BACKGROUND

The world has shifted greatly in the 200 years since the public school as we know it, a universal model, was introduced and what students need to be prepared for the workforce has changed with it. Global economies are currently at odds with training their workforce during what experts have coined the Fourth Industrial Revolution (4IR), which describes the disruption and change in technology, industries, and societal patterns and processes (such as production) due to the convergence of digital, biological, and physical worlds. Nationally and locally, occupations in IT, engineering, and healthcare are expected to grow at three times the rate of other professions. Additionally, the number of skilled technical positions, those requiring science and engineering expertise, such as those in construction and extraction, are nearly double those of positions requiring a Science, Technology, Engineering, or Mathematics (STEM) degree. Given these labor trends, STEM education and Career Technical Education (CTE) training are an essential part of preparing our current students for being productive citizens in a globalized economy that is marked by rapid technological change.

A regional analysis conducted by the University of North Florida (UNF) in 2017 identified significant strengths in Northeast Florida for expediting the growth and expansion of high quality STEM training. Given the rate of technological advancement, the role of STEM training in creating globally competitive workers, and the unprecedented shift to hybrid and remote learning across the COVID-19 pandemic, it is important to visit the Duval County landscape and see what exists in the landscape for STEM and CTE preparation for all students, but particularly students from historically marginalized backgrounds.

The Jacksonville Public Education Fund drew on previous research from various organizations including UNF and STEM2Hub in order to identify community stakeholders who could help us answer the question: **What skills do students need to succeed in the 21st**

century workforce? JPEF conducted interviews and focus groups with educators and a variety of employers (N=30) to compare their perspectives on what skills students need to be successful in the workforce and what challenges they face reaching those needs.

JPEF also critically examined the offerings and any publicly available data of 40+ STEM and CTE programs available in Duval County to answer the question: **What opportunities exist for Duval County students to develop interest and skills in STEM and CTE fields?**

The Landscape snapshot analysis conducted was not intended to capture every individual initiative in Duval County that is involved in the space of STEM and CTE; rather it is meant to provide an overview of the most relevant opportunities going forward based on the current capacity of major players in this space.

Overall, partnerships between the Duval County School district and major university, business, and community leaders has deepened significantly over the past 5 years, as is evidenced by the increase in STEM, computer science, and CTE courses offered and enrollment in those courses. In school partners and employers agree on chal-

lenges still facing student preparation for careers in Duval County, related to communication and critical thinking skills.

What Opportunities Do Duval County Students Have to Put Skills Related To STEM and CTE Into Practice?

The research team collected and reviewed information from over 40 STEM and CTE providing institutions in Duval county. Institutions were coded for the specific skills they publicly advertise offering, setting, target population, duration of program, and number served. Included among the 40 are partners that have ecosystems of programs like DCPS and STEM2Hub as well as singular programs like the Jacksonville Zoo and Gardens STEAM interactive workshops. Most of the out-of-school time companies reviewed did not include detailed information publicly on skills offered and population-served.

DCPS has the greatest equity opportunity because of their student reach during the school day. Due to partnerships with university stakeholders like UNF's STEM2Hub, community stakeholders like Lift Jax and Jacksonville Transit Authority, and business community stakeholders like the Microsoft TEALs and Code.org, DCPS is able to offer 53 STEM Choice programs, 50 Career academies, and

a variety of courses and opportunities . Of 103 specialized programs or academies, 55% of them are focused on high school aged students, 25% on elementary, and 15% on middle school students.

There are roughly 125,000 to 130,000 students in Duval County, 44% are identified as Black, 31% as White, 15% as Latine, 5% as Multi-Racial, and 4 % Asian across 194 schools. In addition, 67% of the students are economically disadvantaged., and 17% are students with disabilities.

Information from key informant interviews suggests that more than half of Duval County students (at least 75,000) are definitely exposed or engaged in some STEM or CTE program annually and that nearly all students should have some opportunity in school to engage in a STEM exposure or applied opportunity during the year (See inputs, activities, and outcomes chart). Many of these opportunities didn't exist in this community a few years ago so their presence represents the great success of partnerships between the school district, university, community, and business partners. However, more information, especially on those outside of schools, on who is being reached is needed. More support, alignment, and investment is needed to further integrate these opportunities to ensure that all students are being reached and to scale best practices.

Opportunities by Grade for Exposure to STEM/CTE

K-5

Engineering lab classes, elementary robotics team, investigating with nature and plants, hands on science experiments, applied mathematics, technology based learning with classroom resources, math lab classes, STEM lab, tiered coastal sciences activities and core content per grade level, focus on coding, designing games and apps, computational thinking, digital citizenship, science enrichment, water safety, recycling, gardening

5

STEM lab, STEAM leadership program, robotic, aviation and military science, computer science

6-8

21st century skills, media and technology skills, communication skills, collaboration skills, agri-science, agriculture, STEM offerings, computer science

9-12

Video game design, cyber security, embry riddle aerospace, exercise science, CTE, information technology, carpentry, cosmetology, criminal justice, Fire science, web and development, welding, digital video, technology, engineering, gaming, commercial art, technology, digital design, cinematic arts, digital photography, cinematic arts, digital video technology, business management and analysis, digital design, culinary arts, agriscience, biotechnology & vet assisting, automotive, aviation, communication, digital video technology, computer science, coding fundamentals, CPT & net security, cybersecurity

SUMMARY OF OPPORTUNITIES 2015-PRESENT

2015-Inputs	2016-2021 Activities	2021-2022 Outcomes

STEM2Hub was formed by the business community to "convene, inspire, and invest in the STEM2 field by providing the essential missing elements to accelerate growth of STEM2 education and careers."

Continuous in-school opportunities
- Expanded computer science access from one to all high schools
- Expanded computer science in secondary schools to offer 14 state approved courses
- Created partnership with Microsoft Philanthrophy's TEALS program integrated instructional support for highest need schools
- Expanded computer science course offerings in elementary schools.

Continuous after school activities
- Institutionalized robotic programs in the school district in all after school programs, over 100 sites.

Continuous virtual learning opportunities
- Created Learning Blade partnership
- Created SpaceGate station, virtual resources for STEM curriculum in the context of space

One day all school events
- Hour of Code
- Space Day Duval

Professional development
- 1,199 teachers (code.org)
- Computer science fundamentals, discoveries, and principles

Hardware and Software
- Developed partnerships with business community to donate computers to economically disadvantaged students

Continuous integrated in-school opportunities
- Created integrated robotics coding and STEM curriculum into core course curriculum maps, standards, and implementation, for all elementary schools.
- 47,951 Elementary school students enrolled in computer science courses
- 5,693 high school students enrolled in advanced placement and other foundational computer science courses, such as coding fundamentals and foundations of web design
- Microsoft Philanthrophy's TEALS program 7 schools

Continuous integrated after school activities
- 750 students on robotics teams during and after school

Continuous virtual learning opportunities
- Around 50,000 students exposed to STEM Spacegate station lessons
- 2,300 students this year

One day all school events
- 20,000 students exposed to last Hour of Code event
- 36,000 students attended Space Day Duval

Professional development
- 1,038 Elementary school teachers trained in computer science fundamentals
- 99 Secondary teachers trained in computer science discoveries

Hardware and Software
- 1,038 Elementary school teachers trained in computer science fundamentals
- 99 Secondary teachers trained in computer science discoveries

EQUITY PERSPECTIVE

Nationally, Black, Indigenous, Latine, and other historically marginalized populations remain underrepresented in STEM occupations compared to their representation in the workforce. The percentage of workers identified as White and Asian in STEM professions exceeds the percentage of representation in the overall workforce.

Gaps in demographic representation in the STEM labor force mirror the national landscape. Additionally, residents with disabilities make up about 15% of the Northeast Florida population, yet only 25.3% of those residents are counted in the labor force, as compared to 66.7% of the labor force participation for workers without disabilities.

RACE/ETHNICITY	% OF TOTAL WORKFORCE	% OF STEM WORKFORCE
American Indian or Alaska Native	.05	.02
Asian	6.2	9.3
Black or African American	11.5	8.5
Hispanic or Latine	17.8	14.2
Other or more than one race	2.2	2.1
White	61.4	65.3

Table drawn from NSF NCES 2020 STEM labor force of today

Despite booming economic growth, the region continues to face difficulties reaching all portions of the labor force, especially historically marginalized groups who face significant barriers to accessing and maintaining employment; such as workers without access to consistent transportation, workers with disabilities,

and justice-involved workers. Significant and intentional efforts to make research based training and opportunities accessible for these groups are necessary to include them in the workforce.

What Skills Do Duval County Students Need to Succeed in the Workforce?

According to the literature, STEM is not a just group of subjects that can be learned in school, it is also a way of looking at the world- "using knowledge and data to design solutions to complex problems, collaborating and communicating with people worldwide, and persisting and continuing to work, even when things get hard." Below is a list of common skills that are often included in workforce development literature when discussing student success.

Learning skills- Also known as the "four Cs" of 21st century learning, these include critical thinking, communication, collaboration, and creativity.

Life skills - Flexibility, initiative, social skills, productivity, leadership.

Literacy skills- Information literacy, media literacy, technology literacy.

To cultivate a community-based perspective on which of these skills is most important and recognized in the Duval County context, the JPEF research team conducted focus groups and individual interviews of DCPS administrators and staff, community business leaders, CTE partners, and labor leaders. Focus group and interview participants were presented with a random arrangement of the 12 skills identified in the literature and asked which the participants think are most needed for success in their organization and what challenges they face with reaching those needs.

Based on these conversations, we

SUMMARY OF FOCUS GROUPS FINDINGS

	SKILLS	CHALLENGES
DCPS STEM District and Teachers	Communication Critical Thinking Social Responsibility	STEM Training for Teachers Embed Soft Skills into Curriculum STEM Opportunities Pre-6th Grade Equitable Uptake of STEM Opportunities
Business Leaders	Communication Critical Thinking Digital/Technical Literacy	Unrealistic career path expectations Embed Soft Skills into Curriculum Bridging Generational Differences Equitable Uptake of STEM Opportunities
Labor Leaders	Communication Critical Thinking Social Responsibility	Insufficient Information on CTE Pathways Labor Shortage Embed Soft Skills into Curriculum CTE Stigma
CTE/STEM Employers	Communication Critical Thinking Digital/Technical Literacy	Insufficient Information on CTE Pathways Labor Shortage Embed Soft Skills into Curriculum Bridging Generational Differences

see that school community members are aligned in their perspective-based approach with a variety of business leaders and workforce partners as to which skills are most necessary and most challenging in Duval County. The high rate of agreement suggests that these partners are ready to collaborate more deeply on ensuring DCPS students are prepared with communication and critical thinking skills. However, the challenges suggest the community could benefit from more funding and convening efforts to understand exactly how to integrate and evaluate these skills in a way that the employer community can also contribute to and value.

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OPPORTUNITIES FOR ACTION

Drawing from a community based perspective on the current state of STEM resources and practice in Duval County, JPEF recommends the following further action:

- Continue to invest in and scale curriculum and training for students.
- Embed evidenced-based, developmentally appropriate STEM and soft skills curriculum throughout K-12 education.
- Provide evidence-based training for teachers.
- Emphasize multiple pathways after K-12 education, including destigmatization of CTE pathways as credible opportunities for advanced education.
- Create a county wide Science and Engineering Workforce Agenda.
- Support existing efforts to combine funding, programming, and data for both in and out of school partners as they collectively engage in accelerating their efforts.
- Leverage strength of CTE structure and success indicators as a model for success metric reporting.
- Further develop the embedding of soft skills into STEM curriculum components and highlight urgency for funding.
- Deepen community-business engagement efforts by

incentivizing workers .
- Include "community engagement" within annual performance reviews to provide structural support for employees to share information and exposure of their occupations/employment pathways with youth in schools.
- Continue research and evaluation efforts on student skills for the future.

A number of questions remain after this landscape analysis which should be answered through further research and evaluation.

- What strategies do programs who are able to reach historically marginalized populations use and how can we scale those strategies?

- What role do guidance counselors play in connecting students to career opportunities in the community?
- What are best practices for bridging generational differences in the workplace?

CONCLUSION

The Duval County landscape has greatly expanded STEM and CTE opportunities for students over the past five years thanks to significant partnership and programming efforts between the district, university, business, and community partners. All partners are primed to continue the great work and create a collective science and engineering workforce learning agenda with shared goals, metrics, and outcomes to better equip all Duval County students with skills for the future.

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