Georgia's 21st-Century Technology, Engineering, and Computer Science Workforce Challenge

4 Big Concepts

Concept # 1

The Economics of Georgia

a few examples

ADVANCED ROBOTICS — **$1.7 to $4.5 trillion**
Global impact per year by 2025
12 % Size of Global Manufacturing Workforce Impacted

CYBERSECURITY — **1.5 Million Jobs** by 2020, nationally
$4.7 billion Georgia Annual Revenue

INFORMATION TECHNOLOGY — **$113.1 Billion** economic impact on Georgia
17,000 technology companies
200,000 high-tech professionals

AEROSPACE — **$ 8.3 Billion** Georgia Annual Revenue

DEFENSE — **$ 6.4 Billion** in U.S. Department of Defense (DoD) contract work was performed in Georgia, Of this, the Aerospace sector accounts for $2.7 Billion

Concept # 2

The High School and Middle School Courses

That are needed to support 21st-century schools

3 Middle School Courses

Engineering and Technology

40 High School Courses

Engineering and Technology
Advanced Manufacturing
Industrial Systems
Computer Science
Cybersecurity
Information Techology

ZERØ

The Amount of K-12 Teachers Produced In Georgia in 2017 for teaching
Technology, Engineering, and Computer Science

Concept # 3

The Teacher Development *Goldilocks* Problem

TOO-COLD
The Common State
of the Teacher Life

Historically, teacher development has followed one of two pathways.

The **TOO-COLD** approach tends toward providing traditional educator development with weak content and non-supportive environments. The result is a teacher without the correct content knowledge, classroom, and career developmental background.

The **TOO-HOT** approach goes to the other extreme and demands a fully qualified engineer or scientist to teach a K-12 course. The result is a very expensively produced teacher, that does not have the correct content knowledge, nor the skills needed to teach.

This is the Goldilocks Problem

in STEM+CS Teacher Development

The optimal approach is to create a 'sub-engineer / teacher' degree program that capture the fundamentals of engineering, technology, and computer science, plus STEM+CS pedagogy.

17 Equations That Changed the World

Pythagora's Theorem	$a^2+b^2=c^2$	
Logarithms	$\log xy=\log x+\log y$	
Calculus	$\frac{df}{dx}=\lim_{h\to 0}\frac{f(t+h)-f(t)}{h}$	
Law of Gravity	$F=G\frac{m1m2}{r^2}$	
The Square Root of Minus 1	$i^2=-1$	
Euler's Formula for Polyhedra	$V-E+F=2$	
Normal Distribution	$\Phi(x)=\frac{1}{\sqrt{2\pi\rho}}e^{\frac{(x-\mu)^2}{2\rho^2}}$	
Wave Equation	$\frac{\partial^2\mu}{\partial t^2}=c^2\frac{\partial^2\mu}{\partial x^2}$	
Fourier Transform	$f(w)=\int_{-\infty}^{\infty}f(x)\,e^{-2\pi ix\omega}dx$	
Navier-Stokes Equation	$\rho\left(\frac{\partial \boldsymbol{v}}{\partial t}+\boldsymbol{v}\cdot\nabla\boldsymbol{v}\right)=-\nabla p+\nabla\mathbf{T}+\mathbf{f}$	
Maxwell's Equations	$\nabla\cdot\boldsymbol{E}=0$	$\nabla\cdot\boldsymbol{H}=0$
	$\nabla\times\boldsymbol{E}=-\frac{1}{c}\frac{d\boldsymbol{H}}{dt}$	$\nabla\times\boldsymbol{E}=\frac{1}{c}\frac{d\boldsymbol{E}}{dt}$
Second Law of Thermodynamics	$dS>0$	
Relativity	$E=mc^2$	
Schrodinger's Equation	$ih\frac{\partial}{\partial t}\Psi=H\Psi$	
Information Theory	$H=-\sum p(x)\log p(x)$	
Chaos Theory	$x_{t+1}=kx_t(1-x_t)$	
Black-Scholes Equation	$\frac{1}{2}\sigma^2S^2\frac{\partial^2V}{\partial S^2}+rS\frac{\partial V}{\partial S}+\frac{\partial V}{\partial t}-rV=0$	

TOO-HOT
17 Fundamental Equations
of the Engineer Life

Concept # 4

Technology, Engineering, and Computer Science Teacher Development

Hybrid Model - Optimize Technical Content Knowledge with Educational Pedagogy

Inputs

Colleges of Education
Colleges of Science & Math
College of Computer Science
College of Engineering
School of Engineering Technology

K-12 Students
K-12 School Districts
Informal STEM Learning Systems
Regents Engineering Pathway Students
Change of Major Students
Informal STEM Learning Alumni

State, District & Industry Budget Support
Professional Standards Commission
Informal Standards

Activities

Create Hybrid Undergraduate Degrees
* University STEM Core
* Sub-Engineer/CS Content
* Educator Content

Create Hybrid Graduate Degrees
STEM+CS to Educator
Educator to STEM+CS

Support Informal STEM Learning
Market Teaching Careers to Students
Change Public Attitude Toward Education
Support Teacher Compensation

Leverage the
Engineering Technology Assets

Outputs

Technology Education Degree Majors

BS, MS, MAT, PhD Graduates

Concentration Areas:
Engineering, Advanced Manufacturing
Computer Science, Cybersecurity
Industrial Systems, Mechatronics

A New Public Culture Toward Education

Marketing Campaigns
at Informal STEM Competitions
Press Coverage
Improved Compensation Structure
Deployment of Infrastructure

Outcomes

Provide broad and quality access to cirricular and informal STEM+CS learning systems, that provide students, across the spectrum of academic ability, the opportunities to develop STEM+CS identity, knowledge,skills, and abilities, that lead to seamless transitions into the 21st-century workplace.

Develop a culture that supports students and encourages them to enter the teaching profession.

Impact

Providing K-12 students with opportunities to learn about and experience career career opportunities in this realm will lead to improved academic performance, improved retention, progression, and graduation rates, in high school, and in post-secondary institutions.

The financial and academic performance students, and institutions will be measurably and significantly improved, making government, and education more efficent and effective.