Strategy Council
Ad-Hoc Subcommittee on K-12 STEM Education
Discussion Paper

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Why Focus on K-12 STEM Education?

Our increasingly knowledge based economy is driven by innovation—the foundation of which lies in a dynamic and well-educated workforce equipped with science, technology, engineering, and math (STE M) skills .

Going forward, more and more jobs will require at least a basic understanding of scientific and mathematical principles, a working knowledge of computer hardware and software, and/or problem solving skills developed by STEM coursework.

- *According to the U.S. Bureau of Labor Statistics, 15 of the 20 fastest growing jobs through 2014 will require substantial math or science preparation.*

Unfortunately, Florida—like much of the rest of the U.S.—is failing to develop an adequate supply of workers with the STEM skill sets needed across a range of state industries and emerging segments of the innovation economy.

- *Florida's business community has expressed serious concerns about looming shortages of high quality engineers, scientists, information technology workers, and technicians of all types—and how such shortages will adversely impact the state's economy.*

Policymakers across the country are recognizing the need to dramatically increasing student STEM achievement and attainment starting with K-12 education—the beginning of the talent development pipeline.

- *Research has shown that many elementary students lose interest in and understanding of STEM subjects prior to reaching middle and high school grades.*

- *In addition, regardless of the path they choose after high school completion—postsecondary education or workforce entry—all K-12 students can benefit from a rigorous and relevant STEM education.*

"A new workforce of problem solvers, innovators, and inventors who are self-reliant and able to think logically is one of the critical foundations that drive innovation capacity in a state. A key to developing these skills is strengthening science, technology, engineering, and math (MATH) competencies in every K-12 student."

— National Governors Association: *Building a Science, Technology, Engineering, and Math Agenda*

Where Does Florida Stand?

	Florida	Top States
8th graders scoring at or above "proficient" on the national assessment exam (NAEP) in math	27%	41%
8th graders scoring at or above "proficient" on the national assessment exam (NAEP) in science	21%	41%
9th to 12th graders taking at least 1 upper-level math course	42%	64%
9th to 12th graders taking at least 1 upper-level science course	27%	46%

Source: *Measuring Up 2008*

International Comparison:
Average Score on 2007 TIMSS by Country

	Math		Science	
	4th Grade	8th Grade	4th Grade	8th Grade
England	541	513	542	542
Hong Kong	607	598	554	530
Japan	568	570	548	554
Singapore	599	593	587	567
U.S.	529	508	539	520

Strategy Council Action on Talent and STEM Education to Date

Florida's Statewide Strategic Plan for Economic Development, the *Roadmap to Florida's Future*, identifies the need to build world-class talent as a top priority for the state's continued development and diversification. It specifically recommends strengthening PreK-12 math and science education.

The EFI Strategy Council is charged with developing the *Roadmap* and strategies to support its priority recommendations and objectives. In that capacity, over the past year, the EFI Strategy Council has worked to explore Florida's talent development landscape, identify key issue areas, and develop an action agenda.

The Strategy Council kicked off its effort in January 2008 with a talent roundtable discussion of key public and private sector education and economic development stakeholders.

- *Roundtable participants agreed that education is too important to be left to educators alone, and that no one knows better than Florida's business community what skills are needed for success in the workplace and to expand economic activity in the state. As a result, the Strategy Council established an agenda of increasing connectivity between and integration of business and education.*

- *Participants further recognized a strong need to build student interest and skills in STEM courses and career fields throughout primary and secondary education. Because students must be engaged in STEM subjects early to "prime the pump" for workforce and higher education for the innovation economy, the Strategy Council set a goal of finding ways to enhance K-12 STEM education.*

To leverage the Strategy Council's discussion and analysis in these areas and translate these efforts into action, the EFI Board of Directors called for the creation of a Strategy Council Ad-Hoc Subcommittee on K-12 STEM Education.

- *The Subcommittee was asked to move the ball forward by identifying and developing specific, actionable ways for businesses to become more engaged in K-12 STEM education efforts.*

The following pages attempt to set the stage for the subcommittee's work by providing background information on current Florida STEM business-education partnerships, a K-12 STEM education framework, and potential action items for consideration.

Please note that the subcommittee's focus on K-12 STEM education is not meant to negate the importance of STEM at the workforce and higher education levels.

Understanding Florida's Current Business-Education STEM Landscape

To develop a better understanding of the current business-education STEM landscape in Florida, EFI staff reached out to state STEM education experts—especially at the Department of Education and the Florida Center for Research in Science, Technology, Engineering, and Math (FCR-STEM).

The following pages provide an illustrative overview of Florida's diverse range of STEM programs with existing or potential opportunities for business involvement. This listing and the findings that follow are not meant to be exhaustive, but rather to convey EFI staff's initial understanding of the STEM business-education environment. EFI thanks all those contacted for their time and counsel.

2 Major Types of STEM Business-Education Programs

In general, Florida's STEM programs fall into two broad categories: (1) those designed to increase students' and teachers' overall STEM interest, knowledge, and awareness, and (2) those designed to increase students' interest and skills in a specific STEM-related cluster or occupation.

- *General STEM programs in place in Florida focus on increasing students' hands-on learning opportunities, building students' overall familiarity and interest in STEM subjects, and improving STEM teaching through professional development programs for teachers in STEM fields of study.*
  - The efforts are accomplished through experiential learning competitions, specialized curriculum programs, field trips, classroom visits and lectures, teacher internship programs, and more.
  - Florida's general STEM programs include homegrown efforts and Florida chapters or affiliates of national programs or organizations.
- *Cluster or occupation specific programs provide students and teachers with more in-depth knowledge about particular STEM career opportunities and more targeted skill development.*
  - These efforts are accomplished via cluster-specific curriculum and training, skill-specific competitions, and professional development / teacher internships, and more.
  - These programs span across industries covering fields from biotechnology to avionics to MS&T to finance.

Though most programs fall into one of the two categories described above, some include elements of both. Such programs are included in both accompanying tables.

General STEM Programs

PRISM Promoting Regional Improvement in Science & Math ▪ Connects Central Florida School Boards Coalition (CFSBC) and business community to enhance STEM teaching and learning ▪ Will work with CFSBC to identify corporate and public policies to support STEM education ▪ Will work with companies to assess, better coordinate, develop, and increase impact of STEM programs ▪ Working to develop repository of curriculum and best practices for teachers ▪ Recognizes excellence in students and teachers with awards ▪ Business leaders on Board—e.g. Lockheed Martin, Progress Energy, EA, Regions Bank ▪ Effort to expand beyond central Florida	**Target Audience** students: PreK-12 teachers: PreK-12 **Geography** Central Florida: Brevard, Hillsborough, Lake, Manatee, Marion, Orange, Osceola, Polk, Seminole, & Volusia County School Districts **Role for Business** Industry contribution possible across spectrum of activities: ▪ Curriculum guidance ▪ Develop corporate and public policies to enhance STEM education ▪ Offer student and/or teacher internships or seminars ▪ Sponsor or coach student teams in math and science competitions **Distinguishing Characteristic** ▪ Regional collaboration of business and education leaders
Project Lead the Way ▪ Prepared curriculum program using a hands-on, problem-based approach to engage students in STEM subjects ▪ Provides course content, materials, student assessments, and teacher access to online professional development tools ▪ Middle school level programs provide general STEM curriculum ▪ High school curricula seek to prepare students for 2 and 4 year college STEM majors	**Target Audience** students: grades 6-8 and 9-12 teachers: grades 6-8 and 9-12 **Geography** statewide: at least 12 middle schools & 40 high schools in PLTW **Role for Business** PLTW schools commit to having a Partnership Team composed of mentors/advisors from business and the community that may: ▪ Offer program input to help apply curriculum ▪ Mentor students and/or lead in-classroom projects and exercises ▪ Provide equipment/supplies **Distinguishing Characteristics** ▪ Nationally recognized / developed by national organization
Teacher Quest ▪ TRDA-administered 7 week, paid summer professional development program for STEM teachers to work at science and technology based businesses ▪ Teachers gain greater understanding of industry and applicability of STEM subjects to work to take back to the classroom ▪ Goal to improve teaching and help spark student interest in STEM fields	**Target Audience** teachers: grades 6-8 **Geography** Central Florida (pilot expansion about to begin) **Role for Business** Businesses can host and/or sponsor a teacher **Distinguishing Characteristics** Focused on teacher professional development
Expanding Your Horizons ▪ UCF College of Engineering and Computer Science conference that brings 300 middle school girls to campus to introduce them to STEM careers through workshops and hands-on learning opportunities ▪ Parents receive simultaneous workshops about why daughters should choose STEM fields and how to help prepare them	**Target Audience** Female students: grades 6-8 **Geography** Orlando / Central Florida **Role for Business** Women engineers from community present workshops **Distinguishing Characteristics** Female-focused program

General STEM Programs (continued)

IHMC Community Programs ▪ the Institute for Human and Machine Cognition conducts a number of community outreach/education programs including *Science Saturdays*, a fun and hands-on science program for elementary school children ▪ its *I LOVE Science* program (Increasing Local Opportunities for Volunteers Enthusiastic about Science), launched with Gulf Power, sends local volunteers to lead monthly 1-hour hands-on science activities in 5th grade classrooms	**Target Audience** Students: grades 3-5 **Geography** Northwest Florida **Role for Business** The *I LOVE Science* program requires community volunteers **Distinguishing Characteristic** One of few programs targeted elementary students
GEOSET ▪ initiative of the Florida Center for Research in Science, Technology, Engineering & Math (FCR-STEM) ▪ develops rich media, internet-based learning modules to help educators teach concepts and to increase student interest in STEM subjects and careers ▪ modules are free to view and download ▪ modules can be created by any interested party, but are subject to quality control (and currently must be produced at FSU or participating center) ▪ module length and scope of subject vary as needed	**Target Audience** students: all ages teachers: all grade levels **Geography** Internet-based / global **Role for Business** Currently largely confined to academia, but potential for businesses to get involved by: ▪ developing modules for teachers to teach specific topics ▪ developing modules for students of all ages about STEM careers and subjects (e.g. using math in real life, career profiles) **Distinguishing Characteristics** ▪ internet-based, so easily accessed around the state at any time ▪ taps into creativity of students and STEM community ▪ potential to establish Florida as a center of excellence in innovative, internet-based STEM learning
JETS (Junior Engineering Technical Society) ▪ national organization promoting engineering and technology careers through experiential learning opportunities and career information (videos, profiles, toolkits, etc.) ▪ its flagship TEAMS program is an annual academic competition for high school schools tasked with solving real-world engineering problems	**Target Audience** Students: grades 9-12 **Geography** Statewide: already more than a dozen participating schools **Role for Business** Businesses can coach teams and/or sponsor competitions **Distinguishing Characteristics** national organization offers hands-on learning through competition
Technology Student Association (TSA) ▪ national organization for students enrolled in technology classes/interested in STEM fields ▪ TSA members learn problem solving, critical thinking, and leadership skills through co-curricular activities, competitive events (local, state, national), and related programs ▪ Vast array of competitions can have either a broad STEM focus (e.g. cyberspace, technology issues) or a more cluster-specific topic (e.g. power/energy, transportation, animatronics, construction, architecture, biotechnology)	**Target Audience** Students: grades 6-8 and 9-12 **Geography** statewide: more than 50 participating middle and high schools **Role for Business** Businesses can contact Florida TSA about opportunities to sponsor or coach teams or judge at competitions **Distinguishing Characteristics** Student organization, so more bottom-up than other approaches

Cluster-Specific STEM Programs

Career Academies

- Variety of cluster/career specific high school curriculum programs (e.g. biotechnology, aviation) offered through a school-within-a-school model or via a technical center
- Many result in industry-recognized certification or training
- Offer training in high demand and/or high wage occupations and tend to be relevant to local economy/industry
- Academically rigorous to support college continuation

Target Audience
students: grades 9-12

Geography
statewide: hundreds of career academies across Florida, with at least 1 program offered in all 67 counties

Role for Business
Businesses can contact relevant/local academies, which offer a wide range of opportunities for involvement, such as:
- curriculum guidance
- mentorship/internships for students
- sponsorship of specific academy/program

Distinguishing Characteristic
Prepare graduating student for immediate entry into jobs

Project Lead the Way

- Prepared curriculum program using a hands-on, problem-based approach to engage students in STEM subjects
- Provides course content, materials, student assessments, and teacher access to online professional development tools
- Middle school level programs provide general STEM curriculum
- High school curricula seek to prepare students for 2 and 4 year college engineering, biomedical science, and other STEM programs
- New programs (e.g. clean energy) under development

Target Audience
students: grades 6-8 and 9-12
teachers: grades 6-8 and 9-12

Geography
statewide: at least 12 middle schools & 40 high schools in PLTW

Role for Business
PLTW schools commit to having a Partnership Team composed of mentors/advisors from business and the community that may:
- Offer program input to help apply curriculum
- Mentor students and/or lead in-classroom projects and exercises
- Provide equipment/supplies
- Offer internships to PLTW students

Distinguishing Characteristics
- nationally recognized / developed by national organization
- program focus changes from broad to specific as students age

Scripps Florida Education & Outreach

- Scripps promotes bioscience education and awareness through a range of outreach programs including *Science Saturday*, career panels, *Introduction to Science* lectures, and hands-on learning in Florida schools
- Summer research internships for teachers to expose them to current lab techniques, issues in basic biomedical research, and create ties to working scientists for curriculum development
- Summer internship program for high school students to provide hands-on lab experience

Similar programs also in place at Torrey Pines

Target Audience
students: grades 6-8 and 9-12
teachers: grades 6-8 and 9-12

Geography
South Florida (not limited by Scripps, but likely by distance)

Role for Business
May be potential for businesses or other research institutions to partners with Scripps or to create their own outreach efforts to address specific company or industry needs

Distinguishing Characteristics
Bioscience focus

Cluster-Specific STEM Programs (continued)

techCAMP ▪ Florida High Tech Corridor Council initiative offering 1 or 2 day workshops to middle and high school teachers to provide them with the knowledge and tools necessary to guide students in their pursuit of high tech careers ▪ previous seminars for semiconductors, optics and photonics, and modeling, simulation & training ▪ plans for a digital media/interactive entertainment, IT, life sciences/biotech, and photonics camps and programs underway	**Target Audience** teachers: grades 6-8 and 9-12 **Geography** Central Florida **Role for Business** Businesses can contact FHTCC for ways to get involved **Distinguishing Characteristic** alignment with Florida's targeted clusters
Gulf Power Workforce Development Education Partnerships ▪ Gulf Power engages in a broad range of workforce development / STEM efforts ▪ partnership programs with local schools offer power-industry relevant curriculum for students of all ages—especially through the award-winning Gulf Power Academy (a Florida career academy) the Gulf Power Institute (a CHOICE institute), and the Get Into Energy middle school summer camp (a UWF Explore summer camp). ▪ Gulf Power also participates in/offers general STEM programs for elementary students	**Target Audience** students: K-12 **Geography** Northwest Florida **Role for Business** Gulf Power's programs offer models for replication **Distinguishing Characteristic** Comprehensive approach to industry talent development
Skills USA ▪ national organization serving high school career and technical education (CTE) students—its programs include local, state and national competitions in which students demonstrate occupational and leadership skills ▪ SkillsUSA programs also help to establish industry standards for job skill training ▪ broad cluster / occupation coverage, ranging from 3-D animation to telecommunications cabling	**Target Audience** students: grades 6-8 and 9-12 **Geography** statewide: regional chapters in place across Florida **Role for Business** Range of opportunities for business involvement in Florida: ▪ coach, judge and/or sponsor teams in Skills USA competitions ▪ provide instruction / training to CTE students ▪ provide technology for CTE programs ▪ provide advice/guidance on CTE programs **Distinguishing Characteristic** alignment with Florida's targeted clusters
Technology Student Association (TSA) ▪ national organization for students enrolled in technology classes/interested in STEM fields ▪ TSA members learn problem solving, critical thinking, and leadership skills through co-curricular activities, competitive events (local, state, national), and related programs ▪ Vast array of competitions can have either a broad STEM focus (e.g. cyberspace, technology issues) or a more cluster-specific topic (e.g. power/energy, transportation, animatronics, construction, architecture, biotechnology)	**Target Audience** Students: grades 6-8 and 9-12 **Geography** statewide: more than 50 participating middle and high schools **Role for Business** Businesses can contact Florida TSA about opportunities to sponsor or coach teams or judge at competitions **Distinguishing Characteristics** Student organization, so more bottom-up than other approaches

Findings

In researching Florida's complex business-education STEM landscape and speaking with Florida STEM experts, EFI staff came away with 3 key findings of particular relevance to the subcommittee and its charge:

Highly Fragmented STEM Landscape

Florida boasts a broad array of quality STEM programs, but they are, for the most part, uncoordinated and highly fragmented. This fragmentation is not surprising given that Florida's STEM programs and initiatives are managed by a variety of parties—from individual schools to private institutions all spread across the state—and that no body exists (or has been assigned) to act as a repository of information or coordinating entity.

- *As a result, it is challenging to try to develop a thorough understanding the proliferation of programs and potential connections among them.*

- *The lack of one easy entry point into STEM partnership programs likely makes it challenging and/or time consuming for businesses to identify, compare, and select programs in which to engage.*

- *Moreover, the fragmentation of the STEM landscape makes it challenging for stakeholders to share best practices and leverage collective resources.*

Range of STEM Programs with Business *Involvement*, but Relative Absence of Business *Partnership* or *Leadership*

While Florida has a diverse range of STEM programs and initiatives in place that offer opportunities for business involvement, few appear to reach the level of business partnership desired by the Strategy Council and increasingly being employed in other states.

- *Though many Florida STEM programs invite business support in the form of student coaching, employee presentations, or in-kind support, few appear to offer meaningful, on-going ways for businesses to engage in education strategy or policy discussions.*

- *Many states have created STEM coalitions or councils composed of education, business, and government leaders—offering a venue for businesses to provide guidance to STEM policymakers. No such arrangement appears to exist at the state level in Florida.*

Need for Business Community K-12 STEM Advocacy

Over the course staff information gathering efforts, education stakeholders repeatedly noted a need for greater business community advocacy for strong K-12 STEM education programs in Florida.

- *As Florida's education leaders work to elevate STEM education requirements (e.g. by increasing math course requirements for high school graduation), improve STEM curriculum (e.g. with new science and math standards), and expand the professional development offered to Florida's STEM teachers, business leaders can drive home the message that these efforts and more are necessary to Florida's long term economic competitiveness.*

- *Advocates from the business community can complement and further the work of DOE, FCR-STEM, and others to raise the bar for STEM education by delivering messages that resonate with state leaders—providing concrete examples of unmet talent needs in Florida and a strong business case for improved and expanded STEM efforts.*

- *Business leaders in other states are already coordinating their efforts to advocate for rigorous STEM curriculum requirements; high-performing STEM teacher development, recruitment and retention programs; expanded professional development offerings; increased use of technology in the classroom; and similar measures.*

Action Recommendation: Create a Florida STEM Council

Ensuring the availability of highly and appropriately skilled talent—with the STEM skills needed for success in the innovation economy—is one of the most pressing challenges facing businesses in Florida and across the U.S. It is therefore incumbent upon business to take a greater stake and leadership role in efforts to develop the workforce of tomorrow. Business guidance is needed to connect, support, and improve STEM initiatives that will adequately prepare students to meet employers' needs.

A Florida STEM Council should be established to act as a formal conduit for business direction, support, and engagement in STEM education. Many other states—including several of Florida's key competitors—have already established or are moving to create STEM councils uniting education and business leaders to improve and expand STEM talent pipelines.

3 Goals of a Florida STEM Council:

- *Act as a nexus for Florida STEM employers, researchers, education policy experts, and the economic development community to interact, coordinate efforts, and maintain a dialogue on STEM policy issues*
- *Facilitate and accelerate business engagement in STEM*
- *Advocate for STEM education needs with a unified business community voice*

Joint Business Community Effort

Achieving these goals will require partnership among a broad range of stakeholders. Accordingly, the Florida STEM Council should be a joint business community effort incorporating and leveraging the expertise of the following parties:

- *Governor's Office*
- *Business community organizations—including the Florida Council of 100, Florida Chamber, and EFI*
- *Florida Department of Education*
- *FCR-STEM*
- *Education community—including Pre-K-12, workforce, and higher education*
- *Workforce organizations—including AWI and Workforce Florida*

Potential Activities of a Florida STEM Council

Provide advice to policymakers in STEM-related areas

Serve as platform for STEM education advocacy

Act as a one stop broker for businesses looking for ways to get engaged in STEM education

Develop a directory of STEM programs in which businesses can participate / provide support

Establish proactive programs to help increase business participation in STEM education

Share best practices with companies considering establishing STEM initiatives

Develop a web portal with STEM business-education links and information

Host a Florida STEM Business-Education Conference to bring all stakeholders together

State STEM Councils: Examples to Draw From

A number of proposed and existing STEM Councils in other states offer models for Florida to consider, including:

- **Recently Proposed Councils:**
  - *California State STEM Council: If created, the proposed new, non-governmental STEM council will coordinate apprenticeship programs that focus on career and technical education, support STEM education outside of the classroom via after-school and summer learning programs, and develop a public information campaign emphasizing the importance of STEM and its many contributions.*
  - *Texas STEM Advisory Council: This recently proposed council would be charged with identifying math and science concepts relevant to current and future workforce needs, advising policymakers on STEM-related decisions, advancing programs to promote student and parent understanding of the benefits of STEM education, and other similar efforts.*
- **Established Councils:**
  - *Missouri METS Coalition: The METS Coalition is an alliance of business, education and community leaders appointed by the Governor to boost student STEM achievement and interest. The METS Coalition developed a state STEM action plan and offers STEM-focused legislative recommendations.*
  - *Ohio STEM Learning Network: The recently launched OSLN is a public-private partnership of K-12, higher education, and business leaders managed by Battelle. It is expected to connect key stakeholders to improve STEM education, support the sharing of best practices, and improve coordination across the state.*
  - *I-STEM Resource Network: This coalition brings together Indiana higher education, K-12 schools, business, and government. Its committees design and employ programs to address STEM issues—e.g. to enhance teacher quality and training, better communicate/ advocate for STEM needs, and develop a strong statewide STEM network.*
  - *Arizona STEM Education Center: This newly created public-private partnership of the Governor's office, Board of Education, post-secondary education, and business will work to promote teacher recruitment, training, and retention; generate interest in STEM subjects among PreK-12 students; and encourage college students to pursue degrees in STEM fields.*