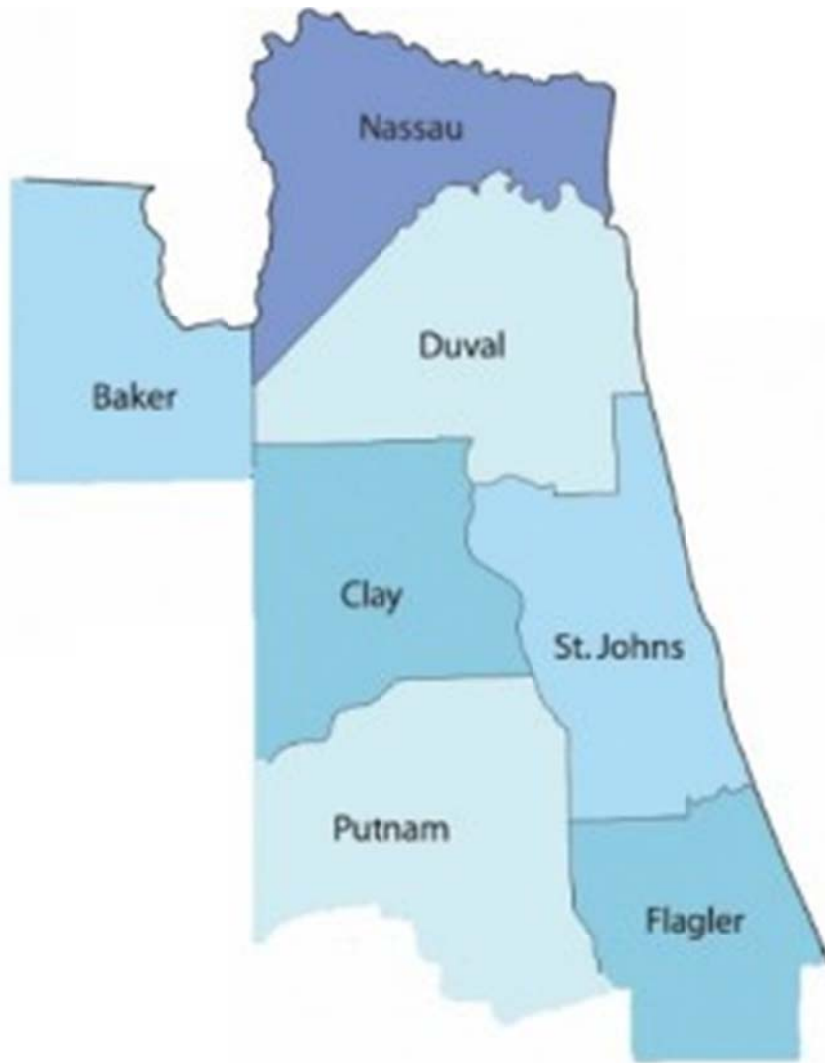


# State of STEM<sup>2</sup> in Northeast Florida

## INITIAL SURVEY REPORT



Prepared by Mark A. Tumeo and Wanyonyi Kendrick  
University of North Florida  
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## Executive Summary

### **The Problem Identified**

The Northeast Florida Region has continued to do an effective job identifying, attracting and sustaining large, medium and smaller companies and start up entities alike. In today's knowledge-driven economy, workforce quality and talent are a region's most important economic assets – and education in Science, Technology, Engineering, Mathematics and Medicine (STEM<sup>2</sup>) is one of the fundamental underpinnings of this asset. Over the past decade, jobs in STEM<sup>2</sup> fields have grown at a rate three times faster than non-STEM<sup>2</sup> jobs. This growth is expected to continue over the next decade with a projected growth rate of 17%. Given that the production of skilled workers and graduates in STEM<sup>2</sup> disciplines has lagged well behind this rate, and has fallen off in many instances, this places the nation and Northeast Florida in a position of losing in the globally competitive economy. For example, by 2018 it is estimated that 1 million computer science jobs will go unfilled by US workers.

Yet, even with the long-standing concern and increased focus on STEM education, the US is still falling behind. In 2013, the Organization for Economic Cooperation and Development published the results of their 2012 study in which the math, science and reading skills of about 510,000 15-year-olds in 65 countries were tested. The U.S. and the U.K., two of the world's leading countries in higher education, were ranked 36 and 26 respectively, and Asian countries occupied the top three positions in the list. Clearly, the current educational system is not addressing issues such as these, especially for underrepresented groups. As stated in the National Academy of Science Report<sup>1</sup>

*Although a set of pathways may be difficult to describe in detail, the ingredients for success in STEM are the acquisition of knowledge, skills, and habits of mind; opportunities to put these into practice; a developing sense of competence and progress; motivation to be in, a sense of belonging to, or self-identification with the field; and information about stages, requirements, and opportunities. These ingredients require attention in some measure for all students at every stage along the STEM educational continuum. However, there are issues that are specific to underrepresented minorities, in general and in STEM, focused on preparation, access and motivation, financial aid, academic support, and social integration.*

***Therefore we have an opportunity to better serve our community when it comes to a quality STEM education. We must muster all of our students' talents to improve our competitive position in the twentieth century. Furthermore minorities and women are significantly underrepresented in STEM<sup>2</sup> fields, leaving a staggering amount of economic potential untapped.*** Underrepresented minority groups comprised 28.5% of the population nationally in 2006, but just only represent 9.1% of college-educated Americans in science and engineering occupations (academic and non-academic), meaning that the percentages of underrepresented minorities in S&E would need to triple to match their share of the overall U.S. population.

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<sup>1</sup> National Academy of Sciences (2011): *Expanding Underrepresented Minority Participation*. Report of the Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline. The National Academies Press, Washington, D.C. Available online at [https://grants.nih.gov/training/minority\\_participation.pdf](https://grants.nih.gov/training/minority_participation.pdf). (Last accessed 3/17/15).

However, despite a national focus on directing more students toward science, technology, engineering and math fields – particularly women and minorities – the STEM workforce is no more diverse now than in 2001. While the percentage of the US population employed in engineering, computing and advanced manufacturing has increased from 24% in 2001 to almost 30% in 2015, the percentages of African Americans and Latinos employed in these sectors have stagnated between 12% and 16%. Women have held constant as a percentage of the Computing workforce (36% in both 2001 and 2015) but have lost slightly in both the Engineering workforce (dropping from 25% to 24%) and the Advanced Manufacturing workforce (dropping from 19% to 18%) from 2001 to 2015. African Americans and Latinos are losing ground in the STEM disciplines.

From the limited data available, it seems the situation in Florida is even more alarming. As early as 2006, National Center for Public Policy and Higher Education had stated

*“Florida’s underperformance in educating its young population could limit the state’s access to a competitive workforce and weaken its economy over time. As the well - educated baby boomer generation begins to retire, the diverse young population that will replace it does not appear prepared educationally to maintain or enhance the state’s position in a global economy.”*

For example, while the national average for women in computing workforce has held steady at around 36% between 2001 and 2015, in Florida males far outnumber females and the gap has increased since 2000. Similarly, while the national average for women in Engineering is around 24%, Florida has held relatively constant around 20%. These trends are also apparent in higher education in the state. The data show that Florida is in line with the national average in terms of minorities earning STEM degrees (averaging about 20% for Latinos to approximately 10% for African Americans) but is behind the national percentages in terms of women in STEM disciplines. ***One of the more important findings of this study is that there are no uniform metrics across the state by which to measure our current situation or monitor future progress. Moreover, regionally, there is no one entity that collects data in a uniform, verifiable manner.***

## **What Others are Doing**

In 2012, driven by the lack of progress demonstrated by the statistics above, an initial group of 13 states announced the formation of STEMx<sup>TM</sup>, a multi-state network to help connect policymakers with teachers, business leaders, and STEM organizations. The group now includes 18 states and the District of Columbia. The group involves both State government and private partners who are focused on: (a) sharing and disseminating information, knowledge and tool development across states; (b) promoting high-quality STEM education in their classrooms, schools and programs; and (c) providing mentoring and assistance to state partners, particularly those who are new to the state-level policy arena, to enable members to solve challenges through collective response and mutual support. The STEMx<sup>TM</sup> initiatives have started to show some success. Some of the more notable state activities include those in Oregon, New York and Texas. There are also an increasing number of examples where a specific Governor and/or local school districts, civic leaders and businesses are uniting to build STEM Hubs focused on the unique needs of their regions. An example of gubernatorial action is found in the STEM-Hub network in Iowa. Example regional efforts include those in Los Angeles and Southeast Pennsylvania.



*All of these efforts share one common element – local and state leaders have come together to develop single or multiple STEM-Hubs that serve to coordinate activities, share best practices, collect data and in some instances, help attract funding from the local, state and national level.*

One of the STEM-Hub networks that might be considered a "best practice" is the Tennessee STEM Innovation Network (TSIN). TSIN's goal is to create a "kindergarten to jobs" system of education focused on building a pipeline of high-quality STEM programming so that students are college and career-ready upon graduation from high school. The network consists of Six STEM Innovation Hubs and each regional hub has developed its own array of STEM initiatives and interested partners to create effective educational systems specific to the needs of the schools, learners, teachers, and business and community partners in the region. Recently, the Jacksonville Chamber sponsored a trip to Nashville as a sister city that has many of the same characteristics of Northeast Florida. Nashville is in the Middle Tennessee STEM Innovation Hub.

One of the unique aspects of the TSIN is a focus on teacher education. The Network created ten STEM-focused Platform Schools designed to function like learning labs, where educators are able to try out new and innovative ways of teaching. Much like the "career academies" found in our region, the platform schools utilize partnerships with industry to create project-based learning units that incorporate actual situations that industry partners are striving to solve. In the platform schools, students work to solve a common problem in all of their classes, regardless of the subject. The ten TSIN platform schools enroll over 4,000 students and are non-selective, making the dream of STEM careers available to all students regardless of aptitude or test scores. The Tennessee system is a strong model, and has produced impressive results.

Another potential "best practice" model is the Chevron Center for STEM Education and Career Development that was established by the Carnegie Science Center in Southwest Pennsylvania. The Center seeks to inspire the next-generation workforce and expand the pipeline of students prepared to enter college and graduate with STEM<sup>2</sup> degrees. The Center's programs have a significant focus on essential support programs that complement the classroom STEM<sup>2</sup> work as well as informal (after-school) education programs. In May 2015 the center hosted a bi-partisan Congressional briefing in Washington DC to present the STEM-related work the organization has been doing in the Pittsburgh region as a national model to expand quality science, technology, engineering and math education.

Other states beyond those mentioned have been developing STEM Hubs as well, and if Jacksonville is to maintain a competitive edge, it seems probable that a coordinated effort in STEM education across multiple organizations is one important and necessary step. *Therefore, to achieve the goal of sustaining and increasing regional competitiveness, it is essential that all regional players come together to not only advance the state of STEM<sup>2</sup> education in the region, but also to expand the number and diversity of individuals entering STEM<sup>2</sup> disciplines and the opportunity for them to find employment.*

## **Proposed Application of Approach to Northeast Florida**

Based on the experience and data from other areas and states, it seems that one of the best ways to advance STEM<sup>2</sup> education and careers is through a regional STEM<sup>2</sup> Hub. Such a Hub would be a new entity dedicated to accelerating the growth of STEM<sup>2</sup> initiatives and measured outcomes in the Northeast Florida region. The goal of such a STEM<sup>2</sup>-Hub would be to provide the essential, missing elements for Northeast Florida to accelerate quickly the percent of Northeast Florida students choosing STEM<sup>2</sup> careers. The STEM<sup>2</sup> Hub would be the base infrastructure needed to coordinate and execute the vision of providing the essential missing elements to accelerate the growth of STEM<sup>2</sup> education and careers. It would do this by: (a) Convening *all* parties and stakeholders to develop an ecosystem in Northeast Florida; (b) Promoting shared vision, goals and strategies; (c) Supporting metric development and data collection; (d) Supporting aligned activities to achieve shared goals; (e) Mobilizing funding; and (f) Encouraging, cultivating, and supporting STEM<sup>2</sup> businesses.

## **Existing Building Blocks**

The Northeast Florida region is already well-positioned to take advantage of a STEM<sup>2</sup>-Hub structure. Our region already has many unique stakeholders who create the foundation for our regional STEM<sup>2</sup> infrastructure. The region is blessed with a community spirit and desire to help that is clearly demonstrated in the numerous non-for-profit organizations that have significant activities focused on STEM<sup>2</sup> issues. From assistance and tutoring starting as early as Kindergarten to job placement and specialized training, regional not-for-profit organizations represent a unique and important asset.

The K-12 educational system is strong, albeit uneven across the region. *One of the most notable strengths is the availability of significant numbers of “academies” focused on STEM<sup>2</sup>. This places the region in a very strong position with respect to the establishment of a STEM<sup>2</sup> hub.* Duval County has two of the best high schools in the nation as well as the beginnings of a promising county-wide early college career academy: VISTAKON<sup>®</sup>'s Advanced Manufacturing Academy. Both St. John's County and Clay County are excellent examples of how close partnerships with industry can produce meaningful and impactful STEM academies for High School students. The attention to STEM<sup>2</sup> topics goes well beyond High School programs, with meaningful, engaging programs as early as 3<sup>rd</sup> grade. The region has nationally recognized successful robotics programs in some schools, with the potential capacity in-place that could be replicated to other schools. The region also has the expertise to provide training for all areas associated with building capacity for STEM programs.

The region also has a world-class system of higher education, including numerous state colleges, several 4-year degree-granting institutions, and one highly-ranked State university. This infrastructure provides a significant advantage on which to build strong STEM programs at all levels of the equation. In addition, these institutions have a history of working collaboratively across several issues, providing an opportunity to leverage resources and build strong programs in cooperation with STEM businesses in the region.

As can be seen in the already existing range of partnerships with industry for K-12 academies, afterschool programs, and college and university level activities, the region has an engaged and vibrant business community. The leaders of industry in Northeast Florida have clearly seen the need for additional STEM<sup>2</sup> workers, and have already started to develop important programs to address this need. These programs cover a wide spectrum of activities from robotics clubs in grade schools to internship programs and scholarship support at the University level.

### **Weaknesses, Opportunities and Threats**

Regionally, the most frequently identified weakness is a lack of funding and the resulting limits on resources. The second most common weakness cited, which is closely related to funding, was the difficulty in finding, training and retaining qualified personnel. This was especially noted within the responses from the school districts and several of the non-for-profit entities. Finally, despite the presence of several outstanding teachers in our region, particular note was made of the struggle that the nation in general, and Northeast Florida in particular, has in hiring qualified mathematics teachers in the K-12 system. The primary reason teachers fail the state teacher qualification exam is their deficiency in math knowledge. Math underpins most STEM academic programs and students who are weak in math are unlikely to be able to pursue a STEM career. Another important part of the teacher quality problem is simply the unattractiveness of teaching in a field such as mathematics when strong math skills can command better and higher paying jobs in industry.

Even in the light of some weaknesses, the region has several notable opportunities of which to take advantage with a STEM<sup>2</sup>-Hub. One of the most promising opportunities associated with the Hub is the coordination of organizations that should greatly increase the ability to attract grant funding for STEM<sup>2</sup> initiatives. The Hub's mission statements is to invest in the STEM<sup>2</sup> field by providing the essential missing elements to accelerate the growth of STEM<sup>2</sup> education and careers. Our regional education institutes have great individual strategies for identifying and winning STEM grant dollars. However, this success could be significantly leveraged by a regional holistic strategy to attract and complete for many of the publicly highlighted STEM dollars presently being announced. The trend toward large STEM companies and foundations providing grant dollars for STEM has been growing and will continue to increase. There is an opportunity for the Northeast Florida Regional STEM<sup>2</sup> Hub to capture more of these dollars for our regional educational institutes. However, while becoming increasingly limited, there are also opportunities in government funding of STEM<sup>2</sup> activities. Many Federal agencies have significant resources to fund STEM<sup>2</sup> related programs.

As with the regional weaknesses, regional threats are closely tied to individual organizational threats identified. Based on stakeholder discussions, it seems that at the regional level, two specific threats need to be recognized:

(a) Challenges from the State Legislature: As noted above, all STEM<sup>2</sup> education is greatly affected by state requirements and funding. There is a history of intense pressure on the educational budget and 2015 legislative session is no different. An overall focus on STEM<sup>2</sup> by the Northeast Florida region will allow our regional elected representatives have increased influence at some of the critical points in the process.

(b) Parental Involvement and Parental Engagement.: Parent and community buy is critical for our students to encourage them to consider a STEM<sup>2</sup> career. Parents must be involved in this process from beginning to end with a positive attitude and be able to view STEM<sup>2</sup> as a bonus to academic achievement. This is especially true because typically STEM<sup>2</sup>-enhancement programs have to be implemented during after school hours which require parents to be involved to ensure the success of the students in the program.

## **Recommendations**

Based on the data and analysis in the report, the following specific actions are recommended.

1. *That the regional stakeholders come together to form and support a Northeast Florida STEM<sup>2</sup>-Hub to convene, inspire and invest in initiatives that develop the essential resources and programs for teachers, administrators and students to change attitudes, behaviors and understanding of STEM<sup>2</sup>. Towards this end, the STEM<sup>2</sup>-Hub should convene our regional stakeholders (schools, businesses, students, parents and the community) to continue to develop nationally recognized approaches to advance STEM<sup>2</sup> education and careers. It should be emphasized that any education solution must provide many synergistic efforts including a clear emphasis on mathematics as the foundation for all STEM<sup>2</sup> education.*
2. That the STEM<sup>2</sup>-Hub convene a group of our regional stakeholders for a lively outcome-focused discussion on next steps for our region to promote entrepreneurial activity and start-ups. Ultimately, our goal should be to determine whether there are essential missing elements in our regional start-up infrastructure.
3. That the STEM<sup>2</sup>-Hub inspire our regional stakeholders to discuss options and alternatives for developing a regional near-sourcing STEM<sup>2</sup> entity to act as a vital part of the sourcing pipeline for both businesses and qualified workforce alike.

In conclusion, the STEM<sup>2</sup> Hub should be the base infrastructure needed to coordinate and execute the vision of providing the essential missing elements to accelerate the growth of STEM<sup>2</sup> education and careers. The journey to establishing the Northeast Regional STEM<sup>2</sup> Hub won't be easy, but we hope all in our community will join us in the journey to a more vibrant STEM<sup>2</sup> regional economy.

## SECTION 1 INTRODUCTION

The Northeast Florida Region has continued to do an effective job identifying, attracting and sustaining large, medium and smaller companies and start up entities alike. In a 2014 article in Business Florida<sup>1</sup>, the strength of the region's economic engine was summarized as follows:

*It should come as no surprise that Jacksonville boasts six Fortune 1000 firms — more than any other Florida city — and the national or divisional headquarters of more than 80 other companies. A world-class intermodal transportation system made up of multiple seaports, airports, railways and highways has made Northeast Florida a focal point for both international and domestic commerce. With its population of close to 1.6 million, workforce exceeding 767,000 and reputation for affordability and accessibility, this seven-county region offers a dynamic market for business relocation and expansion.*

In today's knowledge-driven economy, workforce quality and talent are a region's most important economic assets – and education in Science, Technology, Engineering, Mathematics and Medicine (STEM<sup>2</sup>) is one of the fundamental underpinnings of this asset. In the article “*STEM Jobs Key to Better Economy*”, USA Today<sup>22</sup> aggregated and highlighted the state of STEM at a national and regional level.

*Over the past decade, jobs in science, technology, engineering and mathematics (STEM) have grown at a rate **three times faster** than non-STEM<sup>2</sup> jobs. Momentum will continue over the next decade as STEM<sup>2</sup> jobs **will grow at a staggering rate of 17%**. . . Minorities and women are underrepresented in STEM<sup>2</sup> fields, leaving a staggering amount of economic potential on the table. By 2018 1 million computer science jobs will go unfilled by US workers.*

***Therefore, to achieve the goal of sustaining and increasing regional competitiveness, it is essential that all regional players come together to not only advance the State of STEM<sup>2</sup> in the region, but also to expand the number and diversity of individuals entering STEM<sup>2</sup> disciplines.***

### 1.1 Definition of STEM<sup>2</sup>

The definition of the disciplines that should be included in an analysis of the fundamental underpinnings of our technological society is a subject of continuing discussion. Traditionally, STEM disciplines (science, technology, engineering and math) have been the focus of national discussion. There is broad agreement that the math, life and physical sciences fields belong in this group, and agreement engineers are a part of this workforce. There remains discussion about what disciplines are included in “technology” – but no disagreement that these fields should also be included.

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<sup>1</sup> “Business Florida 2015 - The Regions: Northeast Florida: Jacksonville, Orange Park, Palatka, Palm Coast, Ponte Vedra, St. Augustine.” Published 9/23/2014 by Trend Magazines Inc., St. Petersburg, Florida. Available online at <http://www.floridatrend.com/article/17624/northeast-florida> (last accessed 3/6/15).

<sup>22</sup> “STEM jobs key to better economy”, USA Today, January 10<sup>th</sup> 2014. Available online at <http://www.usatoday.com/story/opinion/2014/01/10/engineering-mathematics-stem-gillibrand-kennedy-column/4361837/> (last accessed 3/6/15).

More recently, there has been a growing movement to include the liberal arts in this focus, creating the acronym STEAM (Science, Technology, Engineering, Arts and Math or in some instances Science, Technology, Arts and Math). The reason for this grows from the belief that the liberal arts provide a framework for creative and innovative approaches to solving problems. As Dr. Jackson-Hayes pointed out in a recent article in the Washington Post<sup>3</sup>

*To innovate is to introduce change. While STEM workers can certainly drive innovation through science alone, imagine how much more innovative students and employees could be if the pool of knowledge from which they draw is wider and deeper. That occurs as the result of a liberal arts education.*

While STEAM programs are appearing in many areas (including the Duval County Public School District through programs such as the Cathedral Arts Project), STEM education remains a more common focus. There is less agreement about the inclusion of the health sciences in this category (represented by Medicine in the acronym – hence STEMM or STEM<sup>2</sup>). There appears to be general agreement that physicians belong in the definition of scientific and technical workforce, but the inclusion of other health professions such as nurses, physician assistants, laboratory technicians, and numerous others is unclear.

In Northeast Florida, the health care sector has been and remains a critical part of the economy. In a 2011 Report entitled Economic Impact Healthcare and Bioscience Industry Northeast Florida<sup>4</sup> it was estimated that 20% of the Jacksonville workforce was employed in the healthcare and bioscience industry. Further it was noted that “*the healthcare industry in Jacksonville contributes a total of almost \$7.4 billion in direct economic impact. When accounting for related industries, the total is almost \$25 billion.*”

Given the importance of the health care sector in the region, and because health professions all require a significant amount of STEM training, as well as specialized education in health, this report includes “medicine” in the grouping examined as represented of the broad spectrum of professions and disciplines in the healthcare and bioscience industry. Therefore, this report will focus on the state of STEMM (represented as STEM<sup>2</sup>) education, employment and careers in our region.

## 1.2 Definition of Northeast Florida

Defining a region always presents unique challenges of inclusion versus exclusion. For this report, given the focus on the connection between STEM<sup>2</sup> education and economic development, it was decided to use the same definition as the Florida Economic Development Council, the Jacksonville Chamber of Commerce, and JAXUSA Partnership. Therefore, throughout this report “Northeast Florida” means Baker County, Clay County, Duval County, Flagler County, Nassau County, Putnam County and St. Johns County.

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<sup>3</sup> Dr. Loretta Jackson-Hayes, “We don’t need more STEM majors. We need more STEM majors with liberal arts training”. Editorial published in the Washington Post, February 18, 2015. Available online at [http://www.naicu.edu/news\\_room/news\\_detail.asp?id=22623](http://www.naicu.edu/news_room/news_detail.asp?id=22623) (last accessed 3/6/15)

<sup>4</sup> *Economic Impact Healthcare and Bioscience Industry Northeast Florida* (2011 Report) published jointly by the Center for Global Health and Medical Diplomacy at UNF, the Jacksonville Chamber of Commerce and the Healthcare and Bioscience Council of Northeast Florida, 2011.

### 1.3 Mission and Goals of STEM<sup>2</sup> Hub

The working mission statement of the proposed Northeast Florida Regional STEM<sup>2</sup> Hub (The STEM<sup>2</sup> Hub) is “to convene, inspire and invest in STEM<sup>2</sup> fields by providing the essential missing elements to accelerate the growth of STEM<sup>2</sup> education and careers”. The STEM<sup>2</sup> Hub will be a new entity solely dedicated to accelerating the growth of STEM<sup>2</sup> initiatives (and measured outcomes) in the Northeast Florida region. It will identify and provide essential, missing elements for Northeast Florida to accelerate quickly the percent of Northeast Florida students choosing STEM<sup>2</sup> careers. The planned launch of the STEM<sup>2</sup> Hub is May 11<sup>th</sup>, 2015. The STEM<sup>2</sup> Hub’s goals are to accelerate the impact of short-term and intermediate metrics toward reaching the JAX2025<sup>5</sup> vision

The STEM<sup>2</sup> Hub will directly focus on two target areas (1) excellence in education and (2) a vibrant economy. The plan is that the STEM<sup>2</sup> Hub will present this State of STEM<sup>2</sup> in Northeast Florida report at its initial spring STEM<sup>2</sup> Forum and will recommend areas of focus for the following year. Annually thereafter the STEM<sup>2</sup> Hub will publish a report on the State of STEM<sup>2</sup> in our region, including outcomes, measurements and new (or continued) areas of focus. The ultimate long-term goal is that Northeast Florida will be the STEM<sup>2</sup> Capital of the Southeast by 2025. The Hub in its first year will identify and start measuring regional education and economic STEM indicators. The metrics will include (1) attracting/recruiting companies, (2) retaining and expanding companies, (3) driving startup innovation, and (4) improving STEM education outcomes at both a K-12 and upper education level. The primary areas the STEM<sup>2</sup> Hub will recommend it focuses on the first year include: (1) Increasing hands-on exploratory project based learning opportunities through increasing after-school STEM clubs; (2) showcasing great academies in our region; and (3) establishing a regional best practice approach to supporting our regional startups. These goals are in alignment with the JAX2025 vision.

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<sup>5</sup> According to the JCCI Website, “JAX2025 is Jacksonville’s community developed platform for action and change. It’s about becoming the city we want to be by creating a shared vision, finding solutions, making them real, and identifying leaders for our future.” See <http://www.jcci.org/#!jax2025/cdmr>

## SECTION 2 WHY A STEM<sup>2</sup> HUB

As discussed above, in today's knowledge-driven economy, workforce quality and talent are a region's most important economic assets – and education in STEM<sup>2</sup> disciplines is one of the fundamental underpinnings of this asset. To sustain and increase regional competitiveness, it is essential that all regional players come together to not only advance the State of STEM<sup>2</sup> in the region, but also to expand the number and diversity of individuals entering STEM<sup>2</sup> disciplines. **However, there is currently no single point of convergence for the disparate ideas, organizations, or programs that relate to STEM<sup>2</sup> in Northeast Florida.** By creating an organization that is focused on setting goals to improve outcomes, the STEM<sup>2</sup> Hub can be the place to provide structure and organization. Furthermore, it can provide a well thought out strategy on how to achieve those outcomes, and hold organizations accountable for their role in improving STEM<sup>2</sup>.

### 2.1 National Perspective

Nationally, there has been growing concern about STEM education in the US for several years. A Government Accountability Office study in 2005<sup>6</sup> found that in FY 2004, approximately \$2.8 billion was spent by the Federal government on STEM education programs. However, even with this level of Federal investment, the report concluded that:

*“Given the trends in the numbers and percentages of students pursuing STEM degrees, particularly advanced degrees, and recent developments that have influenced international students' decisions about pursuing degrees in the United States, it is uncertain whether the number of STEM graduates will be sufficient to meet future academic and employment needs and help the country maintain its technological competitive advantage.”*

In 2007, the National Academy of Sciences (NAS) issued a report entitled “Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future”<sup>7</sup>. In this highly influential report, the NAS panel stated:

*“Having reviewed trends in the United States and abroad, the committee is deeply concerned that the scientific and technical building blocks of our economic leadership are eroding at a time when many other nations are gathering strength. . . we are worried about the future prosperity of the United States. Although many people assume that United States will always be a world leader in science and technology, this may not continue to be the case inasmuch as great minds and ideas exist throughout the world. We fear the abruptness with which a lead in science and technology can be lost—and the difficulty of recovering a lead once lost, if indeed it can be regained at all.*

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<sup>6</sup> United States Government Accountability Office (GAO): “Higher Education: Federal Science, Technology, Engineering, and Mathematics Programs and Related Trends”. Report to the Chairman, Committee on Rules, House of Representatives. GAO-06-114, October 2005.

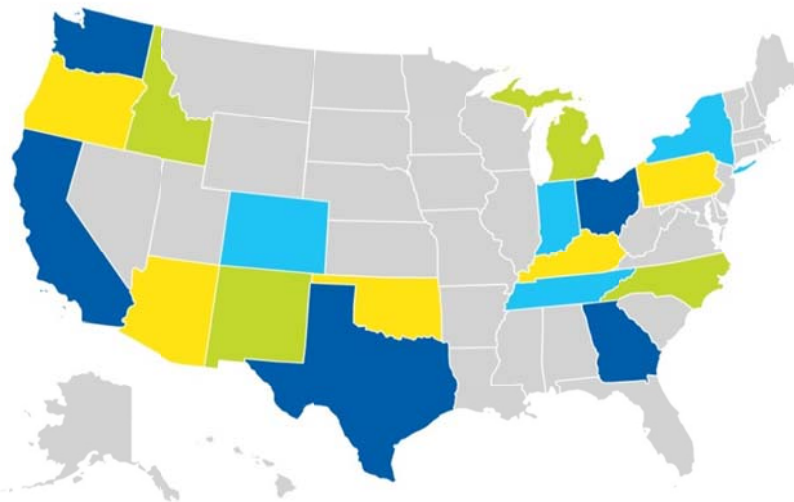
<sup>7</sup> National Academy of Science “Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future.” National Academy Press, Washington DC, 2007.



Yet, even with the long-standing concern and increased focus on STEM education, the US is still falling behind. In 2013, the Organization for Economic Cooperation and Development (OECD) published the results of their 2012 study in which the math, science and reading skills of about 510,000 15-year-olds in 65 countries were tested<sup>8</sup>. The U.S. and the U.K., two of the world's leading countries in higher education, were ranked 36 and 26 respectively, and Asian countries occupied the top three positions in the list.

In 2012, driven by the lack of progress an initial group of 13 states announced the formation of STEMx<sup>TM</sup>, a multi-state network to help connect policymakers with teachers, business leaders, and STEM organizations. The group now includes 18 states and the District of Columbia. The group involves both State government and private partners who are focused on: (a) sharing and disseminating information, knowledge and tool development across states; (b) promoting high-quality STEM education in their classrooms, schools and programs; and (c) providing mentoring and assistance to state partners, particularly those who are new to the state-level policy arena, to enable members to solve challenges through collective response and mutual support. The “Hour of Code” is an example of the type of activity that has been widely promoted and adopted by STEMx<sup>TM</sup>. Figure 2-1 shows the current members of the organization. More information about the organization can be found online at <http://www.stemx.us/>.

**Figure 2-1: Current Membership in STEMx<sup>TM</sup> (as of March 2015, colors have known meaning)**

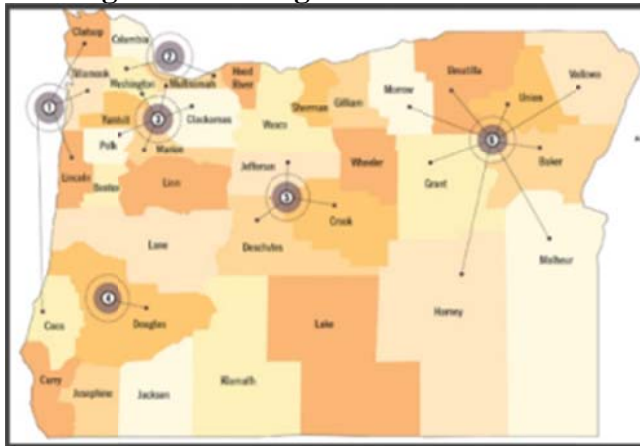


It is interesting to note that each state involved has formed a set of Regional Hubs to enact the state STEM innovation program. Two of these efforts are highlighted in the following section.

## 2.2 Select Examples of STEMx<sup>TM</sup> State Initiatives

**2.2.1 Oregon:** In 2014, as part of their STEMx<sup>TM</sup> membership and based on input from business and education organizations, the State of Oregon established the *Oregon STEM Education Initiative*: a STEM Hub system composed of regional hubs networked together to promote effective and coordinated changes in STEM education statewide. Figure 2-2 shows the initial STEM Hubs defined.

<sup>8</sup> OECD (21012). “PISA 2012 Results in Focus What 15-year-olds know and what they can do with what they know”. Available online at <http://www.oecd.org/pisa/keyfindings/pisa-2012-results.htm>. (Last accessed 3/6/15).

**Figure 2-2: Oregon STEM Initiative**

The specific goals of the Oregon STEM Education Initiative is to

- Define STEM education and goals related to preparation for college, careers, and citizenship.
- Identify critical components needed for improvement in STEM education.
- Describe a mechanism for linking educators and communities interested in improving STEM education.

The Initiative currently consists of: (1) the Central Oregon STEM Hub; (2) the East Metro STEAM Partnership; (3) the GO STEM Collaborative; (4) the Oregon Coast STEM Hub; (5) the Portland Metro STEM Partnership; (6) the South Metro-Salem STEM Partnership; (7) the Southern Oregon STEM Hub. More can be found about this system online at <http://stemoregon.org/regional-stem-hubs/>.

**2.2.2 New York:** New York joined STEMx<sup>TM</sup> as one of its founding state members. The New York State STEM Education Collaborative<sup>9</sup> was established January 2009 with the overarching goals of:

- transforming the New York State (NYS) MST Learning Standards into effective and meaningful STEM Education Learning Standards delivery;
- providing STEM learning symposia that encourage and facilitate sharing successful and innovative classroom STEM practices by presenters;
- carrying-forward the NYS STEM Education Collaborative foundational work with enlightening debate and constructive discussions;
- working together to ensure that accepted research and practice based STEM principles are applied in the ongoing development and implementation of new standards;
- supporting, integrating, and strengthening P-16 instruction and literacy in science, technology, engineering, and math; and
- advocating for the modification of existing assessments, with changes in written language and references, to realize STEM connections and for funding, school policy, teacher training and preparation to advance mutually envisioned STEM education approach

**2.2.3 Tennessee:** One of the STEMx<sup>TM</sup> networks that might be considered a "best practice" is the Tennessee STEM Innovation Network (TSIN). TSIN was established in 2010 as a partnership between the Battelle Memorial Institute and the Tennessee Department of Education. TSIN's goal is to create a "kindergarten to jobs" system of education focused on building a pipeline of high-quality STEM programming so that students are college and career-ready upon graduation from high school. The network consists of Six STEM Innovation Hubs. Each regional hub has developed its own array of STEM initiatives and interested partners to create effective educational systems specific to the needs of the schools, learners, teachers, and business and community partners in the region. The regional hub structure for the TSIN is shown in Figure 2-3.

<sup>9</sup> More information about the New York State STEM Education Collaborative can be found at <http://nysstemeducation.org/>.

**Figure 2-3: Tennessee STEM Innovation Network**

One of the unique aspects of the TSIN is a focus on teacher education. The Network created ten STEM-focused Platform Schools designed to function like learning labs, where educators are able to try out new and innovative ways of teaching.

Much like the "career academies" found in our region, the platform schools utilize partnerships with industry to create project-based learning units that incorporate actual situations that industry partners are striving to solve. In the platform schools students work to solve a common problem in all of their classes, regardless of the subject. The ten TSIN platform schools enroll over 4,000 students and are non-selective, making the dream of STEM careers available to all students regardless of aptitude or test scores. The Tennessee system is a strong model, and has produced impressive results. For example, as published on the TSIN website<sup>10</sup>:

- The 2013-2014 TCAP (Tennessee Comprehensive Assessment Program) data shows that approximately 100,000 additional Tennessee students are on grade level in math and 57,000 additional students are on grade level in science compared to 2010 statewide results. Particularly strong growth was shown in high school mathematics, leading to a greater level of readiness for those students about to enter college and career. 100% of STEM School Chattanooga's 11th grade students are enrolled in college courses and are receiving both high school and college credits. (The school is grades 9 – 11, adding 12th grade in 2015.)
- L&N STEM Academy in Knoxville graduated their first class in 2014 with a 100% graduation rate. Ninety-five percent of the graduates were headed to a 4 or 2 year university or the military.
- Southwind High School in Memphis is a 2014 Reward School for progress, and L&N STEM Academy is a 2014 Reward School for performance.
- The 2014 graduates from Stratford STEM Magnet High School in Nashville and L&N STEM Academy earned over \$6.5 Million in scholarships.
- Innovation Academy in Blountville and L&N STEM Academy both earned the designation of "Apple School of Distinction," making them the only two schools in Tennessee to earn the high honor.

Furthermore, Tennessee has three of the twenty forward-leaning communities identified by the White House as committed to working with each other and with national employers to expand access tech jobs. Techhire offers \$100 million in grants to a multi-sector initiative and call to action to empower Americans with the skills they need, through universities and community colleges but also nontraditional approaches like "coding boot camps," and high-quality online courses that can rapidly train workers for a well-paying jobs, often in just a few months.<sup>11</sup>

<sup>10</sup> Information taken from TSIN Website at <http://thetsin.org/about/tennessee-stem-successes/>

<sup>11</sup> Information found in White House press release, March 09, 2015. "President Obama Announces Multi-Sector Effort and Call to Action to Give Americans Pathways to Well-Paying Technology Jobs; Makes Available \$100 Million in Grants". Available online at <https://www.whitehouse.gov/the-press-office/2015/03/09/fact-sheet-president-obama-launches-new-techhire-initiative>. (Last Accessed 7 May, 2015).

Recently, the Jacksonville Chamber sponsored a trip to Nashville as a sister city that has many of the same characteristics of Northeast Florida. Nashville is in the Middle Tennessee STEM Innovation Hub. This hub includes the Metro Nashville Public Schools (MNPS) and recently was relocated to Belmont University, which provides a centralized location to support the region's educational advancement in (STEM). MNPS has 12 zoned high schools and 4 magnet high schools. Each high school offers at least one STEM pathway. Over 325 business partners engage daily in the development and delivery of curriculum. The STEM pathways were selected based on high-skill, high-wage careers or emerging careers within the middle Tennessee region. All STEM pathways are aligned with a postsecondary degree offered at a middle Tennessee college, university, or technical school. Over 20,000 high school students are in a career academy, many focused on STEM. We have one STEM Platform high school and two STEM Platform middle schools. The Center for Science Outreach at Vanderbilt University partners with the school district to provide PhD professors teaching alongside teachers in the elementary and secondary level. Students are exposed to real scientific research studies and projects.

### 2.3 Other Example State and Regional Initiatives

In addition to the coordinated state-wide efforts STEMx<sup>TM</sup>, there are an increasing number of examples where a specific Governor and/or local school districts, civic leaders and businesses are uniting to build STEM Hubs focused on the unique needs of their regions. The examples below are only a few of the many examples of these types of efforts around the country.

**2.3.1 Los Angeles:** The Los Angeles Area Chamber of Commerce has developed a regional STEM Hub for Los Angeles (L.A. STEM<sup>12</sup>). The Hub is not only working to develop operational concepts for collaboration to enhance and expand STEM disciplines, but is also including critical thinking and the arts (STEAM) LA STEM seeks to leverage the city's resources and civic institutions to increase the capacity for system-wide transformation of STEM education. Specifically, the HUB seeks to:

- Effectively partner with elementary, secondary and post-secondary education to produce the 21st Century workforce
- Identify STEM education, skills and competency goals
- Develop a unified STEM message from industry in greater Los Angeles to educators, parents and students.
- To identify STEM education, workforce development activities, goals and strategies to be fostered and scaled through collaboration across the L.A. STEM Hub network

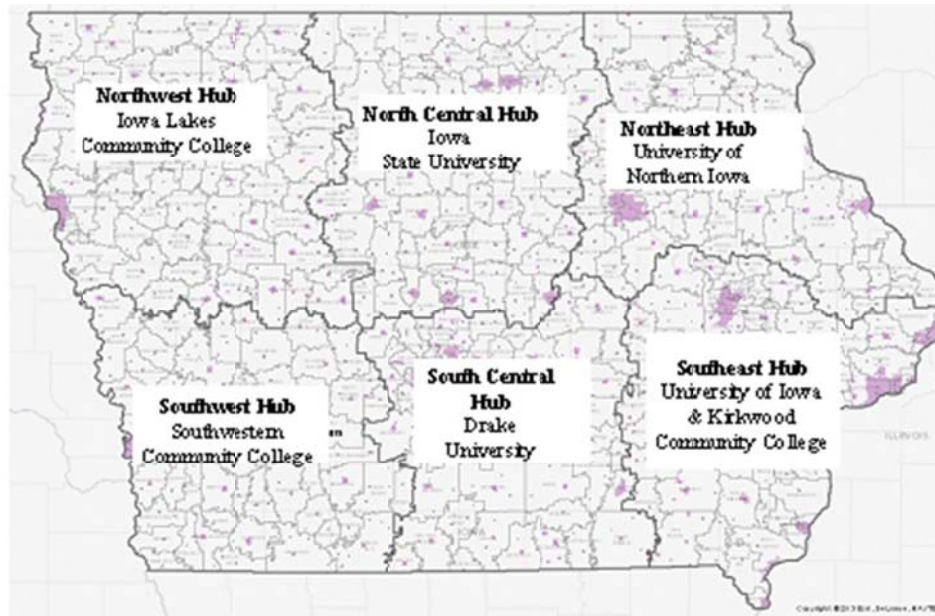
**2.3.2 Iowa:** Unlike the examples of New York and Oregon, Iowa has started a state-wide effort that is not affiliated with STEMx<sup>TM</sup> at this point. In 2011, through Executive Order 74, the Governor of Iowa created the Governor's STEM Advisory Council. The Council is a partnership of business, policy and education leaders from across the state convened to bolster STEM education and innovation and to better position Iowa's young people and the state's economy for the future. The Council is co-chaired by the Lieutenant Governor Kim Reynolds and Vermeer Corporation's President and CEO. The Iowa Mathematics and Science Education Partnership (IMSEP) is the program arm of the Governor's STEM

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<sup>12</sup> The LA STEM Hub's website is at <http://www.lachamber.com/webpage-directory/ed-and-workforce-stem/ed-and-workforce-lastemhub-main/>

Advisory Council and serves to coordinate a set of 6 regional STEM hubs. The STEM Hubs are led by a College or University located in each of the regions. In 2012, the State issued a request for proposals to the State's Colleges and universities to compete for a three-year agreement to serve as one of six regional hubs. The selected institutions were renewed for a second three-year contract in January of 2015. The regions and their lead institutions are shown in Figure 2-4.

**Figure 2-4: Iowa STEM Hubs**



**2.3.3 Southwestern Pennsylvania:** Another example of a regional Center or STEM Hub is the Chevron Center for STEM Education and Career Development that was established by the Carnegie Science Center in 2011. In 2014, the Center completed a State of STEM study<sup>13</sup> for the tri-state region centered in southwestern Pennsylvania. The findings of this study are relevant to the Northeast Florida region as well, most notable:

- The U.S. ranks 27<sup>th</sup> among developed nations in the proportion of students receiving undergraduate degrees in science or engineering.
- The World Economic Forum ranks the United States 48<sup>th</sup> in the quality of mathematics and science education.
- China has replaced the U.S. as the world's number one big-technology exporter.
- In 2010, people with jobs in STEM<sup>2</sup> fields earned 26% more than those employed in non-STEM<sup>2</sup> fields.
- 65% of graduates with bachelor's degree in a STEM<sup>2</sup> field earn more than those with master's degrees in non-STEM<sup>2</sup> fields.
- Graduates with an associate degree in a STEM<sup>2</sup> field earn more than those with a bachelor's degree in a non-STEM<sup>2</sup> field.

<sup>13</sup> Carnegie Science Center (2014). "Work to Do The Role of STEM Education in Improving the Tri-State Region's Workforce". Study conducted by Campos Research Strategies, Inc. Report is available at [www.campos.com](http://www.campos.com)

The study also reported on the perceptions and attitudes about STEM<sup>2</sup> and its potential for workforce development among teachers, parents, students and business leaders. The major results are both summarized below:

- Many parents, educators, and business leaders believe that schools must do a better job of preparing tomorrow's workforce. The U.S. is perceived to be far behind in math and science.
- Parents' awareness of and understanding about STEM<sup>2</sup> is low throughout the region. It is at its lowest in rural areas.
- Educators and business leaders identify key prerequisites for robust STEM<sup>2</sup> education, the most important of which is making it engaging to students—collaborative, hands-on, problem-solving, and project-based.
- Parents' underlying attitudes about education and careers align with many STEM<sup>2</sup> fundamentals.
- Educators and business leaders are adamant in their opinions that STEM<sup>2</sup> education is for all students.
- The current language around STEM<sup>2</sup> is not resonating with parents.
- Business leaders believe that quality STEM<sup>2</sup> education can help develop the next generation of collaborative problem-solvers as a way to close the regional workforce gap of skilled workers.
- Most educators say that STEM<sup>2</sup> education is becoming more of a priority, but there are differences by region. Rural areas represent the greatest opportunity for STEM<sup>2</sup> education related careers in new industries.
- Educators identify major obstacles to STEM<sup>2</sup> education both inside and outside of school and the classroom.

In May 2015 the center hosted a bi-partisan Congressional briefing in Washington DC to present the STEM-related work the organization has been doing in the Pittsburgh region as a national model to expand quality science, technology, engineering and math education.<sup>14</sup>

**2.3.4 Central Florida:** Florida Polytechnic University in Lakeland was established in 2012 as the only higher education institution in the Florida State University System wholly dedicated to STEM (science, technology, engineering and mathematics). Florida Poly was founded by the Legislature and Governor to help fill a critical need for STEM professionals in Central Florida and to leverage business/community partnerships in the region to create a hub of knowledge and resources for driving economic development. Through business partnerships, an industry-inspired curriculum and applied research for real-world application, Florida Poly not only strives to increase the number of STEM graduates to fill high-tech jobs, but also to attract technology-based businesses to Florida. The new University is developing plans for a research park that would attract and concentrate high-tech businesses around the University's campus, thus helping to catalyze technology as a primary economic driver for the region and state.

Florida Poly is located along the I-4 High Tech Corridor halfway between Tampa and Orlando. This creates ample opportunities for collaboration with tech-based businesses and organizations. The region includes more than 20 regional or local economic development groups and 70 percent of the state's high-tech companies. Before the University opened for classes in August 2014, it already had formal

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<sup>14</sup> Justine Coyne, "Carnegie Science Center hosts Congressional briefing on STEM" In the Pittsburgh Business Times, Morning Edition, March 19, 2015. Available online at <http://www.bizjournals.com/pittsburgh/blog/morning-edition/2015/03/carnegie-science-center-hosts-congressional.html> (Last Accessed 8 May, 2015).

industry partnerships with more than 75 firms. These partners support the University by helping to shape an industry-inspired curriculum, participating in joint research and providing internship and employment opportunities for Florida Poly students.

The University's Strategic Plan is to deliver core STEM education in fast-growing high-tech areas, to work with industry to foster problem-driven research for near-term impact, to grow business and community partnerships, and to maintain organizational efficiency. Through this focus, Florida Poly is:

- Creating avenues for joint research for product development
- Supplying talent for internships and STEM jobs in high demand
- Enabling knowledge building and information sharing
- Ensuring curriculum is relevant to the needs of industry
- Acting as a STEM resource for high schools and middle schools, including partnering to host an annual medical engineering and robotics camp

## 2.4 Northeast Florida

Other states have been developing STEM Hubs as well, and if Jacksonville is to maintain a competitive edge, it seems probable that a coordinated effort in STEM education across multiple organizations is one important and necessary step. Leaders in our community recognize the importance of focusing energy and resources on this effort. In fact, our community is passionate about making our region a STEM<sup>2</sup> Regional Hub. Below is a cross section of our community's voices:

*"Our region can make a significant difference in accelerating the growth of STEM<sup>2</sup> education. It will require visionary leadership, determination, commitment, and a passion to rebel against the status quo. The future belongs to those who create it. The time to act is now!"* Gary Chartrand, Chair Acosta Inc.

*"I believe we can do this (build a significant regional STEM<sup>2</sup> hub)."* John Baker, Executive Chairman Patriot Transportation Holdings, Inc.

*"I am in, what do you need from me?"* Karen Bowling, former CAO City of Jacksonville

*"It's exciting for Jacksonville and Northeast Florida to be taking an innovative, groundbreaking leadership role in this essential element for a successful future."* Walt Bussells, President Forbes Street Capital

*"We need to duplicate successful business/school partnerships."* Steve Halverson, CEO The Haskell Company

*"Companies want an entity that will manage their STEM<sup>2</sup> dollars they invest in STEM<sup>2</sup> programs like a business, we need to know that we are getting a real return on our investment."* Michael Oates, FIS General Counsel

*"We need this focus on STEM<sup>2</sup> in our region. This is the right time; this is the right direction."* Ben Warner, former President & CEO, JCCI

*"Make me believe in the vision with short-term results and I am in."* Jim Stallings, Managing Partner PS 27 Ventures

*"(When it comes to STEM<sup>2</sup> in our region) we need to capture the imagination of our kids."* Dr. Bruce Taylor, CEO/Chairman Taylor Engineering

*"We need business partners that take the lead on supporting our region's STEM<sup>2</sup> education programs so I can focus on what I do best: educate."* Vicki Schultz, Principal Sandalwood High School

**2.4.1 What will the STEM<sup>2</sup> Hub provide?:** The STEM<sup>2</sup> Hub will be the base infrastructure needed to coordinate and execute the vision of providing the essential missing elements to accelerate the growth of STEM<sup>2</sup> education and careers. It will do this by providing the following main components for both the education and business components of STEM<sup>2</sup>.

2.4.1(a) Convening STEM<sup>2</sup> Partners: The STEM<sup>2</sup> Hub will be the base infrastructure needed to coordinate and execute the vision of providing the essential missing elements needed to accelerate the growth of STEM<sup>2</sup> education and careers. The Hub will bring together three sectors—business, education, and the community – to focus on eight key pillars needed for success.

2.4.1(b) Guiding Shared Vision, Goals and Strategies: There is currently no single point of convergence for the disparate ideas, organizations, or programs that relate to STEM<sup>2</sup> in our community. By creating an organization that is focused on setting goals to improve outcomes, the STEM<sup>2</sup> Hub can be the place to provide structure and organization. Furthermore, it can provide a well thought out strategy on how to achieve those outcomes, and hold organizations accountable for their role in improving STEM<sup>2</sup>.

2.4.1(c) Advancing Policy: The Hub will highlight and showcase best practice approaches to establishing a vibrant regional STEM Hub and advance any policy changes required to support this vision.

2.4.1(d) Establish Shared Measures and Practices on Behalf of the STEM<sup>2</sup> Partners: As Yogi Berra once said “*If you don't know where you are going, you might wind up someplace else.*” The STEM<sup>2</sup> Hub’s first responsibility will be to complete a “State of STEM<sup>2</sup> Report” for Northeast Florida. It will then use the data and baselines to set measureable, achievable goals and continue to track our success.

2.4.1(e) Supporting Aligned Activities to Achieve Shared Goals: The Hub will also create programs where voids exist. Beginning with the K4-12 sector, where exposure to STEM<sup>2</sup> fields can help grow the input of students who focus on STEM<sup>2</sup> education so that we can produce the needed larger output of STEM<sup>2</sup> students. We will start by increasing the numbers of after -school programs focusing on STEM<sup>2</sup>, as well as working with higher education to increase the size and attractiveness of their STEM<sup>2</sup> programs. On the business side we will encourage, cultivate, and support STEM<sup>2</sup> businesses as an important part of growing the ecosySTEM in our region. There is opportunity to partner with or develop an incubator/accelerator program to help launch business ideas in Northeast Florida. Helping to connect capital to these entrepreneurs, as well as making sure there is pathway from idea to profitability could ultimately put the exclamation point on a vibrant STEM<sup>2</sup> ecosySTEM!

2.4.1(f) Building Public Passion: The Hub believes it is important to communicate and celebrate our regional successes to attract even more talent to the STEM<sup>2</sup> fields. Communicating the success of education programs as well as startup and established businesses is crucial to attracting more talent to the area, internally and externally.

2.4.1(g) Mobilizing Funding: The Hub will engage with national non-profits and government to help identify, write, and bring STEM<sup>2</sup> grants to Jacksonville. The Hub will work with our regional partners to ensure we establish a best practice approach to competing for national grants.

2.4.1 (h) Fostering Business Opportunities: Encouraging, cultivating, and supporting STEM<sup>2</sup> businesses is an important part of growing the ecosySTEM. We believe there is opportunity to partner with or develop an incubator/accelerator program to help launch business ideas in Northeast Florida. Helping to connect capital to these entrepreneurs, as well as making sure there is pathway from idea to profitability could ultimately put the exclamation point on a vibrant STEM<sup>2</sup> ecosySTEM.



## SECTION 3 BASELINE FOR THE STATE OF STEM<sup>2</sup> IN NORTHEAST FLORIDA

### 3.1 Baseline Metrics

In all the examples of STEM Hubs, Partnerships or other structures to promote STEM activities presented in Section 2, the first step to establishing a viable organization was to conduct a survey of the existing activities, organizations and assets associated with STEM in the region and measure a baseline of activity. This is why the plan is that the STEM<sup>2</sup> Hub will present an annual State of STEM<sup>2</sup> in Northeast Florida report. Unfortunately, there are very few baseline metrics for Northeast Florida when it comes to measuring STEM<sup>2</sup> activity. Some national organizations do provide localized bits of information. For example, [nerd.wallet.com](http://nerd.wallet.com) calculates the Jacksonville region as being in the lower third quartile nationally when it comes to generating STEM<sup>2</sup> career opportunities in its region.<sup>15</sup>

**3.1.1 State Wide Data:** In January of 2009, Enterprise Florida's Strategy Council issued a Discussion Paper<sup>16</sup> that outlined its findings relative to the current state of STEM education and reported that Florida, much like the rest of the country, was failing to develop an adequate supply of STEM - capable workers. This was not unexpected finding as a 2006 report by the National Center for Public Policy and Higher Education<sup>17</sup> had stated

*“Florida’s underperformance in educating its young population could limit the state’s access to a competitive workforce and weaken its economy over time. As the well - educated baby boomer generation begins to retire, the diverse young population that will replace it does not appear prepared educationally to maintain or enhance the state’s position in a global economy.”*

As mentioned in Section 3, following Enterprise Florida's paper, the Florida Center for Research in STEM, produced a report for STEM Florida entitled *“The State of STEM in Florida: A Snapshot”*<sup>18</sup> that presented baseline data on several metrics the state. Some findings of particular note include:

- Currently less than 50% of Florida's students perform at or above grade level in science.
- Performance levels decline from grades 5 to 11.
- In 2009, over 2/3 of the districts in Florida had fewer than 68% of their Grade 3 - 10 student population performing on grade level and above in mathematics.
- Only 8 districts had at least 74% of their Grade 3 - 10 student population performing on grade level and above in mathematics.

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<sup>15</sup> From [nerd.wallet.com](http://nerd.wallet.com), Best Places STEM Graduates

<sup>16</sup> Strategy Council Ad-Hoc Subcommittee on K-12 STEM Education Discussion Paper, Enterprise Florida, 2009.

<sup>17</sup> Hunt, James B., Jr.; Carruthers, Garrey; Callan, Patrick M.; Ewell, Peter T. (2006): *Measuring up 2006: The State Report Card on Higher Education, Florida*. Published by The National Center for Public Policy and Higher Education, San Jose California. Available online at <http://eric.ed.gov/?id=ED493360> (last accessed on 3/11/15).

<sup>18</sup> Laura B. Lang, Mabry Gaboardi, Frank Fuller, & Christine Johnson (2010): *The State of STEM in Florida: A Snapshot*. Produced by The Florida Center for Research in Science, Technology, Engineering, and Mathematics, Florida State University, Tallahassee, Florida (January, 2010). Available online at [http://www.helios.org/uploads/docs/StateofSTEM\\_Final.pdf](http://www.helios.org/uploads/docs/StateofSTEM_Final.pdf) (Last Accessed on 3/11/15).

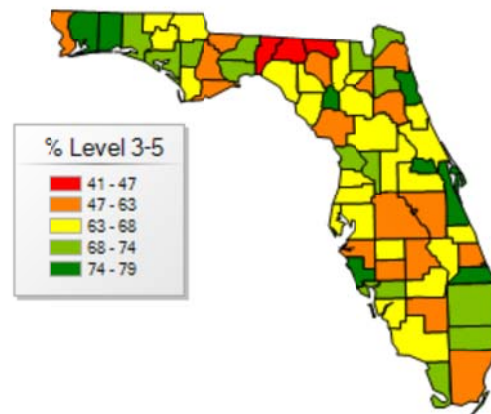
Of specific concern for northeast Florida was the fact that of the ten school districts with the highest student enrollment, accounting for about 60% of PreK - 12 student enrollment, Duval County had one of the lowest percentages of students performing at or above their grade-level in mathematics (See Table 3-1). The results of the 2009 survey across the state are shown in Figure 3-1

**Table 3-1  
Results for Ten Highest Enrollment Districts**

Districts	Percent of student population at grade level or above
Dade, Duval, Polk	47-63
Hillsborough, Lee, Orange, Pinellas	63-68
Broward, Palm Beach	68-74
Brevard	74-79

**Figure 3-1**

2009 Grades 3-10 Performing on Grade Level and Above (Math)



**3.1.2 Data from the Jacksonville Community Council, Inc. (JCCI):** In 2013, JCCI facilitated Jacksonville's largest community-driven vision for the future, JAX2025. Of particular note for this report are two specific JAX2025 vision targets: (a) Excellence in Education: in 2025-Jacksonville prioritizes excellence in education at every age; and (b) Vibrant Economy: in 2025-Jacksonville's vibrant economy is a global magnet for new business. The organization developed a set of community indicators around these vision targets and collected data to provide insight into the trends in a community, over time. Table 3-2 shows the specific indicators for the two vision targets "Excellence in Education" and "Vibrant Economy" for the seven counties in the region and the data for 2013. Details on the data sources, calculation of the indicators and historical data over various periods are available at the JCI website <http://www.communitysnapshot.org/>.

**Table 3-2: Example Indicators and Data from JCCI Community Snapshot**

**Excellence in Education**

Indicator	Baker	Clay	Duval	Flagler	Nassau	Putnam	St. Johns
Kindergarten Readiness	95%	94%	88%	ND*	93%	ND	97%
High School Graduation Rate	75.2%	80.1%	74.0%	77.8%	89.9%	58.2%	87.8%
Adults with Bachelor Degrees or Higher	10%	22.5%	27.4%	20.9%	23.0%	13.4%	41.0%

**Table 3-2 (continued) Example Indicators and Data from JCCI Community Snapshot****Vibrant Economy**

<b>Indicator</b>	<b>Baker</b>	<b>Clay</b>	<b>Duval</b>	<b>Flagler</b>	<b>Nassau</b>	<b>Putnam</b>	<b>St. Johns</b>
Employment Growth	3.0%	8.4%	2.8%	3.5%	3.6%	0.6%	5.6%
Unemployment Rate	6.7%	6.3%	7.4%	10.2%	6.2%	9.4%	5.6%
Per Capita income	\$26,670	\$35,987	\$42,423	\$36,753	\$45,817	\$28,594	\$54,082
Percent in Poverty	17.3%	9.1%	17.1%	16.2%	15.6%	26.3%	9.7%

\* ND = No Data Reported

**3.2 Surveying Northeast Florida for Baseline Information**

The lack of a clear, concise and widely accepted set of quantitative and qualitative metrics for the region's STEM<sup>2</sup> activity is one of the first goals for the STEM<sup>2</sup> Hub. However, a lack of metrics does not mean that there is a lack of activity or a lack of significant impact from those activities – it merely means we are not uniformly measuring that impact.

As an initial step to build the necessary understanding of the State of STEM<sup>2</sup> in Northeast Florida, a survey was sent to as many organizations and individuals that could be identified as having activities or programs related to STEM. As there are a myriad of activities related to STEM<sup>2</sup> currently ongoing, it was not possible in this initial survey to ensure all possible organizations were included, and in some instances, no response was received. However, in order to establish a baseline, major players, including school districts, institutions of higher education, and well-known entities were contacted. Table 3-3 shows the list of individuals and organizations to which a short survey was sent.

**Table 3-3: Recipients of Initial STEM<sup>2</sup> Activity Survey**

ACE Mentoring	JAXNAP
Baker County School District	JAXPort
Cecil Commerce Center	JAXUSA Partnership
Children's Commission	Museum of Science and History (MOSH)
Clay County Public School District	Nassau County Public School District
Communities in Schools	Naval Air Station JAX
Duval County Public School District	Naval Station Mayport
Edward Waters College	Pragmatic Works (Brian Knight)
Flagler College	RSCA
Florida State College Jacksonville	Schultz Center
Girls Scouts	St Johns County Public School District
Jacksonville Community Council, Inc. (JCCI)	Stellar
Jacksonville University	University of North Florida
Jacksonville Zoo and Gardens	Wolfson's Children's Hospital

A copy of the survey is found in Appendix A of this report. Sections 4 and 5 of this report are devoted to highlighting a few of the myriad of current, ongoing activities related to STEM<sup>2</sup>, summarizing our initial findings on the unique assets of the region (Section 4) and focusing on important educational assets in the region.

## SECTION 4 EXAMPLES OF UNIQUE ASSETS IN NORTHEAST FLORIDA

### 4.1 Unique Facilities

As mentioned earlier the STEM<sup>2</sup> Hub will be the base infrastructure needed to coordinate and execute the vision of providing the essential missing elements needed to accelerate the growth of STEM<sup>2</sup> education and careers. The STEM<sup>2</sup> Hub is similar to the central part of a wheel from which the spokes radiate, thereby ensuring the whole wheel moves forward together. Our region already has many unique stakeholders who create the foundation for our regional STEM<sup>2</sup> infrastructure. The following is a sampling of some of these unique assets.

**4.1.1 Cecil Commerce Center:** Jacksonville's strategic Northeast Florida location means unparalleled global access through both a deep water port and a prime position at the crossroads of three major railroads, three major highways and four airports. Add to these logistical assets a strong manufacturing base, a young dynamic workforce with 21st century skills and more than \$317.5 million in infrastructure and utility improvements. The result: An industrial center leading in global quality, speed and access. There is no better place to leverage those advantages than Cecil Commerce Center®, an industrial development offering huge opportunity in more than 4,700 available acres, shovel-ready sites, and multimodal connections that put domestic and global markets within easy reach.

**4.1.2 JAX NAP:** Located in Jacksonville, Florida the JAX NAP is the premier fiber connection point between Atlanta and Miami. Situated in the heart of downtown Jacksonville, Florida and adjacent to the AT&T switch hub and the JEA chilled water plant, the NAP is strategically located at the crossroad of the North - South and East West fiber routes. The NAP comprises 240,000 sq. ft. of floor area with 8 - 30,000 sq. ft. floor plates. Jax NAP is home to the largest concentration of lit and dark fiber in northeast Florida. With a wide selection of domestic and international fiber backbones and Carriers in our facility, the Jax NAP provides exceptional connectivity for Carriers or Network users. JAX NAP core infrastructure and utility grade structure is rated to withstand hurricane category 5 forces, and features state-of-the-art security, power, cooling, and diverse fiber network systems to ensure maximum reliability and peace of mind. With a neutral central landing facility for fiber entering the NAP, we make interconnection to building tenants simple, inexpensive and extremely fast. The JAX NAP has northeast Florida's only triple redundant utility spot network with fourteen megawatts on the most reliable municipal owned electric grid in Florida. We are the hosting home the Jax IX internet exchange with available peering to all networks.

**4.1.3 JAXPORT:** In 2014, following extensive research and analysis, JAXPORT finalized a new Strategic Master Plan to lead the port and the Northeast Florida region into the future. This roadmap to success was developed using internal trade and capacity analytics as well as in-depth assessments of industry trends and forecasts. We also looked to our valued customers and tenants for feedback to ensure our goals are in line with the demands of this rapidly changing business. The plan features four major JAXPORT business goals and the strategies to achieve them. The Strategic Master Plan also includes our pledge to the community to maximize the use of the public assets entrusted to us to create jobs and opportunity and to always demand a measurable return for the dollars invested in our facilities.

**4.1.4 Military Installations:** Northeast Florida has several military bases within its region.

4.1.4(a) Naval Air Station JAX: Enable Naval Aviation war-fighting readiness by supporting the Fleet, Fighter, and Family. Today, almost 19,000 civilian and active-duty personnel are employed on the base. The installation is considered to be one of the hubs for naval activity in the U.S. South. Other U.S. Navy Bases in the area include Naval Station Mayport, Naval Submarine Base Kings Bay in Camden County, Georgia, Naval Outlying Landing Field Whitehouse (just north of the former NAS Cecil Field) and the Pinecastle Range Complex stretching from just south of Camp Blanding to the southern border of the Ocala National Forest.

4.1.4(b) Naval Station Mayport: Sustain and enhance war fighter readiness by providing support to the Fleet and to our Sailors. Mayport is a major United States Navy base in Jacksonville, Florida. Today, 10,000 civilian and active-duty personnel are employed on the base. It contains a protected harbor that can accommodate aircraft carrier-size vessels, ship's intermediate maintenance activity (SIMA) and a military airfield (Admiral David L. McDonald Field) with one asphalt paved runway (5/23) measuring 8,001 × 200 ft. (2,439 × 61 m).

4.1.4(c) Camp Blanding: Joint Training Center is the primary military reservation and training base for the Florida National Guard, both the Florida Army National Guard and certain non-flying activities of the Florida Air National Guard. Blount Island Command: Responsible for the United States Marine Corps' Maritime Prepositioning Ships (MPS) Maintenance Cycle operations and oversight of the Marine Corps Prepositioning Program-Norway.

4.1.4(d) Florida Air National Guard at JIA: The air force militia of the State of Florida is a component of the air force militia of the United States. Along with the Florida Army National Guard, it is an element of the Florida National Guard.

**4.1.5 OneSpark:** One Spark is about connecting people with great ideas to the resources they need to make them a reality. The Mission of One Spark is to connect ideas to the resources they need through the world's largest crowd-funding festival. It is built on the premise that great creations can come from garages, small studios, and dorm rooms and that the only thing that separates them from the big dogs is access to capital and resources. The selection process for One Spark is completely independent. Venues select which Creators showcase in their spaces and attendees decide who gets funded. In 2015, One Spark gave creators access to \$300,000 in crowd-funding and prize money plus millions of dollars worth of capital from potential investors.

**4.1.6 Schultz Center:** Founded with a vision to transform public education through the development of expert teachers and school leaders, The Schultz Center is a community asset developed with private contributions and tax dollars to serve the multi-faceted learning needs of the region. The Schultz Center has more than a decade of experience in creating learning solutions with partners – primarily in the education sector. As a nonprofit agency with a vision of creating a culture of learning within organizations, educational institutions and communities, the Center has experience in collaborative partnerships between sectors. It also offers a full suite of learning services from our premier conference facility located five minutes from downtown with free parking, to unique use of the Blackboard Learning Management System for effective adult professional development.

**4.1.7 *Wolfson's Children's Hospital:*** Recognized year after year as one of America's Best Children's Hospitals by *U.S. News & World Report*, 213-bed Wolfson Children's Hospital is the only full-service tertiary hospital for children in the region, serving North Florida, South Georgia and beyond. We provide care for all children, regardless of their ability to pay. Wolfson Children's Hospital is a part of Baptist Health, the region's most comprehensive healthcare provider. Baptist Health's circle of care includes five nationally accredited hospitals and more than 70 primary care and specialty offices, as well as home health, rehabilitation and urgent care. The world-class pediatric care available at Wolfson Children's Hospital is made possible by the support of Baptist Health Foundation and enhanced through physician partnerships with Nemours Children's Specialty Care, Jacksonville, the University of Florida College of Medicine – Jacksonville, Brooks Rehabilitation and Mayo Clinic.

A non-profit organization, Wolfson Children's Hospital relies on charitable donations to provide world-class care for all children in the region. With the aid of an initial \$500,000 donation from the Wolfson Family Foundation, the hospital opened in 1955 as a place for all children to be admitted and treated without regard to creed, religion, race or financial position. That original mission remains today. In addition to providing the best pediatric care, as evidenced by Wolfson Children's Hospital's selection as one of only two children's hospitals in Florida to receive Magnet™ status in 2007 and again in 2012, Wolfson Children's Hospital is a growing center of research and a leading teaching hospital dedicated to training tomorrow's pediatric doctors, nurses and technical staff. Serving as the main teaching facility for the University of Florida College of Medicine – Jacksonville Pediatric Residency Training Program, Wolfson Children's is also affiliated with premier nursing programs, including those at the University of North Florida, Jacksonville University, Florida State College Jacksonville, St. Johns River State College, the University of Florida, Florida State University and the University of Central Florida.

## **4.2 Examples of Private/Non-Profit Organizations Supporting STEM<sup>2</sup>**

**4.2.1 *ACE Mentoring:*** The ACE Mentoring program was founded during the 2006-2007 school year with significant support from the Associated Builders and Contractors (ABC), the ACE Mentor Program of Northeast Florida, helps high school students explore potential careers in architecture, construction and engineering. Through the program, mentors from local industry professional firms meet with students for two hours once a week for 16 weeks. During these sessions, students work in teams to create practical solutions for “real-world” projects. It's an effective way for students to experience the reality of what architects, contractors and engineers do during a typical working day. The program is in its seventh year and has teams from five schools – A. Philip Randolph Academies of Technology, Orange Park High School, Englewood High School, Lee High School and Middleburg High School.

**4.2.2 *BSA North Florida Council:*** The Boy Scouts of America is one of the nation's largest and most prominent values-based youth development organizations. The BSA provides a program for young people that builds character, trains them in the responsibilities of participating citizenship, and develops personal fitness. Through almost 7,000 volunteers the North Florida Council serves over 57,000 youth in over 850 units. The North Florida Council also owns, maintains and operates two camps. The Boy Scouts of America's NOVA Awards program incorporates learning with cool activities and exposure to science, technology, engineering and mathematics for Cub Scouts, Boy Scouts, and Venturers. The hope is that the requirements and activities for earning these awards stimulates interest in STEM-related fields and shows how science, technology, engineering and mathematics apply to everyday living and the world around them.

**4.2.3 *Charlton Camps for Aviation, Science and Technology Training (CCASTT) Foundation:*** For the past three years, the CCASTT Foundation has organized the Jacksonville Aviation Career Education (ACE) program at Ribault High School. The program is a nationally recognized program co-sponsored by the Federal Aviation Administration and the National Black Coalition of Federal Aviation Employees. The camp consists of a week-long program offered at Ribault by a coalition of partners including the UNF School of Engineering, Communities in Schools, Jacksonville University, Florida State College of Jacksonville, Jacksonville Aviation Authority, Florida Air National Guard, United States Coast Guard, Jacksonville Fire and Rescue Department, and the Aeroism Flight Academy. The Academy offers an interactive introduction to the aviation industry and careers to middle and high school students. The purpose of the academy is to introduce youth to the world of aviation by exposing them to the many challenging careers and opportunities the industry has to offer. Students have the opportunity to interact with active professionals from the aviation community, receive career mentoring, take field trips, and see how professionals achieve their goals. The academy concludes with students taking an orientation flight.

**4.2.4 *Communities In Schools of Jacksonville:*** Communities In Schools (CIS) is a nonprofit that provides dropout prevention services to students in Duval County Public Schools. CIS was incorporated in 1989 in response to a school dropout prevention study conducted by the Jacksonville Community Council Inc. In 1996, the organization became the first local program in Florida to achieve a chartered status. In 1998, CIS was chosen to operate the first four after school programs which are now known as TEAM UP and in 1999, the DUVAL READS literacy program started with ten members in five elementary schools. By 2006, the DUVAL READS program was recognized as the largest and most successful of its kind in Florida with 82% of students improving overall. Communities In Schools now serves more than 6,900 students in 37 Duval County Public Schools. It is the largest CIS affiliate in the state of Florida and the fourth largest in the country.

Communities In Schools has long recognized STEM as a critical component of learning for our students and have worked to make it a part of the services brought to students. As a result of their long history, CIS has significant credibility among students and caregivers as an organization that can be counted on to deliver quality programming. They have access to thousands of students during the crucial after-school and summer periods when learning and academic gains often suffer. STEM is a priority of the organization's after-school program which reaches 3000 students every day. Some of the notable STEM programs include:

- partnering with Haskell Company to implement a STEM component in the after-school program at Mathew Gilbert Middle School.
- implementing two summer STEM camps at A. Philip Randolph Academies of Technology and Terry Parker High School. These camps have partnered with Jacksonville University, St. Johns Riverkeeper and other organizations to provide a quality summer experience to our students.
- signing a memorandum of understanding with the Environmental Protection Agency to provide educational opportunities to students that enhance their understanding of environmental issues impacting our community.
- providing quality summer camps to 1200 students at 20 sites. A STEM component could be worked into these camps serving hundreds of minority students.

**4.2.5 Gandhi Memorial Society:** The mission of Gandhi Memorial Society is to promote and present programs and activities devoted to the advancement of charitable, and other worthwhile humanitarian causes. The organization has been working in the STEM field for last 10 years and helps approximately 150 kids interested in STEM fields every year. They follow the US FIRST curriculum, values and principles and use hands-on learning activities in all STEM areas. The society has run Julia Landon Middle School's Robotics Club for 2 years and helped Robert E. Lee High School's FRC Robotics Club. The mentors and coaches involved in these programs are engineers and scientists. The teams the society supports are being studied and researched by FIRST (Brandeis University). The Gandhi Memorial Society runs year-long STEM programs at all levels and their success is visible in the numerous awards and trophies won in various competitions.

**4.2.6 Girl Scouts of Gateway Council:** The Girl Scouts began 100 years ago with Girl Scouts' founder Juliette Gordon "Daisy" Low, who believed in the power of every girl. She organized the first Girl Scout troop in Savannah in 1912. The organization is the preeminent leadership development organization for girls and counts 2 million girls and 800,000 adults as members world-wide. The Gateway Council represents over 9,000 girls in 16 Northeast Florida Counties. They have strong partnerships with communities with subject matter experts in STEM fields. The Girl Scout Research Institute (GSRI) has found that girls' future career choices are more influenced by role models than by academic interests. As a girl-led organization, they introduce more Florida girls to female leaders in STEM than any other organization. Every Girl Scout led event has a STEM component built into the curriculum and provides more than 9,000 girls with hands-on experiences in STEM in a supportive, all-girl environment where they don't have to compete with boys for attention. For example, the Girl Scouts take STEM to the outdoors at Girl Scout properties through such programs as Living in Florida Environments – which is a partnership with Clay County Schools and the US Department of Defense.

**4.2.7 Jacksonville Community Council, Inc.:** JCCI is a truly unique civic organization consisting of community leaders, advocates, and experts. The organization is governed by a Board of Directors comprised of business professionals, community leaders, and a diverse group of engaged citizens. JCCI's history stretches back over 130 years to 1883, when Jacksonville faced a smallpox epidemic and a citizen's committee, led by Colonel James Jaquelin Daniel, was quickly formed and brought together business, charitable organizations, healthcare systems, and government to respond to the problem. In January 1975, after many decades of outstanding service and several incarnations under different names, the group became the Jacksonville Council on Citizen Involvement, which later changed its name to the Jacksonville Community Council Inc. Mr. J.J. Daniel, grandson and namesake of Colonel Daniel, was the first chair. In 2013, JCCI facilitated Jacksonville's largest community-driven vision for the future, JAX2025<sup>19</sup>. Of particular note for this report are two specific JAX2025 vision targets: (a) Excellence in Education: in 2025-Jacksonville prioritizes excellence in education at every age; and (b) Vibrant Economy: in 2025-Jacksonville's vibrant economy is a global magnet for new business. The vision of the STEM<sup>2</sup> Hub is directly aligned with these two targets and will accelerate progress toward reaching the JAX2025 vision.

**4.2.8 Jacksonville Zoo and Gardens:** The Jacksonville Zoo and Gardens is an award-winning zoological, cultural and education institution in Northeast Florida. The Jacksonville Zoo and Gardens offers a unique, hands-on learning environment to advance STEM<sup>2</sup> education at all levels including (a) use of Animal Ambassadors, (b) educational biological artifacts and (c) opportunities to use the Zoo

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<sup>19</sup> According to the JCCI Website, "JAX2025 is Jacksonville's community developed platform for action and change. It's about becoming the city we want to be by creating a shared vision, finding solutions, making them real, and identifying leaders for our future." See <http://www.jcci.org/#!jax2025/cdmr>



and Gardens as a learning center. There are a variety of programming opportunities –such as science programs (ex. Anatomy and Physiology), exhibit design (Engineering and Math), landscaping, citizen science, and career-based programming. The Zoo also has the ability to bring the majority of programs to schools.

**4.2.9 JAXUSA Partnerships:** The JAX Chamber, with its economic development division JAXUSA Partnership, together make up one of the top five chambers of commerce in the nation in member size and geographic reach. For more than 15 years, the business community has identified education and workforce development as a top concern for both quality of life and economic competitiveness. To address the gap between current supply and industry demand for a skilled STEM workforce, the Chamber has served as convener of industry and education to address the needs and acts as a small-scale program provider to directly connect teachers and students with educational and career opportunities in STEM. Through its convening role, the JAXUSA Partnership has helped to make connections and form partnerships by inviting education leaders to hear from industry executives about in-demand skills and spurring to action those employers to in turn engage hands-on with schools. As direct service providers, the Partnership has three programs that provide information about career pathways in STEM occupations, including:

- **Teacher Fellowship Externships** – summer program linking regional high school teachers with STEM-related employers to learn current industry trends and workforce needs through on-site visitations, tours and demonstrations at workplaces throughout the region. Teachers take information learned and working in teams, develop hands-on learning activities and lesson plans to deliver the knowledge to students during the coming school year.
- **Future Jobs** – Through video vignettes, a website and printed posters, we share information about the exciting careers available in STEM fields, the education required for those careers and the attractive pay those careers offer. Profiles have included an Ethical Hacker, Zoologist and Mechanical Engineer among others. See more at CareerAcademies.net and click the “students” tab.
- **Grad Path** – A program for college students close to graduation, Grad Path is designed to share the real picture of employer demand in the region—including the lack of graduates in STEM fields—and encourages liberal arts students to consider graduate education in technical fields as a possible hybrid career pathway.

**4.2.10 The Museum of Science & History:** The Museum of Science and History (MOSH) offers daily programs, school programs, and special events. MOSH has a strong introductory (1 hour and 30 minute long) teacher training program in place that starts teachers down the path to understanding the importance of inquiry-based science lessons. The training also gets them started thinking about subjects that can be effective inquiry lessons. This workshop is a collaboration among MOSH, NASA, CPALMS and Accelerate Learning. To date, this training program has been utilized by:

- 45 visiting home school parents through MOSH’s Home School Days program.
- 35 DCPS families through a program coordinated between MOSH and the Department of Family Involvement at DCPS;
- 20 afterschool educators through a Florida Afterschool Network program where MOSH serves as a STEM hub; and
- 25 teachers receive inquiry-based workshops at the Jewish Community Alliance as part of a larger program.

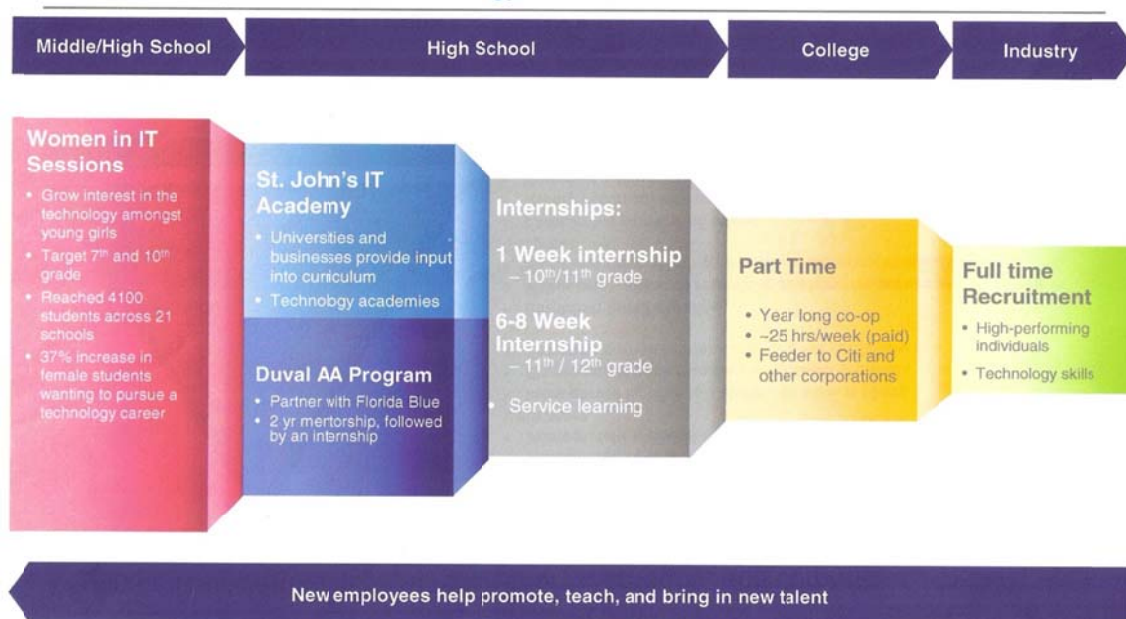
MOSH hosts a series of science and history camps throughout the year. The camps serve children in K through 8th grade, broken into classes of K-1, 2-3, 4-5, and middle school grades. The camps consist of hands-on activities and experiments, planetarium shows and live presentations, live science demonstrations, student-led project development, exhibit exploration, and of course, liquid Nitrogen Ice Cream (according to the kids it should receive its own category). Camps have themes and curricula that vary widely. The themes are chosen according to 1) correlation to themes on exhibit at the time of the camp, 2) significant tie to seasons or other current events, 3) interesting science or history subject that is ripe for inquiry-based curriculum.

**4.2.11 Professional Societies:** Throughout the region, there is a plethora of professional societies that work to increase STEM<sup>2</sup> interest and especially to advance diversity in STEM<sup>2</sup> fields. Groups such as the National Society of Black Engineers (NSBE), the Society of Hispanic Professional Engineers (SHPE), the American Chemical Society (ACE), and a host of others work to provide mentorship and hands-on activities both in partnership with individual schools and school districts, or as extra-curricular activities. One example of such activities is the MATHCOUNTS<sup>®</sup> Program run by the Florida Engineering Society (FES). MATHCOUNTS<sup>®</sup> is a coaching and competition program that promotes 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> grade math achievement and emphasizes the importance of STEM within the school system. The NEFL competition (hosted by the Northeast Florida Chapter of FES) is one of the largest in the country, bringing students from Baker, Bradford, Clay, Columbia, Duval, Nassau, St. Johns, and Union counties.

### 4.3 Examples of Private/For-Profit Organizations Supporting STEM<sup>2</sup>

**4.3.1 Citigroup IT Academies:** The Citigroup academies focus on attracting students at an early age and then providing development and STEM<sup>2</sup> educational opportunities throughout high school and college. The goal is to develop a pipeline of talented and trained individuals to sustain and grow high-tech industries in the region. The overall concept for these academies is shown in Figure 4-1.

**Figure 4-1: Citigroup IT Academies Talent Development Pipeline**



**4.3.2 Florida Blue:** Florida Blue is partnering with Andrew Jackson's High School and Citibank to offer the Specialized Information Technology Early College Associate in Science (AS) Program. Jackson's Early College Program provides students greater access to higher education and promotes student achievement at the high school and postsecondary levels. Florida Blue/Jackson's Early College Program blends high school and college courses to enable students to earn a high school diploma and an Associate in Arts degree or an Associate in Science degree with minimal financial cost. In grades 11 and 12, Early College students are enrolled full time at Florida State College at Jacksonville (FSCJ). Florida Blue's partnership with Jackson also includes a mentorship program for their students. The Florida Blue's Mentoring Program is based on the concept of mentoring young people in areas for which Florida Blue would consider the individuals for future employment. Students are given access to research, development, computer networking, network/cyber security, etc. Florida Blue employees advise, preferably on a one-to-one basis, those individuals for a minimum of one school year. Florida Blue's partnership with Jackson also includes a paid High School Intern, where students have the opportunity to gain valuable insight into the world of computer networking and network/cyber security by being exposed to the processes and procedures within a world class Information Technology (IT) environment. Student interns will be assigned to various positions within the IT department. Student intern roles and responsibilities include: contribute individually and/or as a team member to support the designated functional area, work toward goals and objectives assigned by functional manager, or analyze business processes for reengineering/improvement opportunities.

**4.3.3 Pragmatic Works' School of Programming:** The Pragmatic Works' School of Programming is a partnership between Pragmatic Works and the Clay County School District that provides 6 juniors and seniors from Middleburg High School technical dual enrollment courses through St. John's River State College. Introductory classes in programming information technology classes are provided after school. Students are provided the opportunity to receive 12 Dual Enrollment credit hours in order to accelerate their college or university pathway after high school. Students are receiving hands-on skills which will enable them to become more employable in the field of their choosing. The academy is in its initial stages but the goal is to extend it to Orange Park High School in the near future, and based on its success, to other schools moving forward.

**4.3.4 Stellar Engineering Academy:** The Stellar Academy of Engineering is a training program that combines an intensive curriculum with real world experiences designed to encourage and advance students' futures in engineering. Students begin with the basics: interpreting scales, lettering techniques, sketching, geometric construction, and multi-view drawings. Then they are introduced to AutoCAD, the computer-aided drafting and design program used in such high-skill, high-wage, and high-demand fields as engineering; construction; and manufacturing. Lessons are hands-on, project-oriented and emphasize critical thinking as well as teamwork. The Stellar Academy of Engineering is a partnership between Stellar, a fully integrated firm focused on design, engineering, construction, and mechanical services worldwide and Nease High School in St. Johns County. The program grew out of Stellar's recognition of the need to increase the quality, diversity and number of students prepared to pursue a career in engineering. The program is a leading example of how students can benefit from real-world projects and perspective practicing engineers bring to the classroom. Stellar and other business partners also provide valuable work-based learning opportunities such as internships and job shadowing.

**4.3.5 VISTAKON<sup>®</sup> Advanced Manufacturing Academy:** VISTAKON<sup>®</sup>, a Division of Johnson & Johnson Vision Care, Inc. is building upon an existing mentoring partnership it has had with Englewood High School for several years, and is supporting the establishment of a new Early College Career Academy, supported by Florida State College at Jacksonville (FSCJ), which was launched in the 2014 -2015 school year. The purpose of the partnership is to transform students' high school experiences with more relevant and engaging classes that prepare students for success in college, career, and life. The Johnson & Johnson Vision Care, Inc. Academy of Advanced Manufacturing and Engineering will afford dozens of Englewood students the opportunity to earn, in addition to their high school diploma, an Associates of Science degree in Advanced Manufacturing and Engineering from Florida State College at Jacksonville (FSCJ). Widely recognized and available in several Duval County high schools, the early college program provides college coursework on high school and FSCJ campuses, resulting in credits that meet both high school and college requirements. With the expanded offerings of the Academy, students will be assigned mentors, participate in paid internships at VISTAKON<sup>®</sup> during the final two summers of high school, and be offered “priority interview status” for employment opportunities at the conclusion of the four-year program.

#### **4.4 Governmental STEM<sup>2</sup> Activities**

**4.4.1 *The Children’s Commission:*** The Commission, established in 1994 is an autonomous entity of the City of Jacksonville serving the needs of children and their families throughout Duval County. JCC partners with local non-profit organizations and sponsors a continuum of research-based programs to help ensure children from birth to age 18 have stable, nurturing families; are prepared to enter kindergarten and succeed in school; have support and guidance afterschool and in the summer; and receive special help when they need it. The Commission works hand in hand with local nonprofit organizations, carefully tracking each program's effectiveness and outcomes. In addition to the general benefit of supporting support families in their effort to maximize their children's potential to be healthy, safe, and educated and contributing members of the community, the Commission has three programs that are a specific asset for STEM<sup>2</sup>.

4.4.1(a) **TEAM UP:** TEAM-UP is a comprehensive, school-based afterschool program that provides educational and enrichment opportunities for youth. All TEAM UP programs are located at Duval County Public School sites and staffed by both certified teachers and youth development staff from the provider agency. Children who participate in TEAM UP programs tend to have better attendance, promotion rates and grades at the same schools as children who do not attend the program.

4.4.1(b) **Summer Camp Programs:** Summer camp programs provide academic and enrichment activities for at-risk children during the summer months. It strives to reduce summer learning loss and helps to prepare children for the next school year. Summer camps generally include a wide variety of services, to include tennis, dance and arts camps. Children who live in Duval County and are 4-15 years of age, are eligible for services. Children must qualify as low-income or special needs.

4.4.1(c) **Community-Based Afterschool Programs:** Many families want their children to attend an afterschool program in a neighborhood club, recreational center or housing complex. The Jacksonville Children’s Commission partners with youth-serving organizations at a number of such locations to provide high quality programs that emphasize academic help, cultural enrichment and recreation. A list of the participating organizations is presented in Table 4-1.

**Table 4-1: Organizations Hosting Programs in Partnership with JCC**

Boys & Girls Clubs	Community Connections
Beaches Club	Normandy Community Center
Lee Club	Davis Center
NFL YET (Youth Education Town)	MaliVai Washington Kids Foundation
Victory Point Club	Police Athletic League (PAL)
Woodland Acres Club	Carpenter's Shop
The Bridge BUS Program	The Boselli Foundation
The Bridge at Southwind Villas	

4.4.1(d) New Town Success Zone: The New Town Success Zone was created and implemented by the Jacksonville Children's Commission in 2007. Modeled after the Harlem Children's Zone, it is a multi-year comprehensive community building initiative aimed at creating a safe learning environment for youth and families living in Jacksonville's urban core.

## Section 5

### STATE OF STEM<sup>2</sup> EDUCATION ACTIVITIES IN NORTHEAST FLORIDA

#### 5.1 STEM<sup>2</sup> Education and Diversity

**5.1.1 National Perspective:** To meet the rapidly increasing demand for a STEM<sup>2</sup> workforce, there is widespread agreement that we must expand the pool from which STEM<sup>2</sup> workers are drawn - but we start from a challenging position: Underrepresented minority groups comprised 28.5 percent of the population nationally in 2006, but just only represent 9.1 percent of college-educated Americans in science and engineering occupations (academic and non-academic), meaning that the percentages of underrepresented minorities in S&E would need to triple to match their share of the overall U.S. population.

5.1.1(a) Focus on Math Education: In most instances, under-represented groups in the STEM<sup>2</sup> disciplines are not absent for lack of interest at the educational level. A recent study by the Girl Scouts Research Institute<sup>20</sup> found the following:

- Seventy-four percent of high school girls across the country are interested in the fields and subjects of STEM.
- Girls are interested in the process of learning, asking questions, and problem solving.
- Girls who are interested in STEM are high achievers who have supportive adult networks and are exposed to STEM fields.
- Girls who are interested in STEM fields are actually interested in many subjects and career opportunities—STEM is just one area of interest among many.

Enrollment in advanced math courses has been equalized in high schools, resulting in less gender differences in performance on standardized math tests. However, only 17 percent of high school girls take computer science Advanced Placement exams. Several studies have shown that as girls progress into middle and high school, gender differences in attitudes towards STEM disciplines begin to emerge. Fewer girls opt to take advanced technology and science courses, which leaves them less prepared for pursuing these disciplines and restricts certain career choices later on.

The Organization for Economic Co-operation and Development (OECD) conducts an annual review of math and science literacy around the world. Based on their data, they have stated “Math proficiency is a strong predictor of positive outcomes for young adults. It influences their ability to participate in post-secondary education and their expected future earnings”<sup>21</sup>. Local educators note that one of the key barriers to enhancing interest in science and technology careers, is the deficiency in mathematics that is pervasive in American education. Studies have shown that self-esteem and self-efficacy in math are among the highest predictors of interest in STEM fields<sup>22</sup>. By middle school, many students are

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<sup>20</sup> *Generation STEM: What Girls Say about Science, Technology, Engineering, and Math*. Available online at [http://www.girlscouts.org/research/pdf/generation\\_stem\\_full\\_report.pdf](http://www.girlscouts.org/research/pdf/generation_stem_full_report.pdf). (Last accessed 3-17-15).

<sup>21</sup> "Asian countries top OECD's latest PISA survey on state of global education", OECD Press Release 3/12/13. Found online at <http://www.oecd.org/newsroom/asian-countries-top-oecd-s-latest-pisa-survey-on-state-of-global-education.htm>. (Last accessed 25 April, 2015).

<sup>22</sup> Skaalvik, E.M' and Skaalvik, S. (2009): "Self-Concept and Self-Efficacy in Mathematics: Relation with Mathematics Motivation and Achievement." In *Journal of Education Research*, Vol. 3 (3), pp. 255-278.

convinced that they cannot be successful in higher math, and by high school their suspicions are confirmed. Given that high level of insecurity, of course they are unlikely to pursue further studies in STEM areas.

A recent study from the University of Wisconsin-Stout<sup>23</sup> directly addressed these issues through a study of 2800 7<sup>th</sup> and 8<sup>th</sup> graders. The results showed that the greatest predictor of math and science interest was self-esteem, accounting for 36.4% of the variability in the interest scale. Self-efficacy was the second highest predictor, accounting for 26.5% of the variability. Perceived social support accounted for 17.8% of the variability. The least significant predictor of math and science interest was perceptions, accounting for a mere 4.1% of the variability. Clearly, the current educational system is not addressing issues such as these, especially for underrepresented groups. As stated in the National Academy of Science Report<sup>24</sup>

*Although a set of pathways may be difficult to describe in detail, the ingredients for success in STEM are the acquisition of knowledge, skills, and habits of mind; opportunities to put these into practice; a developing sense of competence and progress; motivation to be in, a sense of belonging to, or self-identification with the field; and information about stages, requirements, and opportunities. These ingredients require attention in some measure for all students at every stage along the STEM educational continuum. However, there are issues that are specific to underrepresented minorities, in general and in STEM, focused on preparation, access and motivation, financial aid, academic support, and social integration.*

5.1.1(b) Math Teachers: An important factor in the poor performance of our students in mathematics is the weakness in mathematics knowledge of our teachers. Universal math deficiency among teachers nationally and locally is a critical issue. Dr. Li Ping Ma surveyed and interviewed math teachers in China and the U.S. and wrote a seminal book on the problems of math instruction entitled "*Knowing and Teaching Elementary Mathematics*"<sup>25</sup>. In her study, Ma found that most Chinese math teachers could explain a math concept, such as distributive property, and describe its importance and application. American teachers, on the other hand, often had weak knowledge of math concepts and depended on rote memory and mnemonic devices as substitutes for conceptual learning. American elementary math teachers even had problems explaining the reason for place value in multiplication. There are really three pillars of good math instruction: conceptual understanding, procedural knowledge, such as knowing the times tables, and practical application. While emphasis on conceptual understanding has been increased in both teacher training and standardized testing in recent years, it was my experience in visiting districts across the country that much still needs to be done.

In recent years, Teach for America has been one way urban school systems have attempted to shore up math and science teaching quality. But while about 60% of TFA teachers stay for a third year, the

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<sup>23</sup> Roue, L. C. (2007). *Young women's interests in technology and engineering*. Available on-line at [http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1003&context=ncete\\_cstudies](http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1003&context=ncete_cstudies). (Last accessed 3/17/15).

<sup>24</sup> National Academy of Sciences (2011): *Expanding Underrepresented Minority Participation*. Report of the Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline. The National Academies Press, Washington, D.C. Available online at [https://grants.nih.gov/training/minority\\_participation.pdf](https://grants.nih.gov/training/minority_participation.pdf). (Last accessed 3/17/15).

<sup>25</sup> Ma, Li-Ping (1999): *Knowing and Teaching Elementary Mathematics*, Routledge publishers, Kentucky, publishers. 166 pp.

retention rate drops considerably after that<sup>26</sup>. And, TFA teachers cost the district considerably more than traditional teachers. So, unless funding sources are increased considerably, TFA will remain an important part of a mosaic of improvement, but not a solution.

In his well-known comparison of teaching throughout the early years of the Third International Math and Science Study (TIMSS)<sup>27</sup>, Jim Stigler found teaching is a culture. Teachers tend to teach as they are taught and in each country where he videotaped math teaching, there was a surprising commonality among teachers in pedagogy, or the methods of teaching, within a country - often differing considerably from country to country. If teachers' knowledge of math concepts is weak and they come from a teaching culture in which procedural training predominates, it is likely that these deficiencies and practices will perpetuate.

Similarly, Amanda Ripley followed American exchange students through their experiences in some of the countries that, at the time of her writing, were among the highest performing countries in the world in obtaining student achievement. In the resulting book, "*The Smartest Kids In The World: And How They Got That Way*"<sup>28</sup>, Ripley reported that in each of these countries there was far greater rigor in teaching and teacher expectations than in America. But rigor in math has often been seen by American teachers as proficiency in more difficult computations, while rigor in competing countries has often been properly recognized as the challenge embedded in translating a real world problem into a mathematic equation and solution.

**5.1.2 State of Florida Perspective:** There are few published and publicly available sources of data on the state of STEM<sup>2</sup> education and underrepresented groups in Florida. One of the most recent statewide analyses was published by the Florida Center for Research in STEM<sup>29</sup>, produced a report for STEM Florida<sup>30</sup> entitled "*The State of STEM in Florida: A Snapshot*"<sup>31</sup> that presented baseline data<sup>32</sup> on several metrics the state, including statewide data on minorities and women in STEM.

The data show that Florida is in line with the national average in terms of minorities earning STEM degrees (averaging about 20% for Latinos to approximately 10% for African Americans). Florida is behind the national percentages in terms of women in STEM disciplines. However, while males significantly outnumber females in the sciences, technology and engineering, women dominate the

<sup>26</sup> Donaldson, Morgaen L. and Johnson, Susan Moore (2011): "TFA Teachers: How Long Do They Teach? Why Do They Leave?", Published online on October 4, 2011 by Phi Delta Kappan. Available online at [http://www.edweek.org/ew/articles/2011/10/04/kappan\\_donaldson.html](http://www.edweek.org/ew/articles/2011/10/04/kappan_donaldson.html). (Last Accessed on 25 April, 2015).

<sup>27</sup> Stigler, Jim (2006): "Improving Mathematics Teaching: Learnings from TIMSS Video" Presentation to the National Math Panel. November 6, 2006, Washington, DC.

<sup>28</sup> Ripley, Amanda (2013): "*The Smartest Kids In The World: And How They Got That Way*", Published by Simon and Schuster, publishers, New York, New York. 306 pp.

<sup>29</sup> The Florida Center for Research in STEM is a multidisciplinary research center created by the Florida Legislature in 2007, located at Florida State University.

<sup>30</sup> Stem Florida is a non-profit organization incorporated on June 24, 2011 with the goal of providing demand-driven leadership for the broader STEM movement in Florida.

<sup>31</sup> Laura B. Lang, Mabry Gaboardi, Frank Fuller, & Christine Johnson (2010): *The State of STEM in Florida: A Snapshot. Produced by The Florida Center for Research in Science, Technology, Engineering, and Mathematics, Florida State University, Tallahassee, Florida (January, 2010)*. Available online at [http://www.helios.org/uploads/docs/StateofSTEM\\_Final.pdf](http://www.helios.org/uploads/docs/StateofSTEM_Final.pdf) (Last Accessed on 3/11/15).

<sup>32</sup> *Data Source:* Florida Department of Education. (2009d). *Science Scores: Statewide Comparison for 2003 to 2009*.



number of bachelor's degrees awarded in Biological and Biomedical Sciences with 63% of the degrees awarded to females in the 2007-2008 academic year. In the Health Professions and Clinical Sciences, the gap is even wider, with females receiving 85% of the Bachelor degrees in the same period. For both fields, the gap is increasing over time.

**5.1.3 Regional Perspective:** While State data are limited, there appears to be no centralized collection of data for the region with respect to diversity in STEM<sup>2</sup> areas. Data can be drawn together from various sources. For example, Tables 5-1 and 5-2 show the State Department of Education's most recent published data on community profiles which provides information on the percentages of minorities enrolled (2007-2008 academic year) and graduating (2011-12) academic year) in the seven county school districts in Northeast Florida.

**Table 5-1 Enrolment Data for Northeast Florida School Districts**

District	Enrollment	% Female	% White	% Black	% Hispanic	% Asian	% Native American
Baker	4,923	ND*	84.4%	12.3%	1.3%	0.4%	0.2%
Clay	36,125	ND	75.2%	12.6%	6.8%	2.8%	0.2%
Duval	124,741	ND	40.9%	44.2%	6.7%	3.9%	0.2%
Flagler	12,771	ND	68.6%	15.5%	9.3%	2.3%	0.3%
Nassau	11,079	ND	86.2%	8.5%	2.2%	0.8%	0.3%
Putnam	11,811	ND	58.9%	25.3%	11.9%	0.5%	0.2%
St. Johns	27,829	ND	82.3%	8.5%	4.5%	2.5%	0.2%

\*ND = No Data Reported

**Table 5-2 Graduation Data for Northeast Florida School Districts**

District	Total Graduating	% Female	% White	% Black	% Hispanic	% Asian	% Native American
Baker	296	45.3%	79.4%	14.2%	ND*	ND	ND
Clay	2,747	47.1%	71.3%	15.3%	8.5%	2.6%	ND
Duval	6,470	53.2%	39.6%	45.7%	7.3%	5.2%	0.2%
Flagler	843	50.7%	65.6%	15.9%	10.9%	3.1%	ND
Nassau	715	51.3%	85.7%	7.4%	4.1%	ND	ND
Putnam	555	49.5%	59.8%	26.5%	11.2%	ND	ND
St. Johns	2,158	48.2%	83.7%	6.7%	6.2%	2.4%	ND

\*ND = No Data Reported

Data can also be collected from the three institutions of higher learning in the region that grant STEM<sup>2</sup> degrees on the percentage of women and minorities receiving STEM<sup>2</sup> bachelor and Graduate degrees. Table 5-3 presents those data.

**Table 5-3 Graduation Data for Northeast Florida School Districts (2013-2014)\*\***

Institution	Level	Total Number	% Female	% White	% Black	% Hispanic	% Asian	% Native American
FSCJ	Associates	86	33.82%	57.35%	26.47%	2.96%	5.88%	0.00%
	Bachelors	131	22.14%	63.36%	11.45%	7.63%	7.63%	0.76%
JU	Bachelors	831	73%	61%	18%	6%	4%	1%
	Graduate	238	4%	65%	15%	0%	5%	1%
UNF	Bachelors	357	33.9%	70.0%	4.2%	9.8%	9.8%	0.3%
	Graduate	42	45.2%	61.9%	4.8%	4.8%	2.4%	0.0%

\*\* The row percentages may not combine to yield 100% because there may be race categories not included in the list above.

## 5.2 County School District STEM<sup>2</sup> Activities

**5.2.1 Baker County:** The Baker County School District actively participates in the Northeast Florida Educational Consortium's Rural Initiative for STEM Education (RISE). Its purpose is to provide teachers and students in small rural districts with an opportunity to participate in unique and innovative rigorous STEM learning experiences with an emphasis on inquiry activities aligned with Florida Standards and 21st Century Learning Skills. Current STEM initiatives through NEFEC include:

- U-FUTURES middle school science grant
- STEM Connections eNews
- STEM Content and Pedagogy Professional Development
- Student Math Design Collaborative
- Problem-Based Learning Lesson Design Training
- NEFEC's STEM Advisory Council
- NEFEC's STEM Student Expo

The Baker County School District also employs a variety of STEM and STEM-related activities in an effort to expose students to applications of individual and integrated Science, Technology, Engineering, and Math content areas. Through various partnerships with colleges, local agencies, and businesses, STEM projects and programs are implemented in every school and organized to engage students at all grade levels.

**5.2.1(a) Pre-K and Kindergarten:** In partnership with the Northeast Florida Educational Consortium Pre-K and Kindergarten students are engaged in the Students Understanding Math and Science (SUMS) curricula that includes concepts of weather, motion, living things, and aeronautical space. Pre-K and Kindergarten students have direct access to learning science, math, and engineering applications through iPad technology and interactive digital applications such as Science Fusion, Think Central, Sid the Science Kid videos, and age appropriate YouTube videos of integrated science, math, and technology concepts.

5.2.1(b) Elementary Grades 1 – 3: Students participate in a science resource class every six days and engage in hands-on activities in the study of Embryology, Plants, Minerals, and Life Cycles. Through partnerships with AT&T, the University of Florida Institute of Food and Agricultural Sciences (IFAS), and the Baker County Extension Agency, first through third grade students have access to a hydroponics system and authentic learning experiences in botany, food sustainability, and research design with practice in observation, investigation, data collection, and interpreting skills. The project serves as a feeder program to the middle and high school career and technical education Agri-science programs. In partnership with the University of Florida and the Baker County Extension Agency, 3rd grade students participate in regular student-led science workshops on animal science, ecosystems, entomology, and embryology. Students are provided regular opportunities to practice the scientific inquiry process of questioning, constructing and testing a hypothesis through experiments, analyzing data, drawing conclusions, and reporting the final results. First through third grade students use EduCreations and PicCollage IPAD digital applications to design and produce science and math project tutorials to share as peer-to-peer learning resources.

5.2.1(c) Elementary Grades 4 – 5: Made possible through the AT&T STEM at Work grant, students are currently involved in a comprehensive cross-curricular hands-on S.T.E.M. project involving the generation of energy from wind as a renewable source. Through an inquiry-based unit titled, *Energy From the Wind*, developed by the National Energy Education Development Project containing hands-on inquiry investigations and critical thinking activities, students will learn about the physics of wind, the history of harnessing wind's energy, and how our nation utilizes wind energy today. Through this comprehensive unit, students will measure wind speed and direction, explain and diagram how wind can perform work, describe how electricity is produced, investigate the effect of blade variables on electrical output, design blades to achieve the optimum electrical output, describe how aerodynamics can affect the turbine's efficiency, and identify the many benefits and challenges of siting wind farms.

5.2.1(d) Middle School Grades 6-8: Students in grades 6 - 8 are exposed to integrated science and technology concepts through the rigorous and interactive IQWST (Investigating and Questioning our World through Science and Technology) curricula and authentic activities including introductions to Chemistry, Earth Science, Life Science, and Physical Science. As a continuation of elementary school STEM experiences, middle school students have access to integrated STEM practice year-round through a 120-plant hydroponics lab in the career and technical education Agricultural exploratory program. Students engage in higher levels of botany, biology, chemistry, physics, engineering, horticulture, and technology, as well as, as basic scientific writing and presentation skills. Once plants are producing vegetable crops, students harvest and package the products for distribution and sale through a student-owned enterprise. Through a Florida Power and Light partnership, middle school students are exposed to solar energy concepts through the use of solar panels and the practice of scientific inquiry techniques.

5.2.1(e) High School Grades 9-12: High school students have access to career and technical education training programs that utilize the integrated STEM approach to problem solving: AgriTechnology; Agriscience; Health Sciences; Horticulture; and Gaming, Simulation, and Design. The programs are designed to give students classroom instruction coupled with authentic lab experiences and real-world industry-aligned training leading to industry-recognized certifications and licenses. The district maintains post-secondary articulation agreements with Florida Gateway College, Florida State College at Jacksonville, and Sante Fe State College specific to linking students in these programs to mirroring higher education STEM occupational training programs. In partnership with Florida Power and Light (FPL) and WeatherSTEM students are engaged in the study of solar energy through the use of solar

panels. Through network interfacing with the panels, students investigate and collect and record solar energy data. Through WeatherSTEM, students use data from the solar panels and coordinate with a weather station to engage in real-world problem solving and inquiry. Through partnership with Florida Gateway College, additional focus is placed on engaging 9th grade female students in non-traditional career fields including those utilizing individual and integrated STEM concepts. The Tech Diva project affords 9th grade female students hands-on practice on the college campus in welding and mechanical design, engineering technology, heating and refrigeration, electrical, and electronics fields. Baker County High School students and teachers participate in the annual NEFEC STEM Expo held on the Sante Fe College campus featuring student projects and providing a venue for students to discuss STEM careers, STEM programs of study, and campus-based STEM opportunities with post-secondary partners and STEM business representatives.

**5.2.2 Clay County:** The Clay County School District is a leader in addressing STEM Education. The school district lists among its strengths:

- A Strong Career and Technical Education (CTE) program with robust STEM academies coupled with a vision and implementation plan that offers small learning communities settings in all high schools beginning with 9<sup>th</sup> grade students for the 2014-14 school year.
- Foundational robotics clubs (FLL) in grades 4 – 6 at 11 elementary schools feeding to 4 junior high schools. Robotics clubs (FTC) at 5 high schools.
- Funding through Department of Defense Education Activity (DoDEA) grants to impact and expand STEM programs in a total of 24 schools.
- Various STEM and technology initiatives are in place and are implementing digital learning and 21<sup>st</sup> Century Skills in many schools across the county.
- Improvement in science rankings in state for 5<sup>th</sup> and 8<sup>th</sup> grade FCAT 2.0 Assessment of Next Generation Sunshine State Science Standards.

The County has a proven record of effective program implementation, along with success in moving student achievement in science in targeted schools and boasts a nationally recognized, successful robotics program with capacity building ability in place which could be easily replicated to other schools. The district has expertise to provide training for all areas associated with building capacity for STEM programs. The district has received the Lt. Pete Taylor Award for Excellence in Partnerships and has partnership capacity in surrounding counties with industry and commerce leaders. .

**5.2.2(a) IT Academy (formerly the CISCO Academy):** A student who completes the IT Academy plan while at Middleburg High School may receive 4 industry certifications: Cisco IT Essentials, CompTIA A+/Network+, CCENT and CCNA. In the 5 years of the program, MHS students have earned 93 Industry Certifications. Students have competed with SkillsUSA and earned numerous awards, including: 1st and 2nd place in many skill areas which qualified the student's attendance and competition at Nationals where they have earned a Gold medal in Computer Maintenance and Repair and Silver medals in Telecommunications and Cabling. The Academy students have earned such recognition for their accomplishments that they were invited to compete at the University of Florida, and the program is now a candidate to add an AP level course, with an industry field professional, that will allow a student, with successful course completion and passing score on the AP exam, to begin a career earning \$80-90,000 a year.

**5.2.3 Duval County:** The County under its new administration has a clear renewed STEM commitment. Attached (Appendix B) is a complete list of STEM offerings by feeder pattern for traditional (non-magnet) schools. The list includes digital media technology, cyber security, global logistics/supply chain technology, and coastal engineering studies among others. These STEM educational offerings include prominent business partnerships for specific STEM initiatives and programs throughout the district. Appendix C provides a copy of the Career Academy collaborative Food Truck Project focused on entrepreneurship, culinary arts, web and graphic design, finance, logistics, and health and life sciences.

The Duval County Public School (DCPS) District has a strong focus on STEAM education programs. Among the programs the school district listed as strengths are:

5.2.3(a) S-T-E-A-M Cultural Passport: The STEAM Cultural Passport provides learning opportunities to all DCPS Title I Elementary School students through Field Trips that are connected to learning in Science, Technology, Engineering, Arts, and Mathematics. Students are able to participate in field experiences with the organizations shown in Table 5-4.

**Table 5-4: Duval County Elementary School Field Trip Sites**

- Cummer Museum of Art and Gardens for grades K, 1<sup>st</sup>, and 5<sup>th</sup>
- Florida Ballet for Pre-Kindergarten students
- FSCJ Artist Series for kindergarten students
- Jacksonville Symphony Orchestra for 2<sup>nd</sup> – 4<sup>th</sup> graders
- Jacksonville Zoo and Gardens for Pre-K, K, and 4<sup>th</sup> grade students
- MOCA Jacksonville for 1<sup>st</sup> and 2<sup>nd</sup> graders
- MOSH for 2<sup>nd</sup> and 5<sup>th</sup> grade students
- MOSH Planetarium for 1<sup>st</sup> and 4<sup>th</sup> graders
- Theatre Jacksonville for 3<sup>rd</sup> graders
- Theatreworks for Pre-K and 5<sup>th</sup> graders
- Tree Hill for 3<sup>rd</sup> graders
- UNF Environmental Studies for Kindergarten and 1<sup>st</sup> graders
- Jewish Community Alliance for 2<sup>nd</sup> and 3<sup>rd</sup> graders
- St. Johns River City Band for Pre-K through 5<sup>th</sup> grade students
- STARBASE for 5<sup>th</sup> grade students

5.2.3(b) Pitsco STEM Labs: DCPS was awarded a grant from the Florida Department of Education in 2014 that has allowed the school district to build state-of-the-art science, technology, engineering, and mathematics labs in nine of the district's middle schools (MS). The curricula that will be implemented at the underlying schools are shown in Table 5-5.

**Table 5-5: Curricula and Middle Schools in Which They Will Be Implemented***Aerospace, Rocketry, & Aeronautics*

- Northwestern MS
- Jean Ribault MS
- Joseph Stilwell MS
- Jefferson Davis MS
- Highland MS

*Sustainable Energies*

- Fort Caroline MS

*Engineering & Structures*

- Young Men's Leadership Academy
- Young Women's Leadership Academy
- Southside MS

*Career Pathways*

- Matthew Gilbert MS

5.2.3(c) DCPS Schools with Exemplar STEM, STEAM or Science Programs: The schools listed in Table 5-6 have been noted and/or recognized for having exceptional STEM curricula and have participated in various competitions within in the school district and throughout the state.

**Table 5-6: DCPS Schools with Exemplar STEM, STEAM or Science Programs**

- Sally B. Mathis S.T.E.M. Magnet
- Carter G. Woodson School of the Medical Arts
- Woodland Acres School of the Medical Arts
- Mayport Elementary Coastal Science Academy
- J. Allen Axson Montessori School
- Kirby Smith Dedicated Mathematics, Science & Technology Middle School
- Darnell Cookman School of the Medical Arts
- Frank H. Peterson Academies of Technology

5.2.3(d) Moving Forward: DCPS has several middle and high schools equipped with infrastructure to bring back various industry shops that offered students an opportunity to graduate high school career ready for the workforce. Some of those include; banking, IT, auto mechanics, drafting and design, etc. This would allow community partners to assist in redeveloping this process enabling more avenues for students' success upon leaving high school. In addition, institutions of higher learning in Northeast Florida and beyond are seeking more students to enroll and major in STEM field curriculums. A strong partnership would ensure DCPS students are exposed to the academic and hands-on experience that will better prepare them for the next level while earning an undergraduate degree. In addition, this partnership has an opportunity for local colleges and institutions to attract more students for enrollment. Furthermore, it would provide a network of skilled workers to remain in the city of Jacksonville, FL as these college graduates enter the work force.

5.2.3(e) River City Science Academy: The River City Science Academy (RCSA) is a Tuition Free, Public, Science, Technology, Engineering and Math (STEM) focus, Duval County Public Charter School located in Jacksonville. RCSA provides strong academics and college bound programs in addition to after school programs. The school was initially granted a five year charter contract from Duval County Public Schools (DCPS) in the fall of 2006 and opened on August 2007, serving grades 6th and 7th. As students were promoted to the next grade level, a new grade level was added every year. In 2010, RCSA applied and was awarded the approval to open RCSA Elementary to serve students in grades K – 5th. RCSA Elementary opened in August of 2010. In 2012, RCSA applied for

and was awarded the approval to open RCSA-Innovation to serve students in grades K-8<sup>th</sup>. RCSA-Innovation is currently serving K-2<sup>nd</sup>. River City Science Academy has been recognized as one of the top charter schools in Duval County on many occasions by the Superintendent, Board Members, and the charter school office of the Duval County Public Schools since its opening.

RCSA targets middle school students for exposure to advance level math and science classes such as Algebra I, Geometry, Algebra II, Biology, Computer and Science Olympiad Course. RCSA's activities, which include campus events, off campus programs, field trips and other extra curriculum activities, help fortify the enthusiasm in STEM programs for teachers, students and the community. RCSA's STEM programs focus on maximizing student involvement in those studies and on providing opportunities for students who want to get involved in STEM fields beyond what RCSA offers during regular school hours.

The School organizes an annual STEM and HEALTH EXPO on its campus which is open to the general public free of charge. Its purpose is to expose students and adults to STEM careers and STEM-related local businesses. Most of the activities are all centered on entertaining STEM-related demonstrations by RCSA students. RCSA also maintains STEM enthusiasm through competitions and the students' involvement in running these events. Students and parents are encouraged and supported by RCSA if they express an interest in any special Science, Technology, Engineering, or Math program or event that will enhance their knowledge outside of their regular school work. Some examples include Science Olympiad, Science Fair, Invention Convention, Science Fun Night, Landscaping Committee and Club, FIRST Robotics, FLL Lego Robotics, Engineering Club, Math League, Math Counts, Mathletes events, Math Counts, STEM Expo events, weekend Duke TIP math prep sessions and SAT practice sessions. Often our students tend to serve as volunteers at Florida regional and state level STEM competitions. These older students also perpetuate the love of STEM fields through mentorship, advising our younger students on similar school wide competitions.

**5.2.4 Flagler County:** Flagler County Schools offers a variety of STEM and STEM-related activities exposing students to many aspects of science, technology, engineering, and mathematics. Through community involvement, local college partnerships, and STEM programs, we ensure that students have experiences unique to their many interests. The county works closely with Daytona State College, Embry Riddle Aeronautical University, Bethune-Cookman University and many community partners to ensure that our students are college and career ready.

All Schools have the opportunity to participate in state Science Olympiad competitions and many other schools also compete in additional robotics, and STEM related competitions around the state. Many schools have STEM clubs, coding clubs, and other STEM related clubs for students. Flagler currently has 3 Weather STEM stations that provide real-time data that can be used in classrooms for STEM projects.

The district is leveraging a full range of technology and digital resources to guarantee that students are immersed in personalized, rigorous and relevant learning experiences that foster 21st century skills across the disciplines to ensure college and career readiness. As part of our Digital Learning Movement, we are at a 1:1 digital device ratio for grades 5 through 12. The technology infusion gives our teachers and students opportunities for authentic and engaging STEM learning experiences. As a part of our Digital Classroom Plan, we are focusing on moving towards integrating technology into the learning environment at a transformation level. Flagler High Schools offer many CTE programs related to STEM. The programs include Biotechnology, Veterinarian Assisting, Power and Energy Technology and Electricity. These programs allow students real-life, hands-on problem-based learning,

and opportunities to work with local community partners to prepare for future careers.

The District is very proud of their Flagship Programs. Flagships provide enrichment and relevance to our curriculums, while focusing on skills and opportunities that lead to college and career readiness. Flagship Programs are designed to align with the targeted industries in Flagler County as well as skills identified as critical by the business communities through studies by the U. S. Department of Labor and surveys conducted through local organizations such as Career Source. These include skills such as communication, enthusiasm and attitude, teamwork, problem solving and critical thinking, dependability, flexibility and confidence. Many of these programs offer opportunities to discover paths that lead students from classroom to career success. Students can explore and grow in the worlds of Agriculture, Aerospace, Green Technology, Health Science, Engineering and Computer Science, and Marine Research.

**5.2.5 Nassau and Putnam Counties:** The Northeast Florida Education Council (NEFEC) provides over 30 programs and services (many of which are STEM focused) to its member districts and other districts throughout Florida. In terms of the STEM<sup>2</sup> Hub's region NEFEC supports Baker, Flagler, Nassau and Putnam counties. The purpose of NEFEC's STEM initiative is to provide teachers and students in small rural districts with an opportunity to participate in unique and innovative rigorous learning experiences related to content in the areas of science, technology, engineering and mathematics (STEM). This initiative places an emphasis on inquiry activities that are centered on Florida's Standards and promote 21st Century Learning Skills.

Current STEM initiatives at NEFEC include Florida's "Race To The Top" STEM Scholars grant, U-FUTuRES middle school science grants, the STEM Connections website, a STEM Content and Pedagogy Professional Learning program, the Math Design Collaborative, Problem Based Learning Lesson Design, NEFEC's STEM Advisory Council, and NEFEC's STEM Expo. Each of these initiatives are facets of a larger project called the Rural Initiative for STEM Education (RISE), which is aimed at promoting excellence in STEM Education for NEFEC districts. RISE seeks to develop connections among students, teachers, schools, higher education, businesses and industries to develop a STEM workforce for Florida's rural region to provide:

- Independent and collaborative opportunities through workforce experiences for students;
- Student and teacher mentoring opportunities with business, industry and community leaders;
- Needs-driven professional development for local school educators, administrators, guidance counselors and teachers; and
- Rigorous STEM challenges that engage students and teachers and help them to build conceptual understanding of STEM concepts.



**5.2.6 St. Johns County:** The St. Johns County School District (SJCS) has a well-known reputation of excellence throughout the state. According to the 2013-2014 FLDOE<sup>33</sup> report St. Johns had the highest FCAT scores in the state. The district has a significant focus on STEM education an established structure of fifteen (15) successful career academies , nine (9) of which typically are fully STEM<sup>2</sup>-related and the remaining six (6) have strands or components associated with STEM<sup>2</sup>. SJCS's collegial planning process that includes all stakeholders enables the district to develop a strategic plan that is resourced and implemented with fidelity. The district touts exemplary leadership that supports STEM<sup>2</sup> related innovations that translate into student achievement and readiness for postsecondary success; including but not limited to the school board, superintendent, principals, career specialists and various advisory boards. Most importantly, the district enjoys a supportive community including families, businesses, governmental bodies as well as other educational institutions who are willing to support STEM<sup>2</sup>-related activities and who trust the direction the school district leads. The district is working to build on the current interest that STEM<sup>2</sup>-related businesses have in developing a "pipeline" from school to employment. In addition, the improving economic environment lends itself to greater support from local businesses and the community.

With an eye towards the growing interest in early childhood education that establishes a K-14 emphasis on specific educational program planning and implementation that includes STEM<sup>2</sup>-related objectives, the SJSD has launched an *Elementary STEM Fair*. The annual 1 Elementary STEM fair will be held at Palencia Elementary School (PES) in May. Third-, fourth- and fifth-grade students from St. Johns County elementary schools will display projects demonstrating the practices of science. The theme for third-grade projects is "Observation Odyssey." "Invention of the Imagination" is the theme for fourth-grade projects and the theme for fifth-grade projects is "Let's Experiment." Fifth graders presenting at the fair worked in teams or as individuals to design and perform experiments following the scientific method for experimentation. National Geographic Emerging Explorer Barrington Irving will make presentations and Northrop Grumman will host interactive displays for students focusing on robotics and lasers. Interactive science displays by the St. Johns County Environmental Division will feature watershed projects and environmental concerns.

5.2.6(a) Career Academies: The SJCSD career academies provide an opportunity for a group of students to enroll in a specific set of courses associated with a designated career area. Each career academy has five main components: (1) a recommended sequence of courses; (2) a capstone project, a work site experience, a research project studying careers in the academy area, or some other experience in which students learn more about the career cluster with which the academy is affiliated; (3) a regional demonstrated need for employees within the career cluster; (4) an advisory board consisting of business leaders in the career cluster; and (5) adherence to specific rules established by the school system. The nine fully STEM<sup>2</sup>-related career academies and the high school in which they are located are shown in Table 5-7.

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<sup>33</sup> <http://schoolgrades.fldoe.org/>

**Table 5-7: SJCS D Stem<sup>2</sup>-Related Career Academies**

<b>High School:</b>	<b>Career Academy Name and Description</b>
<b>Bartram Trail High School:</b>	<b>The Design Academy</b> - a rigorous and relevant Science, Technology, Engineering and Math (STEM) program focusing on one of three concentrations: Interior Design, Fashion Design or Architectural Design
<b>Creekside High School:</b>	<b>Academy of Environmental and Urban Planning</b> - a STEM program focusing on two strands: Civil Engineering and Environmental Engineering
	<b>Academy of Emerging Technology</b> - a program that focuses on two strands: Digital Media Technology or Network/Cybersecurity
<b>Pedro Menendez High School:</b>	<b>The Flagler Hospital Academy of Medical and Health Careers</b> - a business/educational partnership featuring internships and dual enrollment for those students interested in entering the medical field
	<b>The FMAEF Academy of Architectural and Building Sciences</b> - a program offering classroom instruction, building projects and internships for careers in architectural drafting, carpentry, masonry and other building trades
<b>Allen D. Nease High School:</b>	<b>The Stellar Academy of Engineering</b> - a STEM program that offers students a broad base of knowledge, skills and experience in drafting and design technology
<b>Ponte Vedra High School:</b>	<b>Academy of Biotechnology and Medical Research</b> - a STEM program focusing on the use of living organisms to solve problems or make useful products from biological systems
<b>St. Augustine High School:</b>	<b>St. Johns County Aerospace Academy</b> - a partnership program with Embry-Riddle Aeronautical University offering an introduction to STEM careers in Aviation and Aerospace Engineering
<b>St. Johns Technical High School:</b>	<b>Academy of Coastal and Water Resources</b> - a hands-on STEM program focusing on coastal, environmental and water resources.

Two new Information Technology Career Academies are planned for Ponte Vedra High School and Bartram Trail High School opening in the 2015-2016 school year.

### 5.3 Colleges and Universities STEM<sup>2</sup> Activities

**5.3.1 Edward Waters College:** The STEM<sup>2</sup> programs that are currently available at Edward Waters College (EWC) are degrees in mathematics and biology. EWC offers not only “second chances” for its student population but an intensive remediation curriculum including mentoring for certain students. As a result EWC has started to see significant progress of its at-risk students. The College also offers a dual degree in mathematics/engineering with agreements from UNF and FAMU for

students to finish their engineering requirements at either one of these universities, as well as a dual degree program in mathematics/computer science with UNF. Additionally starting in the fall 2015, the department of mathematics and science is adding a new degree plan for mathematics. The new degree plan will be a major in mathematics with a concentration in statistics (a critical need for the growing need for data scientists). The Biology Department currently has the following faculty conducting research in which students may participate: (a) Dr. Seymour, the Director Health Disparities Center with research primarily focused on African American Health issues; (b) Dr. Mandal, Dr. Armstrong West and Mrs. Wider Lewis who offer an integrated stem course BIO 490 special topics in research where students can develop research through interdisciplinary practices. Several faculty members also mentor students through the mathematics club.

**5.3.2 Flagler College:** Flagler College is a small, private residential college located in the nation's oldest city, St. Augustine, Florida. Students can choose from 29 majors and 34 minors that combine focused academic study with real-world experiences and community-integrated projects. The STEM<sup>2</sup> programs currently available are (a) a Coastal Environmental Science major, (b) a Mathematics minor, and (c) a Management Information Systems minor. The college does not offer any type of engineering, computer science or math major. Because the College's focus is on liberal arts, the physical science offerings are limited as well. However, even though Flagler's Coastal Environmental Science major is only two years old, it already has over 100 majors, which is quite large for a small school. Follow-up opportunities in the curriculum such as Biology may also be offered in the future.

**5.3.3 Florida State College Jacksonville:** Florida State College Jacksonville (FSCJ) is rapidly growing its reputation as the largest, and one of the most dynamic and influential higher education institution on the First Coast. The number of programs and quality of the graduates produce a significant economic impact on the Northeast Florida region. FSCJ boasts a nimble development of quality programs that respond to regional, state, and national needs. The college has received national recognition as a leader in the development and delivery of workforce programs and is the largest workforce program provider in the State of Florida. This is possible because of the amount and quality of hands-on equipment, faculty expertise, and FSCJ's strong connection with business community. One area in FSCJ excels is our online course offerings – the largest in the State of Florida. As the college seeks to develop and offer more STEM<sup>2</sup> programs and to create even greater access in current program offerings, online course development will be an area of focus.

**5.3.3(a) Grant Funding for Innovative Initiatives and Programs:** FSCJ focuses on STEM<sup>2</sup> workforce training on their five campuses through engagement in competitive grant applications and awards. Some of the relevant projects include the following grants:

- Carl D. Perkins, Career and Technical Education (CTE) Postsecondary Programs, Section 132 – This grant is funded by the Florida Department of Education. The college receives approximately \$1.6 million annually to improve career and technical education programs, several of which are in STEM<sup>2</sup> related fields: (a) Biomedical Engineering Technology; (b) Biotechnology Laboratory Technology; (c) Engineering Technology (Advanced Manufacturing); and (d) Cardiovascular Technology (and indeed, all of our medical/health programs). The Perkins grant supports all our CTE programs for workforce skills attainment, retention, completion and placement.

- Florida Georgia Louis Stokes Alliance for Minority Participation (FGLSAMP) – This grant is funded by the National Science Foundation to support the greater participation by underrepresented minority students in science, technology, engineering, and mathematics degree programs. The College has received this grant for more than 15 years.
- Florida Regional Consortium for Technology-enabled Learning Solutions. This grant is funded by the U.S. Department of Labor and is just one of our consortium programs. This collaboration among FSCJ and nine other Florida Colleges serves to develop online and hybrid training in Information Technology and Health Sciences, allowing displaced workers to be trained for quick re-entry into the workforce and to earn state approved or nationally approved certifications.
- INoVATE - A Network Virtualization Project is a grant project funded by the National Science Foundation. This collaboration among FSCJ, Daytona State College, Seminole State College of Florida, Eastern Florida State College, Tallahassee Community College, and the Convergence Technology Center at Collin College in Texas is focused on developing standard curriculum for a network virtualization technical certificate.
- North Florida IT Careers Alliance – This project involves a partnership between Florida State College at Jacksonville and Florida State University to address the areas of Information Technology (IT) that have a critical shortage of baccalaureate degree holders in Florida. FSCJ and FSU are developing an online Associate in Science program in IT Security that feeds directly into the College's Bachelor of Applied Science degree and FSU's Bachelor of Science programs in IT.
- National STEM Consortium Grant – This multi-year collaboration involves eleven colleges around the country who have come together to develop curriculum focusing on a select group of technical fields and offering one-year certificate programs for each. FSCJ's specific programs associated with this grant are mechatronics, environmental technology, and cyber technology.
- Ready to Work Grant – This U.S. Department of Labor grant partnership program funds a partnership among FSCJ, the Jacksonville Chamber of Commerce, and the Jacksonville Information Technology Council. The grant centers around preparing unemployed or underemployed residents of the Jacksonville community for IT jobs in the region and helping to place these program-completers with employers. Unemployed veterans are given priority admission to the program. Participants are offered training, test preparation, funding for certifications, and placement into employment or internships.

5.3.3(b) Co-Curricular Student Engagement Experiences: Through co-curricular Student Life activities, FSCJ provides students with numerous engagement opportunities in STEM<sup>2</sup> professional fields:

- Chemistry Club – This club promotes chemistry to all students and engages them in science activities external of the formal classroom. Students have engaged in a Quality Assurance tours of the research laboratories of Jacksonville -based Budweiser, research tours of Mayo Clinic chemistry and bio-chemistry laboratories as well as medical technology laboratories. Alumni of FSCJ who work in the chemistry and laboratory fields are paired with current club members for mentorships and career guidance.

- STARS Computing Club - The focus of the STARS Computing Club is to broaden participation and understanding of IT among women and under-represented minorities. The activities are linked with CROP and FAME program, serving Grades 6-12 and the college community. The group is also connected to Skills, USA program to engage with industry partners.
- Engineering Society - This engineering club promotes the field of engineering to all the campus students and provides a venue for business and industry representatives as well as alumni to network with the students. These opportunities assist our students as they identify their particular interests in the varied engineering tracks, select correct courses for articulation into an upper-division program, and fuel enthusiasm for the selection of the engineering career path. In addition, through an agreement with UNF's College of Computing, Engineering and Construction, students in FSCJ can join specific engineering student clubs at UNF.
- Association of Information Technology Professionals - The primary function of this group is to establish a professional network for mentorship and internship with Information Technology professionals in the area. The students enjoy field trip experiences to industry sites, guest lecturers in IT, partnering with alumni for career development, and attending the local chapter meetings for IT professionals.
- FSCJ Scholarships – FSCJ offers a yearly STEM scholarship of varying amounts to students in a STEM program.

**5.3.4 Jacksonville University:** Jacksonville University is a private liberal arts comprehensive university that is dedicated to developing civic-minded people who are competent, creative, curious, and confident. JU has excellent programs in Computer Science, Biology, Chemistry, Engineering, Marine Science, Mathematics, Physics, and Health Sciences (Nursing, Orthodontics, Speech-Language Pathology, Exercise Science and Health Informatics) and boasts an outstanding STEM<sup>2</sup> faculty. The University is currently building on opportunities in Engineering programs (Electrical and Mechanical Engineering), Information Systems and Cyber Security and the Health Sciences (Mental Health Counseling, Occupational Therapy, and Physician Assistant Studies, Nursing Informatics, Nurse Psychiatry, Food Science, Health and Policy).

**5.3.5 St. Johns River State College:** St. Johns River State (SJR State) is a public, full-service college serving approximately 11,000 full and part-time students in Clay, Putnam and St. Johns counties. The College offers baccalaureate degrees, associate in science degrees (AS), the associate in arts (AA) degree, college credit and vocational certificates; SJR State also houses the Florida School for the Arts (FLoArts) and Thrasher-Horne Center for the Arts. SJR State is dedicated to developing quality programs to meet educational and workforce training needs and drive economic development in Northeast Florida. Program quality is built on faculty expertise, individualized and hands-on instruction, and robust relationships with employers, businesses and universities.

SJR State offers students a range of opportunities in the Science, Technology, Engineering, Math and Medicine (STEM<sup>2</sup>) fields through its programs and through outreach and special initiatives. Degree and college credit certificate (CCC) programs in STEM<sup>2</sup> fields offered by SJR State are shown in Table 5-8. Typically, 600-700 students per year are enrolled in a STEM<sup>2</sup> degrees and/or certificates at SJR State. Mathematics, physical and life sciences courses are offered for the AA degree. Students can transfer to a variety of STEM<sup>2</sup> degree programs at numerous universities—including Embry-Riddle Aeronautical University and the University of North Florida, with whom SJR State has active

articulation partnerships. In 2012-13, more than 35% of SJR State AA graduates who transferred to a state university pursued a STEM<sup>2</sup> field.

**Table 5-8: STEM<sup>2</sup> Degrees and Certificate Program Areas at SJR State**

Accounting	Computer Information Technology	Computer Network Engineering Technology	Computer Programming
Criminal Justice Technology	Digital Forensics / Computer Related Crime Investigation	Emergency Medical Services	Emergency Medical Technician
Fire Science Technology	Geographic Information Systems	Health Information Technology	Health Services Management
Internet Services Technology	Medical Office	Network Infrastructure CISCO	Network Security
Nursing (ASN, LPN-RN, BSN)	Paramedic	Radiologic Technology	Respiratory Care

The federal Carl D. Perkins, Career and Technical Education (CTE) Postsecondary Programs, Section 132 and Rural and Sparsely Populated grant awards are funded through the Florida Department of Education to enhance career and technical education programs and encourage students and special populations to consider non-traditional career paths. The Perkins grant supports all of SJR State's CTE programs including the STEM<sup>2</sup> related fields for workforce skills attainment, retention, completion and placement. Advising support is provided to encourage high school and college students to progress in their selected pathway. The Perkins grant was instrumental in the development of our CISCO academy, providing vouchers for computer education students to sit for industry certification exams, and with the design and implementation of new courses in robotics. Additionally, simulation technology purchased with Perkins funds contributes toward SJR State's ability to promote the most advanced education for the next generation of healthcare professionals.

5.3.5(a) Business and Computer Technology: Initiatives in business and computer technology at SJR State include:

- **Collaboration in the *Florida XCEL-IT consortium*** led by the College of Central Florida and supported by the Department of Labor. This grant initiative expands training programs in Information Technology for displaced workers in 7 rural Florida communities. SJR State has developed 6 programs and anticipates serving more than 150 workers as part of this program. Students are afforded opportunities to intern and collaborate on real-world projects with partnering businesses.
- **Collaboration in the *Florida Regional Consortium for Technology-enabled Learning Solutions grant*** led by Florida State College at Jacksonville (FSCJ) and supported by the Department of Labor. This initiative develops online and hybrid training in Information Technology and Health Sciences for displaced workers. SJR State has served 47 participants in Information Technology program areas as part of this initiative. The industry certification exam process that was developed has yielded a 94% success rate.

- **Partnership with the United Way's/IRS Volunteer Income Tax Assistance Program (VITA)** provides students with experience prior to graduation. Free tax preparation is for low-income individuals, students, couples, families and seniors. This initiative is led by the faculty and students of the SJR State Accounting program in collaboration with VITA.

5.3.5(b) Health Sciences: Initiatives in the health sciences include:

- **A Jobs Ready Willing and Able program**, supported by The Walmart Foundation and lead by The American Association of Community Colleges, expands and enhances employability, soft skills training and employer connections for students in various programs including Nursing and Allied Health areas.
- **SJR State College led the Health Care Education Alliance (HEAL) project** which was funded by a Community Based Job Training Grant (CBJT) Administered through the Department of Labor Employment and Training Administration. The HEAL project at SJR State College enhanced opportunities for workers to engage in comprehensive training in health care, leading to improved employment options. Working together with 12 partners from the public and private sectors, who provided over two million dollars in leveraged support, HEAL strengthened and expanded the College's health care training capacity. HEAL activities included: faculty professional development opportunities through both instructional technology and advanced degree training, student support services for academic success and career development, and financial assistance for transportation, child care, or emergency financial situations directly impacting the student's retention and program completion. More than 600 participants benefited from the HEAL training programs and services.
- **SJR State Nursing and Allied Health Programs** are responsive to the needs of business partners, by providing advancement opportunities for current health care workers. The Bachelor of Science in Nursing and LPN-RN Bridge programs provide an upward pathway for nurses. This supports hospitals seeking Magnet Status, an award recognizing the strength and quality of their nursing. The Health Information Technology and LPN-RN Bridge programs are offered online, hybrid, evenings, weekends to encourage the progression and completion of working adults returning to College.
- **SJR State's Respiratory Care Program** was honored with the distinguished Registered Respiratory Therapist (RRT) Credentialing Success Award. SJR State is one of only 49 colleges nationwide to be honored with the award – an achievement that places the program in the nation's top 10%.

5.3.5(c) Outreach and Special Initiatives: SJR State outreach and special initiatives that impact STEM<sup>2</sup> education and training include:

- **Partnership with Pragmatic Works and Clay County School District on the School of Programming.** The program provides introductory programming dual enrollment courses for 6 juniors and seniors at Middleburg High School. The initiative allows students to earn college credit and accelerate their education and career pathways after high school. The program is currently being expanded to other high schools in Clay County; the number of students is projected to triple.
- **Health Science Career Pathways.** Nursing and Allied Health faculty actively participate in high school health science academy advisory boards, and support field trips, curriculum development and transition to work and/or college activities.

- **The College Reach Out Summer Institute**, sponsored by the Florida Department of Education, and the **Work-Ready Youth program**, supported by CareerSource Northeast Florida, integrate STEM<sup>2</sup> skills and career awareness in their activities targeted at improving the college and career-readiness of middle and high school students.
- **The Data Busters program** supports teens with employment and job skills training during the summer. The College partners with the Northeast Florida Community Action Agency (NFCAA) to provide the classroom instruction component. Students also participate in on-site work experiences with local businesses.
- **SJR State's STEM Partnership with Northeast Florida Educational Consortium (NEFEC)** hosted two STEM activities on our Palatka and St. Augustine Campuses. The students gained exposure to careers that were STEM related and were made aware of programs that were offered at SJR State. Hands-on and group activities were developed to engage the students. Examples included students given a box of items to build cars that would move a certain distance, exposure to our firing range simulation technology, and analysis of a crime scene scenario delivered by the Putnam County crime scene investigator.
- **SJR State College students participate in STEM<sup>2</sup> related program competitions.** The College hosts an annual *Robotics Competition* for middle school students in partnership with Clay County School District to help students develop computer programming skills and encourage them to explore STEM<sup>2</sup> careers. Through the Cisco Academy, students participated in the International NetRider Competition with five SJR State students selected to represent Florida in round two competitions and one SJR State student moving to the international final competition. SJR State students participate in the intercollegiate programming competition annually at Seminole State College. The Mathematics Club participates in the Mathematics Olympics held at the University of North Florida each spring.

**The following STEM<sup>2</sup> related student clubs** are active on our campuses: The Association for Computing Machinery Student Chapter, Math Club, Gaming Club, Radiology Club, and the Respiratory Club

5.3.5(d) Math and Science Initiatives: Initiatives in math and science include:

- **A comprehensive Quality Enhancement Plan (QEP), Conquer Math**, is aimed at improving student learning and success in Intermediate Algebra, which is often a gatekeeper course for students interested in STEM<sup>2</sup> careers. Initiatives include: increased academic support and tutoring and professional development for math instructors. The QEP is developing promising practices and impacts in its first year of implementation.
- **Experiential Learning in the Sciences** is incorporated by the faculty within SJR State classrooms and the school districts. Examples are field trips, elementary school classroom presentations, and guest speakers from STEM<sup>2</sup> fields.



**5.3.6 University of North Florida:** The University of North Florida (UNF) is the region's only PhD granting institution. Nationally, UNF is recognized as a high-caliber education destination and a great place to study, live and thrive. Through the University's five Colleges, Continuing Education, Library and numerous other units, UNF offers a wide range of STEM<sup>2</sup> degrees, outreach programs and activities for all ages. UNF's degree programs, both on-site and online, are nationally ranked. For example, the Affordable Colleges Foundation, a leading resource for online learning and college affordability information, has published its new ranking of 2015's Best Online Nursing Schools, ranking the University of North Florida No. 3 in the country. UNF is the only Florida state university to make the list. Table 5-9 lists the numerous STEM<sup>2</sup> degrees offered at the University.

**Table 5-9 STEM<sup>2</sup> Degrees Offered at UNF**

Mathematics Teacher Education.	Computer and Information Sciences
Science Teacher Education	Civil Engineering
General Science Teacher Education.	Electrical Engineering
Health Sciences	Mechanical Engineering.
Health Care Administration	Construction
Athletic Training	Biology.
Mental Health Counseling	Mathematics
Community Health/Preventive Medicine.	Statistics
Physical Therapy	Biology
Vocational Rehabilitation Counseling	Chemistry
Dietetics.	Physics.

In addition to programs for UNF students, the University also offer opportunities to expand college-student interest in STEM<sup>2</sup> for non-UNF college students. For about 20 years, UNF's College of Arts and Sciences has hosted and created a math competition for all State of Florida Community Colleges and Colleges. In general, eligible competitors will have only taken mathematics/statistics courses from the following list: Precalculus, Calculus I, Calculus II, Calculus III, ODE, Linear Algebra, Discrete Mathematics, Number Theory, History of Math, and any other 1000 or 2000 level courses.

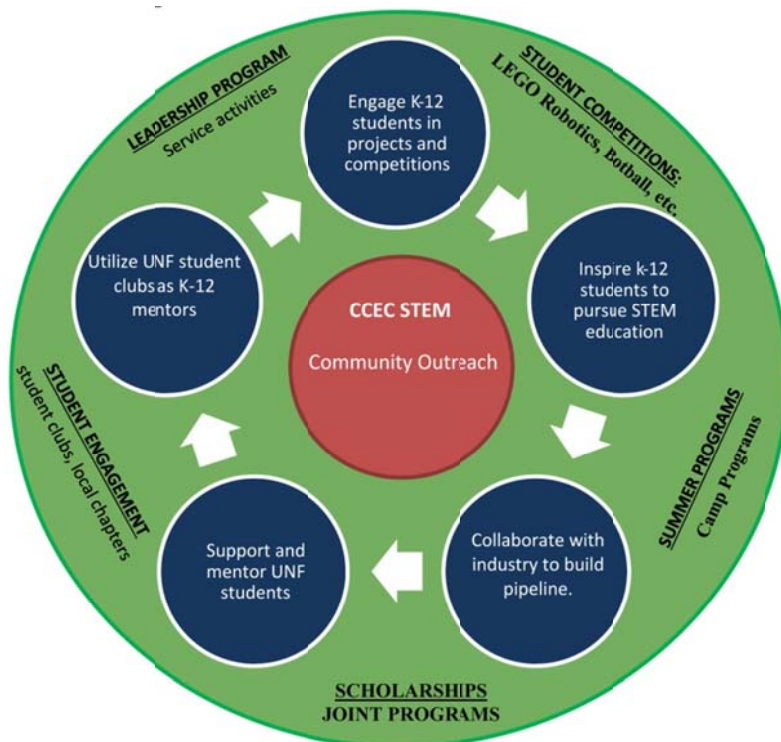
The College of Education and Human Services has developed The Jacksonville Teacher Residency (JTR) program, which is specifically designed for STEM graduates who are interested in becoming math or science teachers in Duval County's urban, high-needs schools. JTR was spearheaded in 2014 by Dr. Nikolai Vitti, Superintendent of Duval County Public Schools (DCPS), as part of his long-term plan to address the county's dire need for effective, long-lasting science and math teachers in Jacksonville's high-needs middle and high schools. JTR offers a unique synthesis of theory and practice, combining a yearlong classroom teaching apprenticeship with a Master of Education degree from UNF. JTR's STEM degree prerequisite means that residents enter the program with a deep understanding of and proficiency in the content area they'll teach in the classrooms (science or math), allowing JTR to provide the teaching theories, practices, and experiences they need to become dynamic teachers. By the end of their first year of JTR, residents are eligible to become full-time teachers in a high-needs DCPS school.

In addition to STEM<sup>2</sup> degrees and programing, the University offers a myriad of outreach activities to support education and growth of STEM<sup>2</sup> disciplines across K-12 schools, continuing education and training opportunities to help businesses maintain and upgrade skills in STEM<sup>2</sup> areas, and programs to

increase the understanding and appreciation of STEM<sup>2</sup> disciplines and topics for the general public. A small selection of these types of programs is presented below.

5.3.6(a) K-12 Outreach and Recruitment Examples: It is well documented that hands-on engagement in STEM builds interest and excitement across elementary, middle and high school students. All of the academic units have significant outreach and recruitment activities to K-12 Schools.

**Figure 5-1: CCEC STEM Outreach, Recruitment and Retention Program**



- The College of Computing, Engineering and Construction (CCEC) has a broad array of outreach programs held on an annual cycle for multiple grade levels. Activities ranging from Botball and Lego robotics competitions, to hosting Women in Engineering day, Expanding Your Horizons, (a program for middle school girl that consists of a full day of interactive STEM workshops) to hosting the National Center for Women in Technology (NCWIT) awards banquet. The College has a well-developed STEM outreach program that extends into the 4-year College curriculum to help support STEM students and ensure retention in the field. Figure 5-10 shows the layout of the CCEC STEM outreach, recruitment and retention program.

- Each year, in collaboration with the College of Education and Human Services, the Biology department in the College of Arts and Sciences offers a week-long STEM summer camp for gifted 9<sup>th</sup> and 10<sup>th</sup> grade students from Northeast Florida. There are two thematic programs in biology that students choose from: Environmental Biology or Biomedical Sciences. Students are taught about aspects of these fields (e.g. environmental remediation plans, genetics, sensory physiology), then design their own experiments, collect and analyze data, and then present their findings.
- Since 2007, the annual Chemistry Olympiad competition for our region has been hosted at UNF by the Jacksonville Section of the American Chemical Society (ACS) and the Department of Chemistry. The U.S. National Chemistry Olympiad (USNCO) program is a chemistry competition for high school students intended to stimulate young people to achieve excellence in chemistry. The regional competition is open to all high school students.
- Physics faculty member, Dr. John Anderson, is the director of the UNF Science and Culture Initiative (SCI). Among its activities the SCI sponsors the Sciences and Humanities Joe Berg Seminar series. This program attracts talented local high school students in the sciences and assists them in gaining a more informed view of the sciences and how the sciences interface with the wider culture and the humanities.

- Each year, the Department of Physics, the School of Engineering, the Chemistry Department, and the School of Computing offer a month long summer STEM Jumpstart Experience for select student entering in the fall. The four-week program includes an intensive update and preparation provided by the Math Department for the mathematics class that is the foundation course taken by entering STEM freshmen. The program also includes field trips and educational challenges and visits to local high-tech companies.

5.3.6(b) UNF Student Activities in STEM<sup>2</sup>: Many of UNF's STEM<sup>2</sup> activities involve student clubs to build interest in all levels in STEM<sup>2</sup> subjects and promote UNF as an community-engaged University. For example, every fall, Osprey Financial Group Members from the Coggin College of Business go to the Susie E. Tolbert Elementary School and "teach" several kindergarten classes about the finance/economics part of math. Using simple examples such as comparing pennies and nickels and relating that to relative value, basic math principles are introduced. Biology faculty and students give demonstrations and presentations each year to regional elementary, middle and high schools; for example "Strawberry Science" at Flagler Palm Coast High School taught students how to extract DNA from strawberries. The Department of Chemistry and the ACS Student Affiliates club will host a Chemical Analysis competition in Spring 2015, funded by a competitive grant from the ACS. In the School of Computing, the Society of Women Advancing Technology (SWAT) is a new student group that focuses on recruiting and retaining women in technology disciplines. The plan is to have monthly meetings at which a female role model is the speaker. The February meeting featured Jane Landon, CIO of web.com and the March meeting featured Kathleen Brandt, President-CSX Technologies. Two all-male winning teams at the Fall symposium donated their winnings to SWAT in support of their activities.

The STEM research program in the Coggin College of Business is an empirical research program, involving math and statically sophisticated data analysis tools developed in collaboration with business leaders to further knowledge in science, technology, and engineering areas. The research focuses on exploring the impact of complex sourcing processes on technology, science and engineering driven businesses such as leading companies in the design and manufacturing of high technology automatic machines for the processing and packaging needs of the pharmaceutical industry, the manufacturing of phosphorus derivatives such as lubricant oil additives and plastic flame retardant additives, and the tire industry.

5.3.6(c) Continuing Education for Professionals: The University of North Florida's Division of Continuing Education offers non-credit course and certificate programs, including many of the computing certificates sought by employers as well as six-sigma and Lean" process certification. In addition UNF can provide customized learning solutions that bring up-to-date knowledge and techniques into companies, shaped for the objectives and culture of that organization. While all of the courses are available on the UNF campus, most can be taught at a company's facility to maximize time, coordinate with shifts and schedules or to dovetail with internal training and development resources.

5.3.6(d) Activities for the General Public: In addition to STEM<sup>2</sup>-related lectures, workshops and activities, the university also offers specialized activities connected to some of the STEM<sup>2</sup> outreach activities discussed above. For example, the UNF Office of Enrollment Services hosts a Parents' Workshop as part of E-week activities. The workshop coincides with the Boy Scouts of America Merit Badge Clinic and the Girl Scouts of America participation in "Expanding your Horizons" workshop, both of which are held on UNF's campus.

## Section 6

### STATE OF STEM<sup>2</sup> BUSINESS & INDUSTRY ACTIVITIES IN NORTHEAST FLORIDA

#### 6.1 STEM<sup>2</sup> Employment and Diversity

**6.1.1 National Perspective:** According to a recent report from the National Academy of Sciences<sup>34</sup>, the STEM<sup>2</sup> workforce is large and projected to grow faster than any other sector in coming years. To meet the rapidly increasing demand, there is widespread agreement that we must expand the pool from which STEM<sup>2</sup> workers are drawn - but we start from a challenging position: Underrepresented minority groups comprised 28.5 percent of the population nationally in 2006, but just only represent 9.1 percent of college-educated Americans in science and engineering occupations (academic and non-academic), meaning that the percentages of underrepresented minorities in S&E would need to triple to match their share of the overall U.S. population.

However, despite a national focus on directing more students toward science, technology, engineering and math fields – particularly women and minorities – the STEM workforce is no more diverse now than in 2001, according to data from Change the Equation<sup>35</sup>. Women have held constant as a percentage of the Computing workforce (36% in both 2001 and 2015) but have lost slightly in both the Engineering workforce (dropping from 25% to 24%) and the Advanced Manufacturing workforce (dropping from 19% to 18%) from 2001 to 2015. African Americans and Latinos are losing ground in the STEM disciplines. While the percentage of the US population employed in engineering, computing and advanced manufacturing has increased from 24% in 2001 to almost 30% in 2015, the percentages of African Americans and Latinos employed in these sectors have stagnated between 12% and 16%.

**6.1.2 State of Florida Perspective:** As noted in section 5.2.1 above, there are few published and publicly available sources of data on the state of STEM<sup>2</sup> education and underrepresented groups in Florida outside of “*The State of STEM in Florida: A Snapshot*”<sup>36</sup> that presented baseline data on several metrics. For example, while the national average for women in Computing workforce has held steady at around 36% between 2001 and 2015, in Florida males far outnumber females and the gap has increased since 2000. Similarly, while the national average for women in Engineering is around 24%, Florida has held relatively constant around 20%. In the Physical Sciences, males outnumber females, but the gap is smaller than in Engineering or Computer/Information Science. .

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<sup>34</sup> National Academy of Sciences (2011): *Expanding Underrepresented Minority Participation*. Report of the Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline. The National Academies Press, Washington, D.C. Available online at [https://grants.nih.gov/training/minority\\_participation.pdf](https://grants.nih.gov/training/minority_participation.pdf). (Last accessed 3/17/15).

<sup>35</sup> Data taken from “Change the Equations” Website at <http://www.changetheequation.org/blog/stemstatistics-display-solving-diversity-dilemma>. (Last accessed 3/17/15).

<sup>36</sup> Laura B. Lang, Mabry Gaboardi, Frank Fuller, & Christine Johnson (2010):*The State of STEM in Florida: A Snapshot*. Produced by The Florida Center for Research in Science, Technology, Engineering, and Mathematics, Florida State University, Tallahassee, Florida (January, 2010). Available online at [http://www.helios.org/uploads/docs/StateofSTEM\\_Final.pdf](http://www.helios.org/uploads/docs/StateofSTEM_Final.pdf) (Last Accessed on 3/11/15).

**6.1.3 Regional Perspective:** While State data are limited, regional data are even less available. The State's Department of Economic Opportunity (DEO) statistics list occupations, but do not separate out STEM<sup>2</sup> related disciplines. Using the 2013 DEO data<sup>37</sup>, approximately 16% of those employed in the region could be classified as STEM<sup>2</sup> workers. However, the DEO data do not provide information on race or ethnicity, so it is not possible to get detailed estimates. The Federal Bureau of Labor Statistics does publish data providing information on employment and unemployment by race, ethnicity and gender, but does not break information out by STEM<sup>2</sup> disciplines.

## 6.2 STEM<sup>2</sup> Entrepreneurs and Start-up Companies

Communities throughout the nation including Colorado, California and Washington State appear to consider their entrepreneurs and start-ups as a vital component in the growth and sustainability of their regions. The U.S. Bureau of Labor Statistics has determined start-ups in their first year of existence currently create around 2.5 million new jobs a year in the U.S. Although many of the drivers for these job creators may be debated what's less debatable is the value to a region of establishing a healthy startup community. Therefore start-up infrastructure has become part of the essential elements to accelerate the growth of STEM<sup>2</sup> careers.

The Brookings Institute's Metropolitan Policy Program<sup>38</sup> has identified many of the most effective metropolitan economies; most include a thriving start-up community built around an effective integrated infrastructure to support fledgling businesses. There are certain "best practice services" included within these communities, oftentimes under the same brand names.

- **Tech Accelerator:** Technology Accelerators provide a place for specific demographics including students (under-graduate and graduate students), budding entrepreneurs (including veterans, unemployed and fully employed) who are in the beginning stage of business development to receive generalized mentoring, structured and unstructured education.  
**Incubator:** At the point where an idea is viable and ready to be patented, and incubator will provide second stage companies intense mentorships and customized programming. Mentoring support involves identifying a diverse group of seasoned mentors to provide customized support and programming for specific start-up companies; generally in a defined period of time ranging generally from twelve weeks to six months.

There are several notable regional start-up entities in the United States. For example, Long Island has a not-for-profit hub that has a relationship with SUNY for research purposes. Cincinnati partners with the Northern Kentucky University and offers a select group of start-ups six-month business development programs. One of the most dynamic hubs - Chicago's 1871 entrepreneurial hub for digital start-ups is a standalone not-for-profit organization and also offers co-working space to its members. Notably, Google's fiber cities (Kansas City, Austin, and Provo) have created unique fiber hubs. While Galvanize Tech Hub is a for-profit structure that offers regional "franchises" in Denver, Boulder, San Francisco and Seattle.

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<sup>37</sup> Data taken from DOE Website at <http://www.floridajobs.org/labor-market-information/data-center/statistical-programs/occupational-employment-statistics-and-wages>

<sup>38</sup> Available online at <http://www.brookings.edu/about/programs/metro>

Several cities have created a defined downtown zone by locating entrepreneurs and innovators into a centrally located region where their proximity creates energy that benefits both them and the community in general. At least fourteen cities around the nation have taken either this approach or a similar next step including: Kansas City Startup Village (lead by entrepreneurs), downtown Detroit (lead by businesses) and Cortex Innovation Community (lead by Washington University in St. Louis). In Florida, the University of Central Florida and the University of Florida both have affiliated start-up hubs. While the Venture Hive® Miami Accelerator offers 12 weeks during which 10 teams work full-time on creating a scalable business model for their technology start-up.

In February 2012, Evolution Finance launched Wallet Hub, billed as a one-stop destination for all the tools and information consumers and small business owners need to make better financial decisions and save money. WalletHub.com analyzed the startup opportunities that exist in the 150 most-populated U.S. cities using 13 metrics, ranging from five-year survival rate and the affordability of office space to the educational attainment of the local labor force (Available at <http://wallethub.com/edu/best-cities-to-start-a-business/2281/#main-findings>). The top 10 cities are shown in Table 6-1. It is notable that no Florida city ranks in the top 20. The highest-ranked Florida City was Tallahassee at number 39. Other Florida Cities that made the top 150 were Jacksonville (No. 58), Tampa (No. 69), Orlando (No. 79) and Miami (No. 108)

**Table 6-1: Top 10 Cities for Start-Ups**

Overall Rank	City	“Access to Resources” Rank	“Business Environment” Rank
1	Shreveport, LA	6	13
2	Tulsa, OK	18	1
3	Springfield, MO	1	70
4	Chattanooga, TN	2	65
5	Jackson, MS	4	72
6	Sioux Falls, SD	39	2
7	Memphis, TN	14	39
8	Augusta, GA	15	21
9	Greensboro, NC	31	11
10	Columbus, GA	26	19

**6.2.1 Start-up Example in Jacksonville:** Founded in Northeast Florida in 2009, by Navy Veteran Juan Carlos Villatoro, Urban Mining is disrupting the process and repairing the reputation for electronics recycling with a focus on environmental sustainability, transparent downstream management and attention to data security. Urban Mining was born from a commitment to innovate an environmentally responsible solution for the growing global issue of hazardous electronic waste. With a state of the art electronics recycling facility and a proprietary on-site Innovation Lab, Urban Mining’s mission is to continually minimize the impact of human progress on the earth’s natural resources. The facility, located in Jacksonville Florida, is the regions only e-Stewards Certified Electronics Recycler and in 2016 will become the first fully contained, solar powered electronics recycler in the United States.

Urban Mining partners with private businesses, government organizations, schools and community organizations to collect, recycle and refurbish tons of unwanted e-waste every year. As a voluntary Public Benefit Corporation, Urban Mining maintains the corporate purpose to create a material positive impact on society and the environment; considering the impact of corporate decisions not only on shareholders but also on workers, community, and the environment. Each year, Urban Mining also makes a commitment through Corporate Social Responsibility to improving the lives of children through access to online information and education. Since 2010, The Urban Mining CSR program has delivered solar powered computer labs, refurbished electronics and computing classes to underdeveloped community in the Dominican Republic.

*“Starting Urban Mining required me to have significant contacts in our region including two universities, the Small Business Administration, VCs and the Chamber. Having all these resources under one roof would have been invaluable and accelerated the development of Urban Mining.”* – Juan Carlos Villatoro, Founder and Lead Urban Mining

### 6.3 STEM<sup>2</sup> Industry Competitiveness

While the Northeast Florida Region continues to do an effective job identifying, attracting and sustaining large, medium and smaller start up entities alike, an important goal is to first retain and increase regional competitiveness. The business rivalry to attract the right combination of company and workforce talent is becoming significantly more competitive. In the article STEM Jobs Key to Better Economy, USA Today aggregated and highlighted the state of STEM at a national and regional level.<sup>39</sup>

*Over the past decade, jobs in science, technology, engineering and mathematics (STEM) have grown at a rate three times faster than non-STEM<sup>2</sup> jobs. Momentum will continue over the next decade as STEM<sup>2</sup> jobs will grow at a staggering rate of 17%. Minorities and women are underrepresented in STEM<sup>2</sup> fields, leaving a staggering amount of economic potential on the table. By 2018 1 million computer science jobs will go unfilled by US workers.*

In 2014, the Consumer Electronics Association (CEA) evaluated all 50 states and Washington, D.C., on conduciveness of their legal, regulatory and overall business environments to welcome and encourage innovation<sup>40</sup>. The scorecard was based on 10 criteria, including: right-to-work laws; policies that support new business models; tax friendliness; Internet speed; and size of the tech workforce. Florida scored highest for its right-to-work laws and its tax friendliness, while it scored lowest on its tech workforce, attracting investments and grants for STEM degrees. The ranking of all 50 states and DC are shown in Table 6.2

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<sup>39</sup> STEM jobs key to better economy, USA Today, January 10<sup>th</sup> 2014

<sup>40</sup> Megan Ribbens “Florida named innovation leader in new state ranking.” Orlando Business Journal, Morning Edition, Apr 20, 2015, available at ([http://www.bizjournals.com/orlando/morning\\_call/2015/04/florida-named-innovation-leader-in-new-state.html](http://www.bizjournals.com/orlando/morning_call/2015/04/florida-named-innovation-leader-in-new-state.html)) (Last accessed 30 April, 2015)

**Table 6.2: Ranking of States on Innovation by CEA**

<b>State</b>	<b>Tech Workforce</b>	<b>Entrepreneurial Activity</b>	<b>Stem Degrees</b>	<b>Overall Score</b>
Alabama	C-	B-	C	Innovation Leader
Alaska	C	A-	F	Modest Innovator
Arizona	B	C	B	Innovation Leader
Arkansas	D	C	D-	Modest Innovator
California	B	B+	B-	Innovation Adopter
Colorado	B	B+	B	Innovation Leader
Connecticut	B	B	B	Innovation Leader
Delaware	B	B	B	Innovation Champion
DC	A+	B	A+	Innovation Champion
Florida	C-	B+	C-	Innovation Leader
Georgia	B	C+	C-	Innovation Leader
Hawaii	D	B+	C	Modest Innovator
Idaho	D	B	C+	Innovation Leader
Illinois	B	C	C+	Innovation Leader
Indiana	C+	D	B	Innovation Champion
Iowa	B-	F	A	Innovation Leader
Kansas	B	D+	C	Innovation Leader
Kentucky	D	B+	D+	Modest Innovator
Louisiana	D-	B	D+	Modest Innovator
Maine	C-	B	B+	Modest Innovator
Maryland	B	B	B	Innovation Leader
Massachusetts	B	B-	B+	Innovation Champion
Michigan	B	B	B	Innovation Champion
Minnesota	B	D	B	Innovation Adopter
Mississippi	F	C+	D-	Innovation Adopter
Missouri	B-	C	B	Innovation Adopter
Montana	D+	A+	B	Innovation Adopter
Nebraska	B	B	B	Innovation Leader
Nevada	D	C+	F	Innovation Adopter
New Hampshire	B	C-	B+	Innovation Leader
New Jersey	B	C-	C+	Innovation Adopter
New Mexico	D+	B+	D	Modest Innovator
New York	B-	B	B	Innovation Adopter
North Carolina	B-	B	B-	Innovation Champion
North Dakota	B	C-	B-	Innovation Leader
Ohio	B	C-	C+	Innovation Adopter
Oklahoma	C-	B	D+	Innovation Adopter
Oregon	B	C	B	Innovation Leader
Pennsylvania	B	C-	B	Innovation Adopter
Rhode Island	B	D-	B+	Innovation Adopter
South Carolina	C-	B-	C	Innovation Leader
South Dakota	C+	A-	B	Innovation Champion
Tennessee	C	B	C-	Innovation Leader
Texas	B	B	D	Innovation Champion
Utah	B	B	B+	Innovation Champion
Vermont	B-	B-	A	Innovation Leader
Virginia	B	C+	B	Innovation Champion
Washington	B	D+	B-	Innovation Leader
West Virginia	F	B	B	Modest Innovator
Wisconsin	B	D+	B	Innovation Adopter
Wyoming	D+	B+	D+	Innovation Leader



Economic Modeling Specialists Intl. (EMSI) is a CareerBuilder company, which turns national labor market data into useful information that helps organizations understand the connection between economies, people, and work. Using sound economic principles and good data, EMSI builds user-friendly services that help educational institutions, workforce planners, and regional developers (such as workforce development boards, economic development organizations, chambers, utilities) build a better workforce and improve the economic conditions in their regions. Using EMSI figures for all occupations with a median hourly wage of \$30.00 and above the Northeast Florida region shows a deficiency in high-wage jobs of over 45,000 based on present employment levels and projections show a deficiency of greater than 52,000 by 2020 based on a comparison of regional college completions in 2013 and projected estimated jobs. Furthermore it is projected employment in STEM<sup>2</sup> occupations will increase 8.7% in Northeast Florida, higher than both state levels (8.3%) and national levels (7.5%).

Of the top 25 jobs showing (projecting) a labor force deficiency from 2014-2019, STEM<sup>2</sup> jobs are heavily weighted, careers in IT and medicine are at the top of the list. The second fastest job classification (computer user support specialists) only requires some college. Additionally, the need for information security analysts continues to grow.

At a specific company level, CareerBuilder helps companies find the right people for their businesses at the right time. Late in 2014 one of their members (Alluvion Staffing) requested details on the market for .Net developers. Based on CareerBuilder data from 2013 – 2015 it was determined there was a demand for 4,004 .Net developers in the Northeast Florida region, however there were only 266 active candidates to meet this demand. These positions also paid an average of \$94,393 annually.

*We have a limited talent supply in key areas such as .Net development. As a result, many local employers have chosen outsourcing partners that provide most of their development resources via an offshore model. If we are able to develop our local talent in these key areas, we have a significant opportunity to transform our workforce and reclaim the jobs for Jacksonville."David Reichard, CEO Alluvion Staffing, Inc.*

## SECTION 7

### ANALYSIS OF STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS FOR STEM<sup>2</sup> IN NORTHEAST FLORIDA

#### 7.1 Summary of Individual Organizational Weaknesses and Threats

As part of the initial baseline survey of STEM<sup>2</sup> activities and assets in Northeast Florida, the organizations surveyed were asked to identify strengths, weaknesses, opportunities and threats related to STEM<sup>2</sup> from the perspective of their individual organizations. The strengths and several of the opportunities were used to develop the description of Northeast Florida STEM<sup>2</sup> assets presented in Section 3 of this report. Individual weaknesses and threats are presented below. These weaknesses and threats are presented unconnected to an individual organization to provide a basis for the development of a regional (as opposed to organizational) assessment. It is also worth noting that many of the opportunities and threats were common across multiple organizations. In these instances, the opportunity or threat has been entered in the tables below only once.

**7.1.1 Weaknesses:** In the survey, organizations were asked to identify the top three to five characteristics that place the business or project at a disadvantage relative to others. The following analysis groups similar comments that were listed in one or more of the surveys into a generalized weakness category.

7.1.1(a) Lack of Funding and Limited Resources: The most frequently identified weakness was a lack of funding and the resulting limits on resources. This was mentioned in one form or another in every organizational response. A sampling of the detailed comments includes:

- Many STEM programs are currently dependent on grant funding, and would not be sustainable with district funds under current economic conditions.
- The biggest challenge is the amount of funding allocated for STEM education. Nothing stifles the success of our programs more than the current level of funding for such a substantially more costly academia.
- The ratio of funds allocated per student requires many of the higher priced equipment to be shared. Robotics and technology devices being the most expensive, is reserved for demonstration only or omitted from the lesson plans all together. This truly prohibits students' engagement in the classroom. We would like to offer robotics to competition teams and even integrate into school's curriculum as a lab with hands on experiences in small group settings. Even simple technological equipment like handheld probes for Science experiments are in limited quantity and at \$1,500 a set they are commonly used only in teacher demonstration.
- The funding challenge in STEM education is not just related with equipment but also limiting additional opportunities such as professional development for staff members.
- Most STEM/STEAM programs in the district have been grant funded or funded by partnering corporations that normally assist with the initiation phase of these programs. Replacing consumable materials, maintenance/upgrading of technology, and alignment of ever changing federal and state standards often become the main issue that cause these programs to dwindle.

- Finding additional monies to supplement expensive specialized STEM field trips, afterschool activities and clubs is a challenging weakness as well. This financial obstacle prevents the participation of families with limited incomes to partake in these truly enlightening and engaging STEM programs with field trips being the most difficult especially if they require overnight hotel accommodations.
- Cutting-edge initiatives are often spurred by grants. This funding source creates problems of sustainability when grants run their course. We need to develop new models/revenue streams (e.g. consulting, subscriptions, etc.) to keep vibrant initiatives going.
- Lack of capacity to supply hardware and software at a one-to-one student ratio.
- Funding opportunities to expand academy offerings and acquire technology to support a more project based curriculum.
- Funding allocated to STEM education is strong but more equipment, better qualified staff dedicated to STEM fields and additional resources for STEM inspired activities outside the classroom would overcome many hurdles of STEM based programs.
- Lack of capacity for facility development and/or retrofitting to keep pace with growth and targeted STEM<sup>2</sup> program needs.
- Limited funding; Limited staff and resources.
- Arranging sponsorship for various activities.
- Availability of technology development.
- Capacity of the Education Buildings.

7.1.1(b) Lack of Personnel: The second most common weakness cited, which is closely related to funding, was the difficulty in finding, training and retaining qualified personnel. This was especially noted within the responses from the school districts and several of the non-for-profit entities. For example, some of the specific weaknesses cited on the survey were:

- Relying on volunteers to understand the importance and value of STEM programming to girls.
- Lack of capacity to find and hire teachers with the necessary certifications to support STEM<sup>2</sup> programs.
- Finding good coaches and mentors.
- Professional development (PD) opportunities are often concerns of school principals prior to implementing STEM/STEAM programs into their schools. Principals want to know exactly what the PD will offer, more important how to effectively monitor the implementation of the program. Teachers often show interest in wanting to teach STEM/STEAM courses which is often balanced by anxiety due to the lack of training. Administrators and teachers are looking for professional development that will assist in connecting STEM/STEAM to their school improvement plans, ongoing classroom support during the initial implementation phases, and a solid focus on improving student achievement rather than fixing student achievement.
- Recruiting, hiring, and retaining faculty who meet faculty credentialing requirements as set by the College's accrediting body, the SACS-COC, as well as individuals who meet industry certifications and standards can be a challenge. Often added to that challenge is a significant disparity between faculty salaries and industry salaries.

7.1.1(c) Other Factors: Each organization has unique challenges based on factors of location, infrastructure or the nature of their activities. Examples of these weaknesses that were cited in the survey include:

- Large geographical area.
- Regional future state of the telecom hub in our region, including policies, procedures and execution next steps to build future business value.
- Lack of STEM industry leaders located within boundaries of County resulting in a lower tax base.
- Lack of technology infrastructure and access to computers in schools (broadband, internet access, and devices) and insufficient funding to remediate at desired pace.
- There are a variety of STEM/STEAM programs offered in pockets throughout the district. However, it comes as a disadvantage to students and parents when the “feeder” middle or high school does not offer a program for students to continue at the middle and high school level. Often times this discourages parents from enrolling their children into a school with a well-established program.
- Not being a “first-choice” institution for high-achieving students who are academically talented and who are inclined to embark on a STEM<sup>2</sup> major course of study. Such students likely pursue admission into research universities rather than state or community colleges.

**7.1.2 Threats**: Much like with weaknesses, organizations were asked to identify the top three to five elements in the environment that could cause trouble for your business or educational institute.. As before, similar comments that were listed in one or more of the surveys into a generalized threats category.

7.1.2(a) Funding, Resources and Personnel: Echoing the characteristics that place organizations at a disadvantage (weakness), most organizations also cited a lack of funding, resources and personnel as an ongoing threat. Examples listed include:

- Ability to fund high cost technology infrastructure, hardware and software that meet industry standards. This goes beyond initial purchase to include sustainability and “refresh” schedules.
- Budget constraints could impede expansion of successful programs.
- District wide there is a critical staff shortage of certified math and science teachers, particularly at the secondary school level. Math and science teachers are typically the individuals that school administrators would choose to lead STEM/STEAM programs. Math underpins most STEM academic programs and students who are weak in math are unlikely to be able to pursue a STEM career. However, administrators may be somewhat reluctant to nominate those teachers because they are currently teaching in high accountability areas.
- The high pay and high demand STEM workforce is stiff competition when employing teachers in the same disciplines. Staffing STEM educators is difficult when they are required to teach, participate in academic team counseling and champion after school activities without equal compensation as their STEM professional counterparts. There should be additional incentives to STEM teachers until the workforce demand is met and the pay differential is more balanced. Until this pay disparagement has been addressed, all STEM programs will struggle with the threat of lacking quality teachers to meet program requirements.
- Funding required to develop, launch, and sustain STEM<sup>2</sup> programs, including monies for equipment purchase/maintenance, faculty, support staff, and advising personnel, faculty and staff professional development, curriculum development, supplies and marketing/recruitment

7.1.2(b) Challenges from the State Legislature: Because STEM<sup>2</sup> education at all levels is greatly affected by state requirements and funding, the uncertainties inherent in the legislative process were cited by several entities as potential threats. Specific notes were made of:

- Legislative mandates that could shift priorities away from STEM programs.
- External influences which tend to shift with great frequency, for example the most recent legislative actions become an immediate district priority regardless of previous planning
- Keeping quality STEM educators and the ever changing curriculum standards are threats.
- Curriculum standards and assessment are constantly changing on a regular basis. The adjustment of curriculum, staff training and proper education takes time. The constant changing of standards and assessment leads to administrative and faculty focus on those components, rather than on academic enrichment, moving beyond regular curricula, and encouraging higher achievement.
- Ensuring that STEM<sup>2</sup> programs are compatible with graduation requirements
- State of Florida legislative mandates have imposed limiting restrictions on the development of new baccalaureate degrees

7.1.2(c) Other Threats: As was the case with weaknesses, each organization faces their own unique threats from competition or other factors. Examples of such threats that were cited in the survey include:

- Ensuring that students who participate in STEM<sup>2</sup> programs can easily articulate into university programs.
- Lack of recognition.
- Parental Involvement and Parental Engagement. Parents must be involved in this process from beginning to end with a positive attitude and be able to view STEM/STEAM as a bonus to academic achievement. Typically these programs only have time to be implemented during after school hours which require parents to be involved to ensure the success of the students in the program.
- Bringing curriculum writers from all core and non-core content areas to own the process of creating an exemplar curriculum that has an established interdisciplinary approach. Establishing a team of optimistic curriculum and assessment writers to streamline all content areas that continues to engage students throughout their STEM/STEAM academic career.
- For-profit colleges and universities often have extensive marketing budgets that allow for strong recruitment, allowing them to draw from the region's talent pool.
- Science programs are expensive. Not having a dedicated science building creates a difficulty in sharing a very limited amount of lab space.

## 7.2 Specific Opportunities Drawn from Surveys

The individual opportunities listed by organizations were by-and-large very closely tied to the specific activities of the organization. Many of these specific elements that the business or educational institute could exploit to its advantage are included in the description of regional assets in Section 3. However, there were important themes that could be identified in common perceptions of opportunities.

**7.2.1 Partnerships and Collaboration:** The region already has a history of building partnerships and collaborative ventures. The partnership capacity in surrounding counties with industry and commerce leaders is high. This opportunity is increased by the interest STEM<sup>2</sup>-related businesses have in developing a “pipeline” from school to employment. The improving economic environment lends itself to greater support from local businesses and the community. Increased internships with employers, business and industry partners enhance career readiness skills of graduates. Strong partnerships between educational institutions and businesses also ensure students are exposed to the academic and hands-on experience that will better prepare them for the next level of education or employment. Furthermore, it would provide a network of skilled workers to remain in the region as these graduates enter the work force. In this regard, an important opportunity exists to expand job placement services and relationships with business and industry recruiters to promote gainful employment opportunities in a student’s field of study. Partnerships between educational institutions create an opportunity for local colleges and institutions to work together to increase STEM<sup>2</sup> educational capacity and attract more students for enrollment. Fortifying our K-12 educators and curriculum directors with increased collaboration with the leadership of local universities could expand local school districts’ professional development programs.

**7.2.2 Societal Demand:** Several opportunities were cited based on the increased recognition of the importance of STEM<sup>2</sup> disciplines. Growing interest in early childhood education establishes a K-14 emphasis on specific educational program planning and implementation, which includes STEM<sup>2</sup> related objectives. To meet increased demand, institutions of higher learning are seeking more students to enroll and major in STEM field curriculums. As colleges seek to develop and offer more STEM<sup>2</sup> programs and to create even greater access in our current program offerings, online course development will be an area of focus. Ultimately there will be new teacher buy-in with new initiatives that provides ongoing support. Opportunities for teachers to take ownership due to personal investment can be driven through mentoring, differential pay, and STEM certification among other things.

**7.2.3 Increased Awareness:** There are always opportunities found in regular communication with community leaders and the media. We could seek out more avenues to spread the word of the importance of a STEM<sup>2</sup>-focused education more than we already do. For example, One Spark and other festivals could be used to market our region as a STEM<sup>2</sup> destination

### 7.3 Components of a Regional SWOT Analysis

After the collection of survey data, the thoughts and opinions of various stakeholders were collected to develop the outlines of a SWOT analysis for the region, drawing from the organizational surveys and individual stakeholder input.

**7.3.1 Strengths:** It is clear from the information collected that the Northeast Florida region has significant strengths in STEM<sup>2</sup> upon which to build.

7.3.1(a) Past Success: It was noted that many organizations in the region have a proven record of effective program implementation, along with success in moving student achievement in science in targeted schools. For example, the region has strong partnerships between the public and private sectors, and a STEM<sup>2</sup> hub as proposed would be well positioned to build upon these past successes.

7.3.1(b) K-12 Education: The K-12 educational system is strong, albeit uneven across the region. One of the most notable strengths is the availability of significant numbers of “academies” focused on STEM<sup>2</sup>. This places the region in a very strong position with respect to the establishment of a STEM<sup>2</sup> hub. It should be noted that one of the model STEM hubs researched during this study, the Tennessee STEM Innovation Network, is built upon such academies. Both St. John’s County and Clay County are excellent examples of how close partnerships with industry can produce meaningful and impactful STEM academies for High School students. Duval County has two of the best high schools in the nation as ranked by US News and World Report<sup>41</sup>, as well as the beginnings of a county-wide early college career academy: VISTAKON<sup>®</sup>’s Advanced Manufacturing Academy. The attention to STEM<sup>2</sup> topics goes well beyond High School programs, with meaningful, engaging programs as early as 3<sup>rd</sup> grade. The region has nationally recognized, successful robotics (and other STEM<sup>2</sup>) programs in some schools, with the potential capacity in-place that could be replicated to other schools. The region also has the expertise to provide training for all areas associated with building capacity for STEM programs.

7.3.1(c) Higher Education: The region has a world-class system of higher education, including numerous state colleges, several 4-year degree-granting institutions, and one highly-ranked State university. This infrastructure provides a significant advantage on which to build strong STEM programs at all levels of the equation. In addition, these institutions have a history of working collaboratively across several issues, providing an opportunity to leverage resources and build strong programs in cooperation with STEM businesses in the region.

7.3.1(d) Engaged and Vibrant Business Community: As can be seen in the already existing range of partnerships with industry for K-12 academies, afterschool programs, and college and university level activities, the region has an engaged and vibrant business community. The leaders of industry in Northeast Florida have clearly seen the need for additional STEM<sup>2</sup> workers, and have already started to develop important programs to address this need. These programs cover a wide spectrum of activities from robotics clubs in grade schools to internship programs and scholarship support at the University level.

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<sup>41</sup> Stanton ranked # 2 state-wide and # 12 nationally (See <http://www.usnews.com/education/best-high-schools/florida/districts/duval-county-public-schools/stanton-college-preparatory-school-4966>) and Paxon ranked # 11 state-wide and #86 nationally (See <http://www.usnews.com/education/best-high-schools/florida/districts/duval-county-public-schools/paxon-school-for-advanced-studies-4962>).

7.3.1(e) Non-for-Profit Organizations: The region is blessed with a community spirit and desire to help that is clearly demonstrated in the numerous non-for-profit organizations that have significant activities focused on STEM<sup>2</sup> issues. From assistance and tutoring starting as early as Kindergarten to job placement and specialized training, regional not-for-profit organizations represent a unique and important asset.

**7.3.2 Weaknesses**: Regional weaknesses flow directly out of the individual organizational weaknesses identified in Section 7.11 above. Specifically, the most frequently identified weakness was a lack of funding and the resulting limits on resources. This was mentioned in one form or another in every organizational response and in individual stakeholder interviews. The second most common weakness cited, which is closely related to funding, was the difficulty in finding, training and retaining qualified personnel. This was especially noted within the responses from the school districts and several of the non-for-profit entities.

7.3.2(a) Teacher Quality: Despite the presence of several outstanding teachers in our region, one weakness that was brought to light during the research is the opinion among several in the region that the nation in general and Northeast Florida in particular, has a lack of qualified mathematics teachers in the K-12 system. The primary reason teachers fail the state teacher qualification exam is their deficiency in math knowledge. While quality math education must start early, the problem of math knowledge among teachers worsens in middle school, where teachers should be laying the foundation for higher order math success in high school. Once new positions open up in the high schools, most of the few middle school math people who have advanced degrees in math migrate upward, where they can teach the higher order math they enjoyed. Even with this “up-migration”, high school math faculties have been degraded by the lack of qualified individuals to fill positions. Another important part of the teacher quality problem is simply the unattractiveness of teaching in a field such as mathematics when strong math skills can command better and higher paying jobs in industry.

**7.3.3 Opportunities**: One of the most promising opportunities associated with the STEM<sup>2</sup> Hub is the coordination of organizations that should greatly increase the ability to attract grant funding for STEM<sup>2</sup> initiatives.

7.3.3(a) Funding Opportunities: The Hub’s mission statement is to invest in the STEM<sup>2</sup> field by providing the essential missing elements to accelerate the growth of STEM<sup>2</sup> education and careers. Our regional education institutes have great individual strategies for identifying and winning STEM grant dollars. However, this success could be significantly leveraged by a regional holistic strategy to attract and complete for many of the publicly highlighted STEM dollars presently being announced.

7.3.3(a)(1) *Private and Foundation Funding*: At a national level, Intel leads Silicon Valley companies by announcing Intel plans to dramatically increase the number of women and minority workers it employs within five years and will commit \$300 million to the effort. Intel is followed by the largest company by capitalization rate, Apple, which is donating more than \$50 million to organizations that aim to boost participation of women and African-Americans in the tech industry. The Thurgood Marshall College Fund, which provides support for students studying at public, historically black colleges and universities like Howard University and Grambling State University, will get more than \$40 million of these dollars. AT&T, as part of the AT&T Aspire initiative, recently announced a \$3 million contribution to Genesys Works to support more opportunities for high school students to experience meaningful year-long internships in businesses - including AT&T - across the country.



Companies are also partnering with local communities to increase STEM opportunities. For example, through the Fuel Your School program, Chevron USA Inc. contributed \$1 when consumers purchased eight or more gallons of fuel during October at participating Chevron and Texaco stations in East Baton Rouge, Jefferson, Lafayette, Orleans, Plaquemines, St. Bernard, St. Tammany, Vermillion, Terrebonne and Lafourche parishes, generating \$500,000 in 2014, to help fund eligible classroom projects and supplies at local public schools.

Within Florida, Lockheed Martin recently granted \$2M to Orange County Schools to expose all its students to science, engineering, technology and mathematics through Project Lead the Way, a nonprofit that develops courses in the so-called STEM fields. The funds will also cover teacher training and tools such as apps, computer upgrades and robotics kits. Florida International University was granted \$2M in research grant funding from the Florida Board of Education to research the use of robots to teach math and science to middle school students.

When Cognizant announced it is awarding 34 grants to after-school, in-school, and summer programs at 54 sites across the U.S. through its 'Making the Future' education initiative, unfortunately only one site in southern Florida was identified as a grant recipient. Designed to inspire interest in STEM education among students from grade school through high school, the initiative supports hands-on learning opportunities that promote creativity, problem-solving, collaboration and self-expression. The 2015 grants will provide more than 5,000 young learners with access to over 250,000 hours of making activities focused on STEM topics, including electronics, robotics, computer programming, digital fabrication, 3D printing and wearable technology.

The trend toward large STEM companies and foundations providing grant dollars for STEM will continue to increase. There is an opportunity for the Northeast Florida Regional STEM<sup>2</sup> Hub to capture more of these dollars for our regional educational institutes.

*7.3.3(a)(2): Federal Funding:* While becoming increasingly limited, there are also opportunities in government funding of STEM<sup>2</sup> activities. For example, while in Nashville Tennessee in March, 2015 President Barack Obama rolled out *TechHire*, an initiative aimed at building a larger technology workforce, and more than 20 regions across the USA were identified, however no areas in the south were targeted other than three cities in Tennessee. The program will bring together city leaders and employers to address the need for more software developers, cyber-security experts and information technology engineers.

Many Federal agencies have significant resources to fund STEM<sup>2</sup> related programs. For example, the National Science Foundation ([www.NSF.gov](http://www.NSF.gov)) offers a broad range of individual scholarships, research funding and programmatic support. Some of the more interesting ones of potential interest to a STEM<sup>2</sup> hub include: (a) ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers; (b) the Advanced Technological Education (ATE) Program; (c) the Innovative Technology Experiences for Students and Teachers (ITEST) Program; and (d) the Improving Undergraduate STEM Education Program. Similarly, the US Department of Education's Institute of Education Sciences (<http://ies.ed.gov/funding/>) offers a broad array of funding to support the study of and implementation of improvements in STEM education.

One excellent resource to identify federal funding opportunities is [FederalGrants.com](http://www.federalgrants.com/) (<http://www.federalgrants.com/>) which has the mission of informing the general public about grants offered by the United States government. The site provides information on how to find and qualify for

grants, how to apply for grants, and how to proceed once if you are successful. The Federal Grant search engine allows access to the requirements, deadlines, and details of over 40,000 past and current grants from 466 different federal agencies.

A comprehensive review of all the potential federal grant programs is well beyond the scope of this report. Suffice it to say that the above examples serve to demonstrate the immense opportunities that exist to address one of the core weaknesses identified in this report – the lack of sufficient resources.

7.3.3(b) Help with Job Placement: Local Colleges and Universities have a strong record of placing graduates in STEM<sup>2</sup> careers. However, with the growing demand, additional tools are needed. One regional opportunity to address this need comes from a local entity named *WickedSmart* that is built on the premise that exceptional students should have exceptional opportunities. This company has developed a tool to improve the process of matching career-minded students and recent graduates to meaningful, paid internships and entry-level positions. The company provides assessments, resources and personal coaching to help potential employees connect and impress employers. The company aims to connect the right students with the right employers for meaningful internship experiences so that both the students and the companies get real results.

**7.3.4 Threats:** As with the regional weaknesses, regional threats are closely tied to the individual organizational threats identified by the survey. Based on stakeholder discussions, it seems that at the regional level, two specific threats need to be recognized.

7.3.4(a) (a) Challenges from the State Legislature: As noted above, all STEM<sup>2</sup> education is greatly affected by state requirements and funding. There is a history of intense pressure on the educational budget and 2015 legislative session is no different. An overall focus on STEM<sup>2</sup> by the Northeast Florida region will allow our regional elected representatives have increased influence at some of the critical points in the process.

7.3.4(b) Parental Involvement and Parental Engagement.: Parent and community buy is critical for our students to encourage them to consider a STEM<sup>2</sup> career. Parents must be involved in this process from beginning to end with a positive attitude and be able to view STEM<sup>2</sup> as a bonus to academic achievement. This is especially true because typically STEM<sup>2</sup>-enhancement programs have to be implemented during after school hours which require parents to be involved to ensure the success of the students in the program. One individual reported that in traditional American parents want to discuss the sports program, parking spots and other less important things, rather than being focused on areas that related to student achievement, such as the quality of teachers, curriculum, academic assistance and so on.

## SECTION 8 CONCLUSIONS AND RECOMMENDATIONS

### 8.1 Conclusions

In conclusion, there are certain themes that have developed in the last several months as we have received completed surveys and interviewed local, regional and national stakeholders on next steps for establishing a regional hub. There are certain notable highlights from the research completed.

1. Over the past decade, jobs in science, technology, engineering and mathematics (STEM) have grown at a rate **three times faster** than non-STEM<sup>2</sup> jobs. Momentum will continue over the next decade as STEM<sup>2</sup> jobs **will grow at a staggering rate of 17%**. . . Minorities and women are underrepresented in STEM<sup>2</sup> fields, leaving a staggering amount of economic potential on the table. By 2018 1 million computer science jobs will go unfilled by US workers.
2. National leaders in STEM<sup>2</sup> such as California, Washington State and Texas all have strong STEM<sup>2</sup> hub infrastructure both regionally and state-wide.
3. Based on both data and experience, leaders in our community recognize the importance of focusing energy and resources on developing a STEM<sup>2</sup> Hub.
4. We have significant STEM assets and programs in our region what's missing an entity that **ONLY** focuses on the essential missing elements for Northeast Florida to accelerate quickly the percent of Northeast Florida students choosing STEM<sup>2</sup> careers.

The Carnegie Science Center's Chevron Center for STEM<sup>2</sup> education and career development was opened in November 2014. The Center conducted a research study about the perceptions and attitudes about STEM<sup>2</sup> and its potential for workforce development among teachers, parents, students and business leaders. Three of the major findings are below.<sup>1</sup>

- Educators and business leaders identify key prerequisites for robust STEM<sup>2</sup> education, the most important of which is making it engaging to students—collaborative, hands-on, problem-solving, and project-based.
- Educators and business leaders are adamant in their opinions that STEM<sup>2</sup> education is for all students.
- Parents' awareness of and understanding about STEM<sup>2</sup> is low.

### 8.2 Recommendations

Many have analogized Kennedy's vision of landing a man on the moon as they discussed closing our nation's gaps in STEM<sup>2</sup>.

*"I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth. No single space project in this period will be more impressive to mankind, or more important for the long-range exploration of space."* President Kennedy, Address to Congress on Urgent National Needs, May 25, 1961.

If we issue a similar challenge around STEM<sup>2</sup> to our community's students, teachers, parents, businesses and institutions of education we can create a STEM<sup>2</sup> filled future in Northeast Florida. As

community of leaders, we must engage our youth's hearts and minds in a singular passionate, inspirational vision that results in a holistic individual, team and community action. Maybe Yogi Berra says it best "If you don't know where you are going, you might wind up someplace else."

Therefore it is recommended the STEM<sup>2</sup> Hub be the base infrastructure needed to coordinate and execute the vision of providing the essential missing elements to accelerate the growth of STEM<sup>2</sup> education and careers. It is recommended the STEM<sup>2</sup> Hub focus on four initial priority areas:

1. As Albert Einstein said "I do not teach anyone I only provide the environment in which they can learn." It is recommended that the hub convene, inspire and invest in initiatives that develop the essential resources and programs for teachers, administrators and students to change attitudes, behaviors and understanding of STEM<sup>2</sup>.
2. It is recommended that the STEM<sup>2</sup> Hub be specifically designed to provide for Northeast Florida students what is now missing after a collaborative and inclusive proves to define those gaps.
3. Any education solution must provide many synergistic efforts including a clear emphasis on mathematics as the foundation for all STEM<sup>2</sup> education. It is recommended that the hub convene our regional stakeholders (schools, businesses, students, parents and the community) to continue to develop nationally recognized approaches to advance STEM<sup>2</sup> education and careers in our region.
4. It is recommended that the STEM<sup>2</sup>-Hub convene a group of our regional stakeholders for a lively outcome-focused discussion on next steps for our region to promote entrepreneurial activity and start-ups. Ultimately, our goal should be to determine whether there are essential missing elements in our regional start-up infrastructure.
5. Finally, it is recommended that the STEM<sup>2</sup>-Hub inspire our regional stakeholders to discuss options and alternatives for developing a regional near-sourcing STEM<sup>2</sup> entity to act as a vital part of the sourcing pipeline for both businesses and qualified workforce alike.

In conclusion, remember the words of the philosopher Aristotle; "*Excellence is never an accident. It is always the result of high intention, sincere effort, and intelligent execution; it represents the wise choice of many alternatives - choice, not chance, determines your destiny.*" The STEM<sup>2</sup> Hub should be the base infrastructure needed to coordinate and execute the vision of providing the essential missing elements to accelerate the growth of STEM<sup>2</sup> education and careers. The journey to establishing the Northeast Regional STEM<sup>2</sup> Hub won't be easy, but we hope all in our community will join us in the journey to a more vibrant STEM<sup>2</sup> regional economy.