to earn up to six industry-recognized certifications such as CompTIA Security +, CompTIA Network +, Java Programmer I, Microsoft Office Specialist Excel Expert, LPI Linux Essentials, and SAS Certified Base Programmer having faculty teach key knowledge and skills that are found on these industry certification exams. The FSCJ IT Advisory Board will help

augment the BILT and will facilitate an annual job skills analysis for the region whereby specific skills desired by employers will be identified.

During the first year of the project, the Data Science curriculum framework package will be approved by the CDT team and then submitted to the Florida Department of Education (FLDOE), Division of Adult Education, for approval. Dr. Carrie Henderson, Executive Vice Chancellor, Florida College System, has pledged technical assistance during the curriculum development and state certification application process (see attached letter of commitment).

| Table 3. *DataTEC* Program Course Topics/Learning Outcomes |
|---|
| *Data Science Technician Certificate I – Completed within Semesters 1-3 of A.S. Degree* |
| Intro to Information Technology (3): Demonstrate understanding of history of computer, basic components of computers, information systems. Demonstrate proficiency in application software. |
| Operating Systems Foundations (3): Demonstrate proficiency in the basics of working with and supporting non-Microsoft operating systems within a network and Internet environment; proficiency in installation, desktop environments, Internet applications, file systems, security, applying updates and network/Internet connectivity. |
| Intro to Programming (3): Utilize basic computer science vocabulary and topics such as algorithm design, user interfaces, data validation techniques, integrated development environments (IDEs); programming debugging and testing, use of application programmer interfaces (APIs), and an introduction to object-oriented programming; Demonstrate algorithm design using structured flow charting and pseudo-coding techniques. |
| Computer Networks and Telecommunications (**Cert Prep for CompTIA Net +)** (3): Demonstrate how to configure, maintain, analyze, and troubleshoot networks using appropriate tools, and to make recommendations based on those actions; Articulate fundamental concepts of network security, virtualization, and cloud computing. |
| Intro to Security **(Cert Prep for CompTIA Security +)** (3): Understand general security concepts, including communication security, infrastructure security, cryptography, and operation and organizational security; Implement computer security policies in a network environment. |
| Intro to SQL (3): Use MS SQL Server software for database application projects; Demonstrate familiarity w/ E-R database modeling, database creation, database maintenance & optimization; Demonstrate proficiency in database architectures-client/server model & distributed database model. |
| **New Course to Be Developed: Java Programming (Cert Prep for Oracle Java Programmer 1)** (3): Demonstrate proficiency in programming with principles and practices of objected oriented (OO) programming. Utilize user interface and problem data classes; class versus instance properties and methods; abstraction; encapsulation, inheritance and multiple inheritance; polymorphism; software design techniques; and problem solving. |
| Intro to SAS **(Cert Prep for SAS Programmer)** (3): Install virtual machine player and SAS University Edition software; Create and process SAS programs; Access data in SAS data sets and SAS Libraries; Read data from SAS data sets, spreadsheet data, and raw data; Combine data sets; Use SAS Visual Analytics to design and create reports; Use conditional logic in SAS programs. |
| *Data Science Technician Certificate II – Completed within Semesters 4 and 5 of A.S. Degree* |
| Web Technologies (3): Demonstrate working knowledge of Extensible Hypertext Markup Language (XHTML) programming for web page and website development; Apply XHTML basics; embedded graphics, animation, and sound; hypertext linking; navigation buttons; tables; data entry forms; frame pages; image maps; embedded code; Cascading Style Sheets; advanced XHTML features; JavaScript; Web page and website design; and documentation. |
| Spreadsheet Concepts and Practices (3): Use advanced functionality of Microsoft Excel for data analysis and visualization skills; Manage large volumes of data through the use of Tables; Explain specific mathematical and statistical functions; Devise formulas utilizing relative, absolute and mixed cell references in formulas. |

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Programming in Python (3): Implement programming concepts in Python such as data types, decision and control structures, functions lists, tuples, dictionaries, and File I/O; Use of Python in an object-oriented context; Implement programs which access a SQL database, incorporate graphical user interfaces, and design Python scripts which interact with a host operating system.

Data Warehousing (3): Demonstrate proficiency in OL TP (Online Transaction Processing) design concepts and principals; Demonstrate proficiency in OLAP (Online Analytical Processing) design concepts and principals; Design an OLAP database using dimensional modeling techniques; Create an ETL (Extract/Transfer/Load) process to populate and update the data warehouse from OL TP database utilizing SQL Server Integration (SSIS). Create reports, dashboards and methods for visualizing data.

**New Course to be Developed: Data Visualization (3):** Become familiar with core data visualization approaches and tools such as JavaScript, PowerBi, and Tableau; Use explanatory data visualization and exploratory visualization tools and software to interpret data analysis results.

Intro to Statistical Programming with R (3): Demonstrate examples of statistical programming concepts; Describe data types and structures used by the R programming language and implement an R program which uses R data types and structures; Describe the common mathematical and statistical functions used in R and implement programs which use those functions, including functions related to probability, correlation, linear regression, and confidence intervals; Demonstrate process of hypothesis testing using R and implement a program which demonstrates hypothesis testing.

Big Data w/Hadoop (3): Learn concepts of the Hadoop Distributed File System and MapReduce; Identify problems that Hadoop is useful for solving; Demonstrate core Hadoop technologies and the Hadoop ecosystem; Develop MapReduce applications; Learn common MapReduce algorithms; Use Hive and Pig for rapid application development.

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Goal 2: Increase access to nontraditional and underrepresented students by modifying courses and associated labs within A.S. Data Science degree for full online delivery.

- Objective 2.1 Modify existing curriculum using feedback from BILT and previous ATE projects focused on by end of year 1.
- Objective 2.2 Utilizing online development expertise with FSCJ's Center for eLearning (CeL), develop two Canvas course shells each year, for a total of six online courses by the end of the project period.
- Objective 2.3 Launch modified courses by end of year three with full online delivery.

The CDT team, led by the *DataTEC* PIs, will collaborate with the College's Center for eLearning to promote Data Science training that is accessible and affordable broadening participation through online delivery. The six courses that will need to be converted for online delivery include the following: **Introduction to Statistical Programming with R; Introduction to Big Data Using Hadoop; Programming in Python; Data Warehousing; Intro to SAS Programming; and Data Visualization.** Once these are online, the entire A.S. Data Science Technology program will be 100% accessible for online delivery. The CeL supports faculty teaching online and assists in designing and developing fully online programs and courses for FSCJ. The CeL has established high quality standards for the development, delivery, support, and evaluation of online courses for the College. In order to create a quality online course, the CeL's Instructional Designers (ID) and Multimedia Team utilize a backward design approach to the online course development process. The design process begins through collaboration with faculty and the CeL an analysis of the learning outcomes; the state's learning standards, and the curriculum. The IDs will assist the PI team in designing and developing online course components: learning activities, multiple forms of assessments, and instructional materials. The IDs ensure that these components align appropriately with both course-level competencies and module-level learning objectives. The Multimedia Team provides an inclusive learning environment, which has been checked for both accessibility and usability. Once each course is developed, it is reviewed by a committee, consisting of administrators, faculty, and instructional designer to verify that it meets the needs of the department and the College's high-quality standards.

Goal 3: Develop and deliver Data Science train-the-trainer faculty workshops and resources.

- Objective 3.1 Complete curriculum for summer face-to-face train-the-trainer (called Working Connections) by end of year 1.
- Objective 3.2 Annually recruit 20 faculty members to attend summer Working Connections professional development each project year.
- Objective 3.3 Deliver Working Connections in year 1, year 2 and year 3.

*DataTEC* will prepare faculty at Florida's colleges to effectively teach the newly created Data Science course content. Senior administrators at each college will recommend faculty members to participate in an annual, week-long, 40-hour intensive training workshop at Florida State College at Jacksonville developed and co-taught by the PIs and industry experts like those from the project's BILT. College faculty will receive training on the same topics that they are expected to teach. Further, faculty workshop leaders will model the instructional strategies that they would like faculty to use with students. Faculty will even take some of the assessments that students are expected to take. This provides faculty with an opportunity to provide feedback on course topics, subtopics, instructional strategies and assessments. The training for faculty will include topics such as: a) Industry certifications in the field of Data Science, b) Recruiting students from underrepresented populations and addressing student barriers to Data Science education, c) High-impact instructional strategies, d) Data Science hands-on labs to personalize student experience, e) Interactive data visualizations, and f) Group activities with open source tools. As an added incentive for their participation, grant funds will help defray the cost of the faculty members' travel and attendance.

<div align="center"><em>DataTEC</em> <strong>outcomes and deliverables</strong> will include:</div>

- After establishing A.S. Data Science Technology frameworks, 100 students enrolled in courses in year 3
- Curriculum adaptation for program to be delivered 100% online
- Development of underrepresented student recruitment model (women, students of color, veterans, low-income students)
- Train-the-Trainer Data Science workshops and resources delivered to 60 faculty members
- Statewide outreach to 27 colleges including outreach to rural and underserved colleges
- Implementation of the A.S. Data Science Technology program and corresponding Data Science Technician Technical Certificates (I/II) at colleges in Florida

**Recruitment and Retention of Underserved Populations:** *Diverse Issues in Higher Education* (Abdul-Alim, 2017) mentions that by 2021, job candidates possessing Data Science and Analytical Skills will be twice as likely to be hired. This provides the perfect opportunity to provide gainful STEM employment to diverse, underrepresented populations. But the study of Data Science lags in gender and racial representation. According to AAUW's *Solving the Equation: The Variables for Women's Success in Engineering and Computing* report (Corbett, 2015), women hold only 26% of data-related jobs in the nation. The situation is even more acute among underrepresented minority students: only 12% of university presidents and provosts agree that Data Science and Analytics courses attract more underrepresented minority students than other STEM courses (BHEF, 2017). If the current STEM employment demographics tell the future for the Data Science field, it is not encouraging; the U.S. Census data shows African Americans and Hispanics are consistently underrepresented – 6% are African American and 7% are Hispanic in STEM employment (BHEF, 2017). Stereotypes, biases, and unwelcoming environments still hold these underrepresented populations back in this field. Students from these underserved groups need encouragement, but also require additional career awareness on how Data Science occupations have **concrete relevance, particularly on harnessing technology for social impact,** applying Data Science skills to inform and provide solutions for topics in public health, environmental protection, disaster response, crime prevention, education, social justice, and more.

In addition to underserved populations of gender and race/ethnicity, *DataTEC* will also recruit veteran students. Florida State College at Jacksonville's Northeast Florida coastal location facilitates multiple military installations including Florida's two largest U.S. Navy bases, **Naval Air Station Jacksonville** and **Naval Station Mayport**. Naval Air Station Jacksonville is the *third largest U.S. Navy*

*base in the world*, and combined with nearby Blount Island Command and Naval Submarine Base Kings Bay, **the area has the 3ʳᵈ largest military presence in the country behind Norfolk, Virginia and San Diego, California and is the nation's #1 requested end-of-duty tour.** According to the most recent 2015 state and national data, FSCJ educates the most veterans in the state of Florida and is 7th in the nation of colleges and universities that serve the most veterans (EMSI, 2015).

The *DataTEC* team will partner with the FSCJ Marketing Department led by Jill Johnson and the Office of Diversity and Social Change with leadership of Vee Byrd to create outreach efforts designed to increase enrollment of underrepresented and nontraditional populations in the College's Data Science program by 5%, particularly the number of women, students of color, veterans, and low-income populations. This will be based upon the current comparable A.S. program, Computer Information Systems. According to FSCJ's Institutional Analytics and Research, the program had the following enrollment in 2017-2018: 23% female, 77% male; and of those students, 27% were African American, 1% were Asian, and 9% were Hispanic. Of the total enrollment, 52% are defined as economically disadvantaged, students who were awarded need-based financial aid. **Outreach efforts will be modeled after Columbus State Community College and University of Hawaii Data Science-focused ATE projects (#1700454 and #1801190), the Georgia Tech University's South Big Data Innovation Hub's resources, and findings from the National Academies of Science's "Challenges and Opportunities to Better Engage Women and Minorities in Data Science Education."** Faculty professional development will include training focused on unconscious bias, equity vs. equality, and stereotype threat related to the Data Science field; this will be delivered within the professional development Working Connection events offered each summer during the project period. Vee Byrd, FSCJ's Associate Director of Diversity and Social Change will be asked to participate in coordination of *DataTEC* planning efforts for this professional development activity. Dr. Angelique Blackmon, *DataTEC* External Evaluator, will also serve in an advisory role and help to co-facilitate the training and share resources. The *DataTEC* team will invite presenters to Working Connections who are multi-cultural scholars, like Dr. Cirecie West-Olatunji, PI of NSF project #1648609 which studied how stereotype threat and microaggressions influence African American students' academic success and psychological wellbeing in engineering. The targeted student recruitment will blend traditional recruitment practices proven to be successful for engaging and targeting underrepresented high school and nontraditional adults with new creative strategies, including millennial and Gen Z-focused (demographic cohort of ages 16-36) technology-enhanced strategies tailored to a tech-savvy generation (Table 4).

| Table 4. *DataTEC* Recruitment Strategies |
|---|
| *High School Populations* |
| **Alignment with Duval County/Nassau County Public School District** To develop Data Science career awareness and recruit students to A.S. Data Science Technology program, team will identify STEM-focused career academies and magnet high schools (such as River City Science Academy, Paxon HS, Stanton HS, Wolfson HS) within districts to present info to high school juniors and seniors. **Alignment with FSCJ Underrepresented Pre-College Programs** Provide presentation to pre-college students collaborating with other FSCJ programs for underserved students including USDOE funded Talent Search – Urban Core Jacksonville and Talent Search – Southside Jacksonville programs, USDOE funded GEAR UP, and FLDOE-funded College Reach Out Program. These programs identify and assist pre-college individuals from <u>disadvantaged backgrounds</u> who have the potential to succeed. |
| *Nontraditional College Students, Underrepresented Students including Women, Students of Color, Veterans, and Low-Income* |
| **FSCJ Diversity and Social Change Office**-K.I.N.G.S. (Keys to Inspiring Noble Gentlemen to Succeed) and Project C.L.A.S.S. (Creating Leaders and Shaping Sisters) is a 12-week enrichment program designed to aid African American males and females in various aspects of collegiate development. The *DataTEC* team will host open house events for K.I.N.G.S. and Project C.L.A.S.S. students to learn more about programs of study and career pathways in Data Science. |

| Table 4. *DataTEC* Recruitment Strategies |
|---|
| **Enrollment Tracker Report-** Using FSCJ's ERP System, Peoplesoft, send *DataTEC* information through mail and e-mail blasts to qualified FSCJ students who have 1) been accepted to FSCJ, but not enrolled, 2) applied to the IT programs, but have not enrolled, 3) successfully passed Elementary Statistics, a pre-requisite to the Data Science program. |
| **Veterans Service Organizations-**Work with FSCJ's Military and Veterans Service Center and service agencies/nonprofits to recruit veterans to the program; organizations such as City of Jacksonville's Military Affairs and Veterans (MAV) Department, Operation New Uniform, For Their Honor, and the NE FL Military Veteran College Network made up of 20 military partners. |
| *DataTEC* will seek referrals and provide program awareness to **Jacksonville Women in Information Technology,** a professional networking group to network and share information and ideas with other women whose business and/or careers are in the IT field, and **Big Data Jax,** a professional networking group (2,086 members) for people interested in topics related to Data Science, Big Data, Data Analysis, Data Mining, Data Warehousing and the related skills, tools, and technologies |

| On-going marketing efforts for all recruitment populations | |
|---|---|
| *DataTEC* Website | Provide up-to-date information about the program, information on the required courses, associated industry certifications, job outlook, and details about salary projections for entry employment in Data Science positions. |
| Digital Media Campaign & Social Media | Digital media campaign that has a mix of targeted display and social advertising. Connect with online users in target demographic through keywords related to Data Science education. The Marketing Department will also retarget users through searches. The PI team will work with FSCJ's Marketing Dept. to advertise *DataTEC* activities on FSCJ's social media accounts including Facebook, LinkedIn, Twitter, and Instagram. |
| Print Media | To create awareness through newspaper, flyers, posters, mailings, newsletters. Collateral materials will be distributed to community partners, schools, etc. |
| FSCJ STARS Computing Corps | FSCJ STARS Computing Corps is an official student computer club with a participation of around thirty students per year. STARS will serve as Ambassadors for the *DataTEC,* helping in peer-to-peer recruitment efforts & high school program/career awareness. |

**TIMETABLE**

| Table 5. *DataTEC* Timeline | |
|---|---|
| **Year One: 2019-2020** | |
| Fall 2019 | • Host grant orientation meeting<br>• Meet with BILT for curriculum design and certification skill needs<br>• External Evaluator develops evaluation logic model, provides measurement process<br>• Faculty work with industry experts on curriculum content/modifications and develop online and lab components for courses |
| Spring 2020 | • Develop underrepresented student recruitment plan<br>• Submit new program request form for credit program to FL Dept. of Ed |
| Summer 2020 | • Host Data Science Working Connections for faculty<br>• Curricular modifications reviewed/approved by FSCJ Curriculum Committee<br>• Year One evaluation report is completed and submitted |
| **Year Two: 2020-2021** | |
| Fall 2020 to Summer 2021 | • Once framework is approved by FL Dept. of Ed, create curriculum proposal for submission to FSCJ's Curriculum Committee for Provost approval<br>• Work with SACSCOC for any implications with accreditation<br>• Deploy recruitment plan for underrepresented students<br>• Host Data Science Working Connections for faculty<br>• Year Two evaluation report is completed and submitted |

| Year Three: 2021-2022 | |
|---|---|
| Fall 2021 to Summer 2022 | • Full implementation of program, students enrolling in Data Science program; new/modified courses launched with cohorts<br>• FSCJ continues offering courses, students entering and completing programs<br>• Students provide feedback on curricula activities, lab activities, evaluation and assessment activities and on their overall experience in the courses<br>• Host Data Science Working Connections for faculty<br>• Year 3 and cumulative evaluation report submitted; Dissemination of best practices |
| **Ongoing Project Sustaining Activities** | |
| Quarterly BILT meetings; Recruitment of underrepresented students; Collect formative evaluation data (shared with PI 1x times a year); Evaluator site visits in Oct/March each year; Project personnel attend STEM and Data Science conferences for dissemination and professional development | |

## MANAGEMENT PLAN, ROLES, AND RESPONSIBILITIES

**Management Plan:** The *DataTEC* Advisory Committee is made up of college Senior Administrators, faculty, and the other strategic industry partners described earlier. The Advisory Committee will oversee strategic planning for sustainability starting in year one, by: 1) securing donations from Advisory Committee partners; 2) recruiting pledges from Business & Industry Leadership Team partners to meet continuing project needs; and 3) anticipating problems for continuation. The sustainability plan will be evaluated on an ongoing basis to ensure that implementation is being executed on time and in a quality manner. The Advisory Committee will meet through quarterly conference calls to: 1) assist in project start-up, 2) develop and review curriculum, 3) compare information about changes in industrial climates and research and 4) plan for project sustainability and dissemination of best practices. **Roles and responsibilities** are included in Table 6.

| Table 6. *DataTEC* Team Roles/Responsibilities |
|---|
| **David Singletary** Professor of Computer Science and Information Technology, will serve as **PI.** Prior to teaching at the College, Singletary served as a software and systems engineer for over 18 years in Silicon Valley, formerly employed by Cisco Systems, Latitude Communications, and Auspex Systems. He will: Oversee all grant activities on a day-to-day basis and will be responsible for ensuring that program goals and objectives are achieved; Lead curriculum development, online development of Data Science coursework working with CeL, development/delivery of Working Connections. |
| **Pamela Brauda,** Professor of Computer Science and Information Technology, will serve as **Co-PI** . Brauda holds a M.S. in Computer Science and prior to teaching at FSCJ, she taught as an adjunct instructor at the University of North Florida and led research efforts on the underrepresentation of women in computing. In addition to postsecondary education teaching, Brauda has also taught mathematics at the secondary level. She will: Lead nontraditional and underrepresented recruitment and retention plan; Deliver Career Awareness and Program Awareness efforts; Support delivery of Working Connections. |
| **Ernie Friend**, Instructional Program Manager, will also serve as **Co-PI.** Friend was recently named Hi-TEC Educator of the Year. Friend has led or participated in more than a dozen NSF and Department of Labor grants centered on creating new curriculum, faculty professional development, and student engagement in high technology fields – please see biosketch. Friend will: Work with CTC to disseminate project findings; Lead sustainability planning; Coordinate BILT members and meetings. |
| **Senior Personnel** will include IT dean, **Dr. Mamdouh Babi.** Dr. Babi received a B.S. in Electronics Engineering Technology from University of Nebraska Lincoln, a M.S. in Computer Information Systems from Bellevue University and an Eng.D.in Electrical and Computer Engineering from Cleveland State University. Prior to serving his leadership role at FSCJ, Dr. Babi served 12 years as dean to engineering and IT programs at other institutions. He will provide administrative oversight and disseminate project information and results to FSCJ leadership, STEM deans, and faculty members. |

| Partners | Role in Project |
|---|---|

| | |
|---|---|
| **Industry Partners**<br>Modis; Robert Half Technologies; Crowley Maritime; Matrix | - Participate on BILT offering program content input and assist with job skills analysis; Conduct work-based learning activities for students such as guest lecturing, career counseling and site visits; Serve as a prospective employer for participants that complete educational/training requirements. |
| **Jax IT Council**<br>*Over 100 employers* | -Refer students for training, provide wrap-around services such as job placement assistance, disseminate info; BILT. |
| **Northeast Florida STEM² Hub** | -Serve on BILT; Distribute project materials/invite project team to speak at forums; Incorporate outcome data into reports. |

## SUSTAINABILITY PLAN

*DataTEC* will implement curriculum that builds FSCJ's capacity to educate over 300 Data Science technicians over the next 10 years. *DataTEC* can also specifically cite two major initiatives that will help support sustainability efforts: 1) Under the FSCJ WORKS initiative, the College will continue to engage the *DataTEC* Business and Industry Leadership team, with the FSCJ Foundation leading donor efforts for further capacity expansion, potentially supporting industry certification exam costs for students in the program. The proposed A.S. Data Science Technology degree program is one example of linking FSCJ academic and workforce educational offering with the workforce needs of local employers. The FSCJ Foundation and FSCJ's School of Technology and Industry will work collaboratively with local funders to continue to expand the program, its enrollment and capabilities. The goal of *DataTEC* will be to address the workforce shortage shared by Northeast Florida finance, insurance, health care and other industries needing skilled Data Science professionals. 2) The state of Florida's Industry Certification Reimbursement Program awards state and community colleges up to $1,000 for each qualifying industry certification students earn. Funds will be utilized to sustain project expenses such as travel, equipment, and further curriculum development.

## EVALUATION PLAN

**Dr. Angelique Tucker Blackmon**, of Innovative Learning Center, LLC (ILC) will serve as the External Evaluator. She has been CEO and Director of Research and Evaluation for 14 years responsible for providing research and evaluation services for STEM education programs designed to broaden the participation of underrepresented students in innovation and STEM. **Impact and Performance Based Evaluation** techniques will be used within a mixed methods quasi-experimental design to analyze qualitative and quantitative data that will contribute to the research literature on data science college courses that enhance students' computational thinking, understanding of data processing and analytics and knowledge of software applications for advanced preparation to enter a broad spectrum of jobs within the workforce. The evaluation team will measure five **non-cognitive variables**: perceptions of problem-solving abilities, computer science self-efficacy, mathematics self-efficacy, STEM self-efficacy, and sense of belonging. Pre-post data will be collected from college students and faculty that participate in courses and faculty professional development sessions. The evaluation team will assess the relationship between *some* content based cognitive variables (knowledge of software applications, data mining, HTML, Java, Python, and R) and each non-cognitive variable. The team will also examine the relationship between each non-cognitive variable and student demographics (gender, ethnicity, first generation, age, etc.). The PI team and the External Evaluator will work together to design multiple choice assessments that measure data science-specific and computational thinking to assess the impact of the *DataTEC* curriculum on students' preparation for the data science job opportunities. The evaluation team will use survey instruments with validity and reliability ratings of 0.70 and higher. The **Computational Thinking** survey measures students' knowledge of decomposition, pattern matching, abstraction and algorithms. The **Problem-Solving Inventory (PSI)** will be used to measure undergraduate students' perceptions of their problem-solving approach, control, and confidence. It is a widely used instrument which measures students' perceptions of their problem-solving behaviors and attitudes (Cooper & Sandi-Urena, 2009). The **Computer Self-Efficacy** scale will be used to measure students' beliefs about using computers and software applications. Positive computer self-efficacy has been shown to be related to willingness to choose and participate in computer-based activities,

expectations of success, perseverance when faced with difficulties and computer-based performance (Holcomb, Brown, Kulikowich & Zheng, 2003). The **Mathematics Self-Efficacy and Anxiety Beliefs Questionnaire (MSEAQ)** will be administered before and after courses that have include a significant amount of mathematics content, e.g. SPSS. The MSEAQ is a 28-item survey divided into two subscales, mathematics self-efficacy and mathematics anxiety. The questionnaire was found to be reliable and valid. Factor analysis revealed that the 28-item survey had a Cronbach Alpha of 0.946. The **STEM Career Interest Survey STEM (CIS)** has three subscales; STEM self-efficacy, STEM Confidence and Future STEM Career (Blanchard, Osborne, & Albert, 2014). The STEM CIS is a 44-item survey designed to measure the effects of strategies intended to promote the awareness of, interest in, and intent to pursue STEM careers with rural and minority students **The Sense of Belonging Instrument** (SOBI) is a 27-item, self-report instrument consisting of two separately scored scales, SOBI-P (psychological state) and antecedents to sense of belonging to include people's motivation (desire and ability) for sense of belonging (SOBI-A). To monitor the impact of faculty professional development, the evaluation team will adapt existing tools and resources for evaluation and assessment at the Cultural Inclusion, Competency, and Diversity National Center for Cultural Competence (NCCC) at Georgetown University, https://nccc.georgetown.edu. Resources and tools from the NSF funded project Transforming Engineering Culture to Advance Inclusion and Diversity (TECAID), https://www.wepan.org/mpage/TECAID, will also be used to assess the impact of professional development designed to increase participants' awareness of unconscious bias and stereotype threat in STEM based courses. All survey items (pre- and post) will be uploaded to Survey Monkey providing easy access to the surveys. Table 7 provides the impact and performance-based evaluation questions that will be answered after collecting empirical data.

| Table 7. *DataTEC* Evaluation Questions and Data Collection Strategies | | |
|---|---|---|
| *Questions* | *Key Indicators* | *Data Sources* |
| 1. What is the impact of *DataTEC* on students' data analytics knowledge and skills specifically related to the mathematics concepts that support descriptive and inferential statistics? | Computational Thinking Software applications Data mining Java, Python, HTML | Computational thinking survey Assessment items from each course |
| 2. What is the impact of *DataTEC* on high school and college students' disciplinary knowledge? | Computational Thinking Software applications Data mining, Java, Python, HTML | Computational thinking survey Assessment items from each course Data Science Career inventory |
| 3. What is the impact of *DataTEC* on high school and college students' CS self-efficacy, perceptions of problem-solving abilities, mathematics self-efficacy and anxiety, and sense of belonging in data science certification courses? | Self-efficacy beliefs Sense of Belonging Perceptions of Problem Solving | Computer Science self-efficacy survey Mathematics self-efficacy and anxiety survey Problem Solving Inventory Sense of Belonging survey |
| 4. What is the impact of *DataTEC* on the recruitment, engagement and successful course completion of women and underrepresented students in data science certification and degree courses? | Demographic variables: number of underrepresented and non-traditional students and women recruited, enrolled, and completed courses | Demographic survey data |
| 5. To what extent has the professional development prepared faculty to become more aware of unconscious | Users' ratings and description of suggested faculty PD improvements | Event feedback survey: Semi-structured interviews |

| bias and stereotype threat and the impact both have on students' performance? | | Documents (meeting notes, course syllabi, assessment items) |
| --- | --- | --- |

The evaluation will include an assessment of the *DataTEC* team's progress during pre-implementation (i.e., data collected via semi-structured interviews and observations), implementation, and post implementation. Specific qualitative and quantitative instruments (interview protocols, internet-based surveys) will be deployed at each phase. **Performance based** evaluation strategies will take place during Years 1 and 2. A front faced survey will be administered at the end of each spring semester. Purposeful sampling will be used to select key stakeholders to participate in interviews. Interviews, to answer question 5, will be conducted with the PI and Co-PIs and a random sample of participants from the faculty cohort, industry partners, and college administrators. Dr. Blackmon will write one formative evaluation report for Years 1 and 2. **Impact Evaluation** will begin in Year 3 after courses have been modified and students recruited and enrolled. **Quantitative survey data** will be analyzed using descriptive and inferential statistics. A two-tailed ANOVA will be applied to the compiled data using computational thinking, perspectives about problem-solving, self-efficacy, mathematics self-efficacy and anxiety, and sense of belonging as the dependent variables and the *DataTEC* courses and program as the independent variable. *Hypothesis*: Participation in the *DataTEC* increases students' mathematics self-efficacy, computer science self-efficacy and knowledge of careers in Data Science. *Null Hypothesis*: *There is no statistically significant difference pre-post cognitive and non-cognitive variables.* A $p<.05$ value or less will be used to reject the null hypothesis and to affirm that the alternative hypothesis is true. Data will be shared with the PI team once per year. Conference calls will keep all parties apprised of the evaluation's progress and results. Dr. Blackmon will visit the project site each year noting markers of institutionalization. A final summative evaluation report will be written the last year of the project.

## DISSEMINATION PLAN

*DataTEC* Co-PI Ernie Friend will lead implementation of a multi-tiered dissemination strategy to expand the impact of program activities throughout Florida and nationally. Regional Dissemination: *DataTEC* will partner with the Northeast Florida STEM²HUB for regional dissemination impact through their monthly newsletter and forums for educators, the community and industry. The *DataTEC* project team will also attend meetings and workshops of the Jacksonville IT Council and Tech Coast Conference to connect with the cross-industries needing this technician training. Statewide Dissemination: Project findings will be shared statewide through Florida College System electronic newsletters, webinars, meetings and events. Deliverables will also be made available through The Orange Grove–Florida's K-20 Digital Repository, both during and following grant-funded activities. The project team will connect with national ATE National Convergence Technology Center and will share project information through their state and national academic, industry and government network. National Dissemination: Evaluation findings, program models, curriculum, and data will be shared through open access online repositories, discipline-specific publications and conferences, and technician education peer networks. Grant funding is requested to make presentations at conferences such as the High Impact Technology (HI-TEC) Exchange, the Symposium on Data Science and Statistics (SDSS), Women in Statistics and Data Science Conference, the American Association for Community Colleges, the other events hosted by organizations such as the American Statistical Association (ASA), the Institute of Electrical and Electronics Engineers (IEEE), and the Association for Computing Machinery (ACM). The PI team, in conjunction with FSCJ's department of Marketing and Communications, will utilize social media platforms through Facebook, Twitter, Instagram, and LinkedIn updates to disseminate project results and products to colleges and industry representatives who are interested in replicating project activities. Deliverables will also be made available through the ATE Central Portal. The External Evaluator will provide *DataTEC* evaluation reports online in an engaging storyboard format with interactive data visualizations on a branded single authentication website. Analytics Data & Reporting features will be configured to track site usage, audience, conversions, performance and benchmarks.

# References Cited

Abdul-Alim, J. (2017, June 29). Experts: Data science and analytics skills essential for minority students. *Diverse Issues in Higher Education*. Retrieved from https://diverseeducation.com/article/98508/

BHEF. (2017, April). Investing in America's data science and analytics talent: The case for action. Business-Higher Education Forum. Retrieved from http://www.bhef.com/sites/default/files/bhef_2017_investing_in_dsa.pdf

CBRE. Scoring Tech Talent in North America 2018. Retrieved from https://www.cbre.com/research-and-reports/Scoring-Tech-Talent-in-North-America-2018

Corbett, C. & Hill, C. (2015). Solving the Equation: The Variables for Women's Success in Engineering and Computing, Washington, DC: AAUW. https://www.aauw.org/research/solving-the-equation/

Davenport, T.H & Patil, D.J. (2012). Data Scientist: The Sexiest Job of the 21st Century. *Harvard Business Review*, pages 70–76, October 2012.

Dell Technologies. (2017). The Next Era of Human|Machine Partnerships: Emerging Technologies' Impact on Society and Work in 2030. Retrieved from https://www.delltechnologies.com/content/dam/delltechnologies/assets/perspectives/2030/pdf/SR1940_IFTFforDellTechnologies_Human-Machine_070517_readerhigh-res.pdf

DEO (Florida Department of Economic Opportunity). (2017). Statewide Targeted Occupations List. Retrieved from http://www.floridajobs.org/labor-market-information/publications-and-reports/labor-market-information-reports/regional-demand-occupations-list

EMSI. (2018). Job Analyst: Northeast Florida Computer and Information Research Scientists Occupation.

EMSI via Integrated Postsecondary Education Data Systems (IPEDS). (2015). Which colleges and universities have the highest veteran enrollment? (2015). Retrieved from: http://www.economicmodeling.com/2015/07/01/which-colleges-and-universities-have-the-highest-veteran-enrollment/

Florida Chamber of Commerce. (2017). Florida Jobs 2030. Retrieved from https://www.flchamber.com/research/research-programs/florida-jobs-2030/

Florida Chamber Foundation. (2017, January). Florida Jobs 2030: A Cornerstone Series Report for the Florida 2030 Initiative. Retrieved from http://www.flchamber.com/wp-content/uploads/2017/01/FINAL_Florida-Jobs-2030-Report-013117.pdf

Johnston, D. (2016, April 29). Data Scientist Salaries and Changing Demographics. Retrieved from https://www.linkedin.com/pulse/data-scientist-salaries-changing-demographics-david-johnston/

LinkedIn Economic Graph Team. (2018, August 10). LinkedIn Workforce Report|United States|August 2018. Retrieved from https://economicgraph.linkedin.com/resources/linkedin-workforce-report-august-2018

Matthews, K. (2017, July 6). What is big data's role in the fourth industrial revolution? Retrieved from http://bigdata-madesimple.com/big-datas-role-fourth-industrial-revolution/

Müller, D., & Ferreira, J.M. (2003): MARVEL: A mixed-reality learning environment for vocational training in mechatronics. Proceedings of the Technology Enhanced Learning International Conference (TEL'03), Milan, Italy, November 2003.

National Academies of Sciences, Engineering, and Medicine. (2018). *Data Science for Undergraduates: Opportunities and Options*. Washington, DC: The National Academies Press.

National Academies of Sciences, Engineering, and Medicine. (2018). *Envisioning the Data Science Discipline: The Undergraduate Perspective: Interim Report*. Washington, DC: The National Academies Press. https://doi.org/10.17226/24886.

Oceans of Data Institute. (2016). Profile of the Data Practitioner. Retrieved from http://oceansofdata.org/our-work/profile-data-practitioner

Priceonomics (2017, September 28). The data science diversity gap. Forbes. Retrieved from https://www.forbes.com/sites/priceonomics/2017/09/28/the-data-science-diversity-gap/#5584e5b35f58

Rawlings-Goss, Renata. (2017, September 1). *Workshop: Bridging the Digital and Data Divide*. National Science Foundation Award Abstract #1747961. Retrieved from https://www.nsf.gov/awardsearch/showAward?AWD_ID=1747961

Robinson, W. (2018, August 23). *Growing the talent pool: How Jacksonville tech firms are dealing with a lack of potential employees*. Jacksonville Business Journal. Retrieved from https://www.bizjournals.com/jacksonville/news/2018/08/23/growing-the-talent-pool-how-jacksonville-tech.html

**Florida State College at Jacksonville**
*Data Science Technician Education & Careers (DataTEC)* **- Data Management Plan**

This Data Management Plan was created for submission to the National Science Foundation as required by NSF guidelines in the interest of securing funding for Florida State College at Jacksonville's ATE project application for **Data** Science **Technician Education & Careers** *(DataTEC).* Through the application of diverse analytical frameworks and methodologies and via key collaborative efforts, the College's Data Reporting drives overall institutional effectiveness related to accreditation by engaging in a range of interrelated project activities involving focused research and analysis to extract practical and actionable information from an ever evolving and expanding array of data sources. Data will be shared with the External Evaluator, Principal Investigator, and project team once a year. Data will be stored in a specific virtual archive.

1. **Types of data, samples, physical collections, software, curriculum materials, and other materials to be produced in the course of the project**.

Project data will consist of survey questionnaires consisting of qualitative and quantitative results, interview recordings and transcripts of such, focus group results and transcripts, interview field notes and transcripts, as well as associated qualitative and quantitative data. Survey questionnaires will be delivered through both paper-based and online surveys. In either case, survey data will be stored in xml spreadsheet format and made available via multiple formats including MS Excel, CSV, and tab-delimited. Data from paper-based surveys will be scanned or otherwise transcribed into xml spreadsheet based format. This includes textual survey data as well which will also be made available in ASCII text (.txt) and MS Word format. Transcripts from interviews, focus groups, field notes and other qualitative instruments will be captured and stored in ASCII text (.txt) format as well as MS Word[1] format.

2. **Standards to be used for data and metadata format and content (where existing standards are absent or deemed inadequate, this should be documented along with any proposed solutions or remedies).**

Data standards will be consistent across the project. For both quantitative and qualitative educational data standards will adhere to the Common Education Data Standards developed by the National Center for Education Statistics (NCES)[2]. The Common Education Data Standards are comprised of several pieces of information that provide context for and describe specific data items including domain, entity, element, option set, related connections, and alternative names.

All members of the investigative team with access to data will receive instruction in the Responsible Conduct of Research (RCR). Original data notebooks will be retained in a secure location in the PI's office, with electronic data backed up on Florida State College at Jacksonville's Open Campus storage server whenever the nature of the data makes such archiving possible. If requested, data will be made available for sharing to qualified parties by the PI, so long as such a request does not compromise intellectual property interests, interfere with publication, invade subject privacy, betray confidentiality, or precede data curation. Data that are shared will include standards and notations needed to interpret the data, following commonly accepted practices in the field.

3. **Policies for access and sharing including the provisions for appropriate protection of privacy, confidentially, security, intellectual property, or other rights and requirements.**

All project data will be made available for public access and sharing via one or more publically accessible. For example, Florida State College at Jacksonville currently hosts data sharing sites (e.g.,

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[1] For backward compatibility purposes, MS Word 97-2003 format will be used
[2] The Education Science Reform Act of 2002 provided NCES authority to determine voluntary standards and guidelines

https://www.fscj.edu/discover/governance-administration/oiea/IAAR ). Policies will follow documented and recognized sources such as AIR (2010) that outline and address specific data sharing guidelines (Association for Institutional Research Annual Forum, 2010)[3]. This document describes several successful data sharing consortia including AAU Data Exchange (AAUDE), the Higher Education Data Sharing consortium (HEDS), and Polytechnic Data Sharing for Higher Education Research (PolyDASHER) as well as other successful consortia that have a more narrow range of data exchange (e.g., Delaware Study and Consortium for Student Retention Data Exchange; see http://www.fccj.org/campuses/mccs/instruction/sar/PDF/datashareoct2010.pdf).

Results utilization will be focused upon the improvement of success and retention for the target population group described.  Progress monitoring will performed specifically to gauge program success and make program adjustments as required to improve the success of the program based on target population student outcomes using the variables identified. All data and results will be made available for secondary analysis and reports will be widely shared with the appropriate project stakeholders including all academic, administrative, and leadership individuals and offices.  Regular monitoring will be performed via periodic committee meetings organized by the administration at the respective campuses involved.  As appropriate, results will also be shared to broader practice communities via both internal presentation sessions and one (or more) academic publication(s).

**4.  Policies and provisions for re-use, re-distribution, and the production of derivatives**
Policies and provision for reuse and redistribution of associated products as well as intellectual property rights for the project will rest with the host institution, Florida State College at Jacksonville.  Reuse and derivative production will be governed by the officially stated policies of the host institution. On completion of the project, the intention is that all data and materials should be freely available for use by the research and practitioner community. Storage and backup will be performed at the host institution in accordance with applicable guidelines information technology and data security policies and practices. Long-term and ongoing security of the data generated by this project as well as a complete copy of materials will be generated and stored independently on recognized and secure primary and backup sources for both the PI and Co-PIs and will include emerging data and results.

**5.  Plans for archiving data, samples, and other research products.**
All project data produced will be retained for at least three years beyond the award period, as required by NSF guidelines. Edutrope will house data on a secure Cloud-based video repository that is password protected. Applicable information guidelines will be adhered to for all project information to protect all data[4].  The archival procedures (described) will be followed to maintain and backup all project data.  Raw project data will be accessible via request from the host institution.

**References**
Association for Institutional Research Annual Forum (2010). Expanding our partnerships, consortia and data sharing. In *Charting Our Future in Higher Education* (pp. 1-9). Tallahassee, FL: Association for Institutional Research.

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[3] Association for Institutional Research Annual Forum (2010). *Expanding our partnerships, consortia and data sharing. In Charting Our Future in Higher Education* (pp. 1-9). Tallahassee, FL: Association for Institutional Research.  Available: http://www.fccj.org/campuses/mccs/instruction/sar/PDF/datashareoct2010.pdf
[4] The Department of Education has released final regulations amending the Family Educational Rights and Privacy Act (FERPA) regulations. The changes to the FERPA regulations will have the important effect of improving access to data. Improved access to data will facilitate States' ability to evaluate education programs, ensure limited resources are invested effectively, build upon what works and discard what does not, increase accountability and transparency, and contribute to a culture of innovation and continuous improvement in education.

October 4, 2018

National Science Foundation
Advanced Technological Education
4201 Wilson Boulevard
Arlington, VA 22230

Dear NSF ATE Proposal Reviewers:

It is with great pleasure that Florida State College at Jacksonville (FSCJ) submits the *Data Technician Education & Careers (DataTEC)* proposal to the National Science Foundation. Through an engaged academic-industry partnership, this opportunity provides the ideal support to establish an Advanced Technological Education (ATE) project.

*DataTEC* will fill the growing need for workers skilled in managing and analyzing enormous amounts of data. The proposed project is based on industry demand and a gap analysis that identified the strengths and weaknesses of Florida State College at Jacksonville's degree and certificate programs in Computer Information Technology. *DataTEC* will ultimately meet the increased industry demand for data science technicians, preparing individuals for meaningful positions in a variety of industries while also contributing to the diversity of the Northeast Florida workforce.

I feel assured that the *DataTEC* is an opportunity to achieve the ultimate goal of the National Science Foundation's ATE program: focusing on the education of technicians for the high-technology fields that drive our nation's economy. The College is extremely excited about this project and looks forward to leading the implementation process.

Sincerely,

Kevin Hyde
College President

**State Board of Education**

Marva Johnson, *Chair*
Andy Tuck, *Vice Chair*
*Members*
Gary Chartrand
Ben Gibson
Tom Grady
Michael Olenick

October 10, 2018

National Science Foundation
Advanced Technological Education
4201 Wilson Blvd.
Arlington VA 22230

Dear NSF ATE Proposal Review Committee:

The Florida College System, a Florida Department of Education division, is glad to support this proposal by Florida State College at Jacksonville to the National Science Foundation's Advanced Technological Education (ATE) program titled *Data Technician Education & Careers (DataTEC)*. While this project is focused on the northeast part of the state, the resulting certificate and data science track will benefit employers and job seekers throughout Florida. Florida State College at Jacksonville's efforts will help foster systematic changes forging meaningful career pathways for data science in Florida.

Florida's colleges remain the primary point of access to higher education in Florida, with 65 percent of the state's high school graduates pursuing postsecondary education beginning at a Florida college, and 82 percent of freshman and sophomore minority students in public higher education attending one of Florida's 28 colleges. More students enroll at Florida's Colleges to retool and retrain during economic downturns. We are more committed than ever to keeping our doors open, and to helping students get the training they need to improve their lives and help boost our state's economy. The Division of Florida Colleges is a dynamic and responsive Department of Education team. We provide leadership and advocacy to promote education innovation and continuous improvement within the Florida College System, fueling economic development for the state of Florida and its citizens.

As big data is rapidly produced by humans, machines, and organizations, it is critical that companies have a skilled pool of graduates to manage and analyze the volume, velocity, and variety. The proposed curriculum developed through *DataTEC* will benefit students and faculty throughout Florida. We are pleased to work with Florida State College at Jacksonville in disseminating project results and materials to other higher education institutions in Florida and nationally so they may launch similar interventions and program offerings. During project implementation, division staff will also be available for technical assistance as well as helping in the curriculum development process.

We believe the proposal will ultimately achieve the National Science Foundation's ATE program goals: to produce more qualified science and engineering technicians to meet workforce demands, and improve the technical skills and the general science, technology, engineering, and mathematics (STEM) preparation of these technicians and the educators who prepare them. We are excited about the positive impact of the *DataTEC* program and we look forward to the implementation process.

Sincerely,

Carrie E. Henderson, Ph.D.
Executive Vice Chancellor, Florida College System

October 10, 2018


National Science Foundation
Advanced Technological Education Program
4201 Wilson Boulevard
Arlington VA  22230


Dear NSF ATE Proposal Reviewers:


The Jacksonville IT Council (JITC) is pleased to support the ***Data Technician Education & Careers (DataTEC)*** submitted by Florida State College at Jacksonville under the National Science Foundation's Advanced Technological Education program.

Facilitated by the region's chamber of commerce, JAXChamber, JITC is a forum for information technology professionals to exchange information, explore new ideas, develop partnerships, educate the IT community, and contribute to the success of our members. Members, who include all IT related and non-related business owners, IT Directors, staffing personnel and others who have a keen interest in technology, come together to increase the strengths and relationships within the IT community. At present, JITC is made up of nearly 100 companies.

The region is scrambling to hire new graduates with data science core foundation knowledge and upskill current employees on data science abilities. We need our local institutions of higher education to develop students' data acumen including foundations in mathematics computations and statistics, while using specialized skills with statistical software, open source technologies, data management, and data visualization tools. Florida State College at Jacksonville's ATE project will develop coursework and enhanced activities needed to help workers obtain critical proficiency in data science tools and programs such as Tableau, Teradata, Power BI, Hadoop, R, MapReduce, and SAS.

JITC will assist this worthwhile project by referring candidates for training and disseminating information about the program to area employers who need skilled new hires. Again, JITC looks forward to having an active role in this worthwhile project to train workers in data science.

Sincerely,

Mike Russo
JITC President, 2018
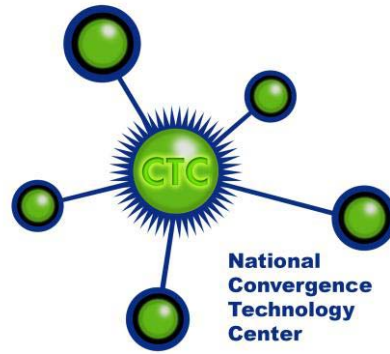
10/8/2018

National Science Foundation
2415 Eisenhower Ave.
Alexandria, VA 22314

Dear NSF ATE Proposal Reviewers:

Please accept this letter representing the National Convergence Technology Center's (CTC) strong support for the ***Data Technician Education & Careers (DataTEC)*** proposal led by Florida State College at Jacksonville. There is a critical need to develop and mature data science pathways throughout the U.S. to meet the growing demand for skilled data science technicians. We support community colleges as they develop educational initiatives to reflect the need for required, advanced technical skills.

As an ATE National Center of Excellence, the CTC is committed to helping support students in learning the cutting-edge skills they need to get and keep a high-wage career with expansive future potential in IT. The CTC pulls together the strengths of both educators and business professionals to create a pool of qualified IT technicians to design, build, test, secure, and troubleshoot communication infrastructure and devices in the convergence technology arena, both for enterprise and home markets. This means serving as a nationwide bridge between business and industry that understand the essential skills IT workers need, educators that must design and implement the curriculum to teach those skills, and students that benefit from this close collaboration between business and education by graduating with "workforce ready" know-how that will get them hired.

One of the goals of the National CTC is the creation of seven regional hubs (throughout the U.S. in Texas, Florida, Georgia, Michigan, Ohio, California). The purpose of the regional hubs is to develop communities that can continue the National CTC's work after it's gone. These hubs will establish engaged, regional Business and Industry Leadership Teams (BILTs) to give feedback on local workforce needs; create robust networks of educators from high schools, community colleges, and four-year universities modeled on the National CTC's Convergence College Network (CCN) community that shares resources and know-how; use that network to create new 2+2+2 articulation pathways for IT students in the region; and host faculty training events on-line or in person that feature longitudinal surveying to measure true impact.

We would be pleased to work with Florida State College at Jacksonville by:
- Sharing project results, curriculum, and recruitment materials with over 69 institutions in our college network and regional hubs;
- Including faculty and staff on professional development opportunities;
- Assisting in project dissemination activities through the CTC website and possible join conference presentations

Sincerely,

*Ann Beheler*

Ann Beheler, Ph.D.
PI, National Convergence Technology Center
Executive Director, Emerging Technology Grants

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**Convergence Technology Center**
Collin College
9700 Wade Blvd.
Frisco, TX 75035
www.ConnectedTech.org
972.377.1649

# COLUMBUS STATE

## COMMUNITY COLLEGE

October 8, 2018

National Science Foundation
Advanced Technological Education
4201 Wilson Blvd.
Arlington VA 22230

**RE: Florida State College at Jacksonville's Data Science ATE Proposal**

Dear NSF ATE Proposal Review Committee:

Columbus State Community College is pleased to participate with Florida State College at Jacksonville in their application that will be submitted to the National Science Foundation for the Advanced Technological Education program. There is a critical need to develop and mature multiple data science pathways throughout the U.S. to meet the growing demand for skilled data science technicians. We support additional community colleges to develop educational initiatives to reflect the need for required, advanced technical skills.

To support Florida State College at Jacksonville's proposed activities, we will share resources, curriculum, and materials resulting from our current ATE data analytics grant program, Data Analytics Technician Advancement (DATA) Program (1700454, 8/1/2017-7/30/2020). The project is currently establishing a DATA certificate with multiple entry and exit points that is stackable towards an A.S. in Information Systems and Analytics. By partnering with Oceans of Data Institute (ODI), our project is designing work-based learning activities and supportive materials for students enrolled in DATA. ODI is currently assisting us as we develop a comprehensive guide for big data related internships that includes: problem scenarios that reflect the current work ethos for data workers; performance-based rubrics that align to industry expectations for the workplace; and relevant, adapted sections of *EDC's Guide to Work-Based Learning in the Manufacturing Firm.*

Florida State College at Jacksonville's proposal shares similar goals to IT and DATA initiatives at our institution and, if selected for funding by NSF, it is Columbus State Community College's intent to collaborate with the project to share content and best practices.

Sincerely,

Shane Kirby, MBA
Director, Grants Office
Columbus State Community College

Gloria Rogiers
Chairperson, Computer Science
Principal Investigator, NSF ATE Data Analytics
Technician Advancement (DATA) Program (1700454)

October 15, 2018

National Science Foundation
Advanced Technological Education Program
2415 Eisenhower Avenue
Alexandria, VA 22314

Dear NSF ATE Proposal Reviewer:

MATRIX Resources, Inc. is honored to support Florida State College at Jacksonville's Advanced Technological Education proposal **Data T**echnician **E**ducation & **C**areers (**Data TEC**), submitted to the National Science Foundation. Our organization is confronted with an on-going shortage of individuals with technical skills to fulfill our client commitments across the country in our twelve offices. Because we specifically provide information technology skills, this challenge grows daily as our business has expanded for the past 35 years.  The only solution is producing more college prepared technicians with undergraduate and graduate achievement in mathematics, computation, statistical, and methodology for information systems development.

MATRIX is headquartered in Atlanta with offices in twelve major U.S. cities and multiple sub-offices including Jacksonville, Florida. MATRIX is privately owned with over 1,600 consultants, and service arms in four countries. Our clients range from medium sized organizations to the largest corporations in the world.  We provide data related solutions for multiple industries including AGILE methodology, systems architecture design, programming, data security, project management, and a myriad of applications and data transformation projects.  MATRIX is hiring, training, and leading technicians on all fronts daily as we provide solutions for client needs.  IT professionals are our life blood and fuel for our rapid growth and expansion.

MATRIX currently has plans for increasing our overall Florida presence beginning with NE Florida (Jacksonville) where we currently provide services to over ten major companies and utilities with a staff of approximately 15 employees. Our projects range from AGILE methodology consulting, large systems design, JAVA programming development, BIG DATA analysis projects, and more. We must have technical professionals to deliver results and our recruiters around the U.S., Mexico, India, and Manilla are constantly searching for these capabilities. We must ferret out these professionals in the U.S. and get them to the projects that we have in progress or are planning. Obviously, we need more competent professionals and also will continue with internships for junior human resource development as well.

Sincerely,

*Bill Gower*

William H. Gower (Bill)
Partner and Founder

October 3, 2018

National Science Foundation
Advanced Technological Education Program
4201 Wilson Boulevard
Arlington VA  22230

Dear NSF ATE Proposal Reviewer:

Crowley Maritime Corporation is pleased to support Florida State College at Jacksonville's Advanced Technological Education (ATE) proposal, **_Data Technician Education & Careers (DataTEC)_**, submitted to the National Science Foundation.

Founded in 1892, Crowley Maritime Corporation is based in Jacksonville, Florida. We are primarily a family and employee-owned marine solutions, energy and logistics services company that provides services through six operating lines of business: Puerto Rico/Caribbean liner services; Latin America liner services; logistics; marine contract solutions; deep sea petroleum transportation; and petroleum transportation, distribution and sales in Alaska. Crowley Maritime's geographically diverse operations require an integrated, well-managed data system to operate efficiently and profitably. The company relies on management and analytics of large amounts of data which requires skilled workers that provide analysis, modeling, and optimization through the output of information products.

Crowley Maritime is in need of qualified and skilled data science professionals. This ATE grant would allow Florida State College at Jacksonville to develop the core curriculum needed to provide introductions to data science training and skill development leading to entry and mid-level data science occupations. We will help this important effort by offering training experiences like internships for students; participating in the grant's Business and Industry Leadership Team offering program content input and assist with job skills analysis; and serving as a prospective employer for participants that complete educational/training requirements.

Sincerely,

Ursula Boudreaux
Technology Training Manager

crowley.com/social

9487 Regency Square Blvd.
Jacksonville, Florida 32225
P: 904.727.2200

**crowley.com**

# modis

October 12, 2018

National Science Foundation
Advanced Technological Education Program
4201 Wilson Boulevard
Arlington VA 22230

Dear NSF ATE Proposal Reviewer:

Modis is pleased to support Florida State College at Jacksonville's Advanced Technological Education (ATE) proposal, _**Data Technician Education & Careers (DataTEC)**_, submitted to the National Science Foundation.

We're proud to be part of the Adecco Group, the world's leading HR solutions provider across 60 countries. As our world becomes increasingly digitized, business processes and outcomes are experiencing more and more disruptions. At Modis, we're excited to see the boundaries between IT and engineering dissolve as we enter a new era of smarter devices, smarter cities, and smarter industries. While technology continues to drives constant change, it's more important than ever to work with the right people. IT and engineering talent – the very best talent – is hard to find in this competitive job market.

Employees skilled in managing and analyzing large amounts of data are increasing in demand. There is currently no higher education institution in Northeast Florida that offers a short-term certificate or A.S. degree program in Data Science, so we support Florida State College at Jacksonville's efforts to develop the state's first technical certificate and academic program with fundamental training in critical data science and analytics programs/tools such as Tableau, Teradata, Power BI, Hadoop, R, MapReduce, and SAS.

Modis will help ensure success of this project by participating in the grant's Business and Industry Leadership Team, offering program content input and assist with job skills analysis; and serving as a prospective staffing agency for participants that complete educational/training requirements.

Sincerely,

Jason E. Johnson
Solutions Consultant

# Robert Half®
## Technology

10751 Deerwood Park Boulevard
Suite 130
Jacksonville, FL 32256

T 904.997.9960
F 904.998.9955

jacksonville.downtown@rht.com

October 10, 2018

National Science Foundation
Advanced Technological Education Program
4201 Wilson Boulevard
Arlington VA 22230

Dear NSF ATE Proposal Reviewer:

Robert Half is pleased to support Florida State College at Jacksonville's Advanced Technological Education (ATE) proposal, ***Data Technician Education & Careers (DataTEC)***, submitted to the National Science Foundation.

Robert Half Technology specializes in placing application development, systems integration, information security, infrastructure management, networking, database development, help desk and technical support professionals in project, contract-to-hire and full-time positions. By combining cutting-edge recruiting technology and matching algorithms, with best-in-class customer service, we provide both job seekers and employers with assistance through our more than 345 staffing locations.

Employees skilled in managing and analyzing large amounts of data will be in high demand through the first half of this century. There is currently no higher education institution in Northeast Florida that offers a short-term certificate in critical data science skills, so we support Florida State College at Jacksonville's efforts to develop the state's first technical certificate with fundamental training in critical data science and analytics programs/tools such as Tableau, Teradata, Power BI, Hadoop, R, MapReduce, and SAS.

We will help this important effort by participating in the grant's Business and Industry Leadership Team offering program content input and assist with job skills analysis; and serving as a prospective staffing placement company for participants that complete educational/training requirements.

Sincerely,

Mike Russo
Director of Permanent Placement Services

October 8, 2018

National Science Foundation
Advanced Technological Education Program
4201 Wilson Boulevard
Arlington VA  22230

Dear NSF ATE Proposal Reviewers:

CareerSource Northeast Florida is pleased to support this proposal by Florida State College at Jacksonville (FSCJ) under the Advanced Technological Education program titled _Data Technician Education and Careers (DataTEC)._

CareerSource Northeast Florida is one of 24 workforce regions in Florida and we serve Baker, Clay, Duval, Nassau, Putnam and St. Johns counties. Our service area includes the City of Jacksonville and its Metropolitan Statistical Area. We work with our partners daily to open the door to improved employment opportunities through education, training and career services for workers.

_DataTEC_ will help Florida State College at Jacksonville develop a certificate program in data science to certify trained data technicians are capable of managing and analyzing the vast amounts of employers' structured and unstructured data. Students enrolled in the program will become proficient on data science tools and programs used in industries such as Tableau, Teradata, Power BI, Hadoop, R, MapReduce, and SAS.

CareerSource Northeast Florida will assist this worthwhile project by referring students for training; providing labor market information, job resource/placement assistance through the One Stop centers; and disseminating information to area employers who desire training for potential new hires.

Again, CareerSource Northeast Florida looks forward to having an active role in Florida State College at Jacksonville's _DataTEC_ project.

Sincerely,

Bruce Ferguson, Jr.
President & CEO

1845 Town Center Boulevard
Suite 250
Fleming Island, FL 32003
p: 904-213-3800 | f: 904-516-9217

# Northeast Florida Regional STEM2 Hub

October 2, 2018

Advanced Technological Education Program
National Science Foundation
4201 Wilson Blvd.
Arlington VA 22230

Dear NSF ATE Proposal Review Committee:

The Northeast Florida Regional STEM[2] Hub (STEM[2] Hub) is a not-for-profit entity solely dedicated to accelerating the growth of STEM[2] initiatives (and measured outcomes) in the Northeast Florida region. We fully support Florida State College at Jacksonville's proposed ATE project, _Data Technician Education & Careers_ (_DataTEC_), as our organization's mission directly aligns with its proposed activities.

The STEM[2] Hub was created to rally and organize local business, university and K-12 leaders to provide the essential missing elements for the region to accelerate the percentage of Northeast Florida students choosing STEM careers. The STEM[2] Hub focuses on eight key pillars needed for success: convening partnerships, sharing vision, advancing policy, establishing measures, supporting activities, building passion, mobilizing funding, and supporting business opportunities. Our organization is cognizant of the importance data science has and will continue to have in efficient, well-run businesses.

The STEM[2] Hub convenes our regional stakeholders and continues to develop nationally recognized approaches to advance STEM[2] education and careers in our region. We will support the project implementation in the following ways:

- Serving on the Business and Industry Leadership Team;
- Distributing project materials/inviting project team to speak at STEM[2] Hub forums and meetings;
- Featuring stories about the project in the STEM2 Hub monthly email newsletter; and,
- Incorporating outcome data into Northeast Florida's "State of STEM" reports.

Sincerely,

Kathleen Schofield
Executive Director
Northeast Florida Regional STEM2 Hub
904-502-0958

Laura DiBella
Executive Director

Shelley Hirsch
Operations and
Compliance Manager

Sherri Mitchell
Workforce|Business
Development

Royce Proctor
Chairman

Roger Rassman
Vice-Chairman

Randy Knagge
Treasurer

C.A. McDonald
Immediate Past Chair

Vicki Beaudry
David Buchanan
Jim Bush
Durand Childers
Mike Cole
Chris Corr
Pat Edwards
Danny Fullwood
Jodi Henson
Michael Hickox
Ed Hubel
Chris Kirkland
Brent Lemond
Donna Martin
Kenneth McAllister
Carmen North
Sarah Pelican
Ronald "Chip" Ross
Eric Schmidt
Michael Stokes
James Weaver
Kevin Webber
Bob White

October 12, 2018

National Science Foundation
Advanced Technological Education Program
2415 Eisenhower Avenue
Alexandria, VA  22314

Dear NSF ATE Proposal Reviewers:

The Nassau County Economic Development Board (NCEDB) is pleased to support the Data Science Technician Education & Careers (DataTEC) proposal submitted by Florida State College at Jacksonville (FSCJ) under the National Science Foundation's Advanced Technological Education (ATE) program.

NCEDB serves as the unified voice and single point-of-contact representing Nassau County, Fla., as a desirable place to relocate a business or to grow and expand an existing business. Our mission is to create, grow and attract business investment to the county and offer high-wage jobs to its residents and our future workforce.

Our region is scrambling to hire new graduates with data science core foundation knowledge and to upskill current employees on data science abilities. We need our local institutions of higher education to develop students' data acumen, including foundations in mathematics computations and statistics, while using specialized skills with statistical software, open source technologies, data management, and data visualization tools. FSCJ's ATE project will develop coursework and enhanced activities needed to help workers obtain critical proficiency in data science tools and programs such as Tableau, Teradata, Power BI, Hadoop, R, MapReduce, and SAS. DataTEC will also develop online formats and resources for each developed course to expand access for students and provide distance learning options for rural technician education, an especially valuable component since Nassau County is a designated rural county by the state of Florida.

NCEDB will assist this worthwhile project by referring candidates for training and disseminating information about the program to area employers who need skilled new hires. Again, NCEDB looks forward to having an active role in this worthwhile project to train workers in data science.

Sincerely,

Laura DiBella

# Angelicque Tucker Blackmon, Ph.D.

## EDUCATIONAL BACKGROUND

# Angelicque Tucker Blackmon, Ph.D.

## EDUCATIONAL BACKGROUND

**2005 - Georgia State University**
American Education Research Association (AERA)
Postdoctoral Fellow
Research Topic: *Influence of Sociocultural Context on Science Teaching and Learning*

**2003 - Emory University**
Ph. D. Educational Studies Emphasis Science Education
Thesis Title: *The influence of professional development on African American Teachers' Conceptual Change and Practice*

**1995 - Georgia Institute of Technology**
Masters of Science in Analytical Chemistry
Master's Thesis: *Characterization of an oscillating capillary nebulizer*

**1991 – Southern University**
Bachelors of Science in Chemistry minor Mathematics

SPECIFIC SKILLS

Designing STEM education, outreach, and research programs; designing STEM education evaluation studies; conducting mixed methods research and evaluation studies; writing evaluation reports and Institutional Review Board applications; conducting cultural audits; writing competitive proposals for STEM education programs; developing strategic plans for program design and implementation; developing logic models for programs and evaluations; preparing and analyzing program budgets.

SPECIFIC TRAINING

*Collaborative Institutional Training Certification 2010-present *NIH Human Research Participant Certification 2013-present

## B. POSITIONS AND HONORS

| | |
|---|---|
| **2003-present**<br>*Chief Executive Officer*<br>Innovative Learning Center, LLC, Atlanta, GA<br>Evaluated over 17 STEM education programs. Wrote or co-wrote proposals securing approximately $8.4M in grant funding. | **2005-2007**<br>*Program Director*<br>National Science Foundation Education and Human Resource Directorate - Division of Research on Learning in Formal and Informal Spaces (DRL) |
| **2015-2016**<br>*Principal Investigator*<br>National Science Foundation EPSCoR<br>Eye Tracking Research: Using innovative technologies to assess the impact of guided inquiry chemistry laboratory activities on undergraduate students' cognition and engagement | **2004-2005**<br>*Postdoctoral Research Fellow*<br>American Educational Research Association- Institute for Educational Sciences<br>Georgia State University |
| **2011-2014**<br>*Co-Principal Investigator*<br>National Science Foundation ITEST<br>Promoting Our Worth as Researchers and Entrepreneurs in Innovative | **2003-2009**<br>Director of Science and Mathematics Focused After School Program Enterprise Community Partners, Atlanta, GA. |

PUBLICATIONS & CONFERENCE PRESENTATIONS

1. Williams, D.A., & Blackmon, A.T. (2015). College Me, Career Me: Building K-12 Student Identities for Success in Engineering. Eds. Slaughter, Tao, Pearson, 2015. *Changing the Face of Engineering: The African American Experience.* Johns Hopkins University Press, Baltimore, Maryland.

2. McKayle, C., Stoltz, R., & Blackmon, A.T. (2018). Non-cognitive psychological variables of gender inequalities in STEM education, Gender Summit 15-Europe (GS15). United in Science and through Science, London, June 19, 2018.