Computing4Change
Developing Our Future Workforce

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OUR LOOMING CRISIS

- By 2040, US projected to be majority/minority country
- Census Bureau projects that by 2050, minorities will comprise 53 percent of the population
INCREASINGLY DIGITAL WORLD NOT REPRESENTATIVE OF OUR INCREASINGLY DIVERSE POPULATION

- By 2020, the US is projected to have need for an additional 1,400,000 high tech jobs
- Computer science programs are projected to graduate 400,000 students with qualifications for these jobs
- That leaves a deficit of 1,000,000 unmet jobs
Increasingly digital world not representative of our increasingly diverse population

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Scientists and engineers working in science and engineering occupations: 2013

- White men 51%
- Asian men 12%
- Asian women 5%
- Black men 3%
- Black women 2%
- Hispanic men 4%
- Hispanic women 2%
- Other men 1%
- Other women 1%

NOTE: Hispanic may be any race. Other includes American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, and multiple race.

Women, Minorities, and Persons with Disabilities in Science and Engineering: 2015

www.nsf.gov/statistics/wmpd/
Scientists and engineers working in science and engineering occupations: 2013

The STEM problem is in computer science:

- **71%** of all new jobs in STEM are in computing
- **8%** of STEM graduates are in computer science

**NOTE:** Hispanic Other Pacific Is

Sources: Bureau of Labor Statistics, National Center for Education Statistics

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McKinsey Global Institute predicts a 2020 global workforce with the requisite college and postgraduate education qualified to fill just 13 percent of projected labor demands worldwide.

Demographics globally:

- India and Brazil are rapidly increasing STEM enrollments through targeted enrollment programs.
- Europe, however, is projected to have a shortage in the high-tech sector similar to the United States.
- This deficit is much more extreme in emerging countries that are depending on 21st century skill sets for economic growth.
DEMOGRAPHICS

• Women’s representation in STEM occupations has declined since the 1990s
• Men are employed in STEM occupations at 2X the rate of women: 31% vs 15%
• Nearly 1 in 5 female STEM graduates leave the labor force, less than 1 in 10 male STEM graduates.
• In 2011, 6% of STEM workers were Black (up from 2% in 1970).
• Hispanics were only 7% of the STEM workforce in 2011.
• Native Americans, Pacific islanders and Indigenous Peoples have been historically low in STEM employment, registering consistently in the low single digits.
DIVERSITY/INCLUSION ➔ INNOVATION ➔ ECONOMIC COMPETITIVENESS

• 95% corporate leaders believe culture of diversity and inclusion contribute to innovation
• For every 10% increase in racial and ethnic diversity on senior executive team, earnings increase .8%
• Companies in the top quartile for racial and ethnic diversity are 35% more likely to have financial returns above national industry median
• 86% female and 74% male millennials consider employers’ policies on diversity, equality and inclusion
• Transitioning from a single-gender office to office evenly split estimate 41% revenue gain
• A move from no female leaders to 30% representation is associated with a 15% increase in revenue
DIVERSITY/INCLUSION → INNOVATION → ECONOMIC COMPETITIVENESS

• 15% of the world’s population has some form of disability and represent $200B in discretionary spending
• Combined buying power of U.S. LGBT adult population is estimated at $917B
• Veterans perform 4% higher than average employees and have 3% less turnover (Company with 1K employees, translates to $7.3M annually)

Ignoring inclusion and diversity in tech comes with a $16B price tag
Unfair treatment in the workplace is the single largest driver of turnover in tech
WHAT DO WE KNOW ABOUT OUR FUTURE WORKFORCE?

- Millennials/Post-millenials are most diverse sector of our population and represent the largest generation to date.

- Grown up in an age of pervasive and often-times ubiquitous technology, violence, and with the introduction of the internet, information overload.

- According to a report by The Council of Economic Advisers in 2014, millennials are more connected to technology than any previous generation. They are more likely to be constantly connected to their smart phones and have multiple means of communicating with their peers via social media.

- They express a greater value to the role they play in their communities, including a close relationship with their families. They rate quality of life as being very important as well as a strong desire to make a positive social impact on their own children and communities and society at large [2].
ADVANCED COMPUTING FOR SOCIAL CHANGE

Advanced Computing for Social Change
Black Lives Matter SC16 Challenge

Advanced Computing for Social Change
Examining Immigration Through a Data Science Lens SC17 Challenge

Chosen to be featured in Jan 2018 issue of IEEE's Computing Edge
ADVANCED COMPUTING FOR SOCIAL CHANGE

Engage students through socially relevant topics

Curriculum Elements:

Storytelling – aids memory by putting information into an emotional context

• When emotions are present, hormones released to the brain act as a memory fixative.
• Story shapes life values and teaches acceptance, and provides students an opportunity to broaden their understanding of heritage and culture, both theirs and others.
ADVANCED COMPUTING FOR SOCIAL CHANGE

Engage students through socially relevant topics

Curriculum Elements:

Visualization – we remember 10% of what we hear, 65% of what we see


Visualization tags into the very best capabilities of our brains, transforming fundamentally abstract numerical data into something that communicates and illuminates information ranging from the simple to the complex. Visualization researchers, developers, practitioners, and educators constantly work across traditional discipline boundaries, often times in teams of people that come from a diverse kind of background, using visualizations as a common language for collaboration. As a community, we are native interdisciplinary thinkers, working at the intersection of science, art, engineering, and technology.

By definition, this intersection space is a celebration of diversity, a space in which curiosity is allowed to flourish and innovation is key. There is a learning global workforce shortage in the computational science and high-tech sector, primarily due to a disconnect between population demographics and the demographics of those educated to fill those jobs. The visualization community is uniquely positioned to bring a fresh approach to making diversity and inclusion fundamental tenets that are necessary rather than optional. Inspired by the IEEE Visualization Conference 2016 panel, “On the Death of Scientific Visualization,” this article provides context for what we as a community can and should do to bring our native universal language to bear on problems that have the potential to make significant societal impact and encourage and foster innovation at every step.

A Shifting Workforce

According to the 2016 US Census Bureau, there were over 20 million children under the age of 16 living in the United States at that time, a significant portion of which were in low-income families. The data indicates that these families are likely to be challenged by basic needs like food, clothing, and shelter. As the world becomes more connected and data-driven, the demand for tech talent will only increase. This is where visualization comes in – by providing visualizations that are easy to understand, we can make complex information accessible to everyone.
ADVANCED COMPUTING FOR SOCIAL CHANGE

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Curriculum Elements:

Team Science – research is becoming increasingly more multidisciplinary
• Requires skills in leadership, communication, and an understanding of the bigger picture
• Curriculum that actively fosters collaboration has proven successful at increasing productivity, retention, and success of women and underrepresented minority scientists in multiple STEM fields
ADVANCED COMPUTING FOR SOCIAL CHANGE

Engage students through socially relevant topics

Curriculum Elements:
Discovery Based Learning – active learning increases mastery of technical skills
• Active learning increases mastery of technical skills, improves communication skills, and enhances critical thinking.
• It provides an opportunity for students to explore and ask questions of the data, and promotes curiosity and interaction with the science, facilitating an iterative question/answer loop
SC16 ADVANCED COMPUTING FOR SOCIAL CHANGE CHALLENGE

• Data-driven discussion to confirm/debunk perceptions/misperceptions on Black Lives Matter
• Worked in four teams
  • Identified their audience
  • Identified their argument
  • Team presentations using evidence-based analysis and visualization
• 60% Female Participants, 40% African American, 58% First Generation College Students
• External Evaluators did focus groups
• Students Rated Challenge Experience 4.5/5.0
SC17: EXPLORING IMMIGRATION THROUGH BIG DATA LENS

- Advanced Computing for Social Change Challenge (Second Year) at SC17
- Nine students from local area
- Four mentors brought back from SC16 challenge
Computing4Change

- In 2017, SIGHPC approached us to create an international version of the program
- Applications opened up for SC18
- Huge thanks to John West and Cherri Pancake for believing in this program
SC18: Computing4Change

Topic: Violence

Sponsored by SIGHPCC

- Received ~250 applications from around the world
- Accepted 16 competitors
  - From 5 countries
  - 10 female, 1 non-binary
  - 2 with disabilities
  - 33% Black/African American, 25% Latinx, 19% White, 13% Asian, Native Hawaiian/Pacific Islander or Mediterranean descent
  - 44% from resource constrained institutions
  - 1 from a Community College

Brought in a Native Hawaiian team from Chaminade University

Supplemented by NSF XSEDE
SUPPORTING PACIFIC INDIGENOUS COMPUTING EXCELLENT (SPICE)

• 2 Year NSF INCLUDES grant
• Partnership with Chaminade University of Honolulu and Georgia Tech University
• Summer Immersion Experience to train undergraduate Native Hawaiian and Pacific Islanders in data science and analytics using visualization as “universal language”
  • Privileges Indigenous Culture
  • 22 students (91% Native Hawaiian/Pacific islander)
  • Month long immersion experience at Chaminade
ALLIANCE FOR SUPPORTING PACIFIC INDIGENOUS COMPUTING EXCELLENT (ALL-SPICE)

• Submitted YESTERDAY to NSF!!!
• Backbone: TACC, Chaminade University of Honolulu and Georgia Tech University
• Month Summer Immersion Experience
• Rotating Sabbatical Program
• Brings in students, faculty and people from local agencies
IN SUMMARY

- This is not exclusively a pipeline problem
- Attracting students into this field requires that we look outside our norms
- There is far too little money going into successful programs
- On the flip side, to grow a successful program requires investment in evaluation and data collection
- Engaging the “why” is crucial before teaching the “how”
THANK YOU FOR YOUR TIME

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