

CLEMSON  
CENTER FOR  
ADVANCED  
MANUFACTURING

# Advanced Manufacturing and Clemson University

Mark Johnson

Materials Science & Mechanical Engineering  
Director of Center for Advanced Manufacturing

Manufacturing: The process of making a product (good)

Advanced Manufacturing: The making of a product (good)  
where technology provides a competitive advantage



# Technology Innovation

## Industry 2.0

Assembly Line  
*Mass Production*

## Industry 3.0

Information Technology  
Robotics & Logistics  
*Global Production*

## Industry 4.0

Communications  
Autonomy & Flexibility  
*Mass Customization*

## Industry 5.0

Human in the Systems  
AI, Additive & Sustainable  
*Mass Personalization*



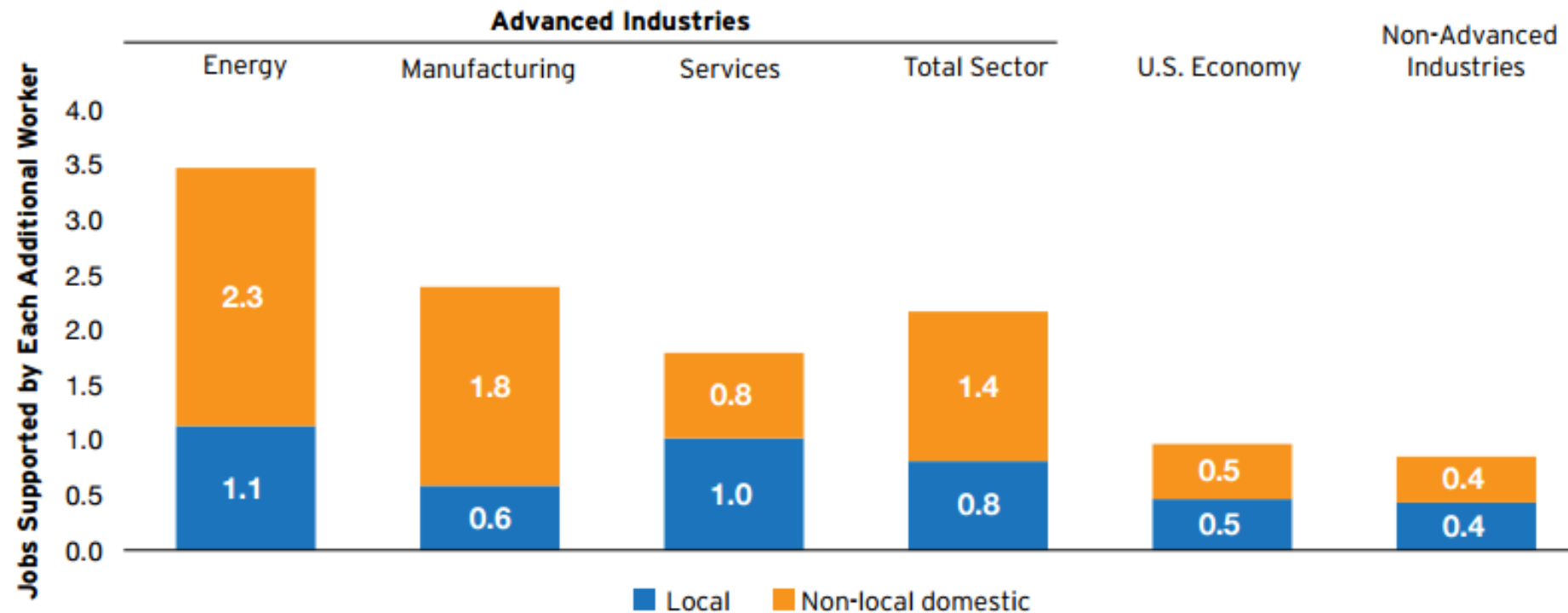
*“If you are worried about Robots taking all of the good jobs, you should study and learn about Robots.....”*

*Dr. Lonnie Love*

*“If you are worried about Artificial Intelligence changing your business and markets, you organization should study and learn about Artificial Intelligence.....”*

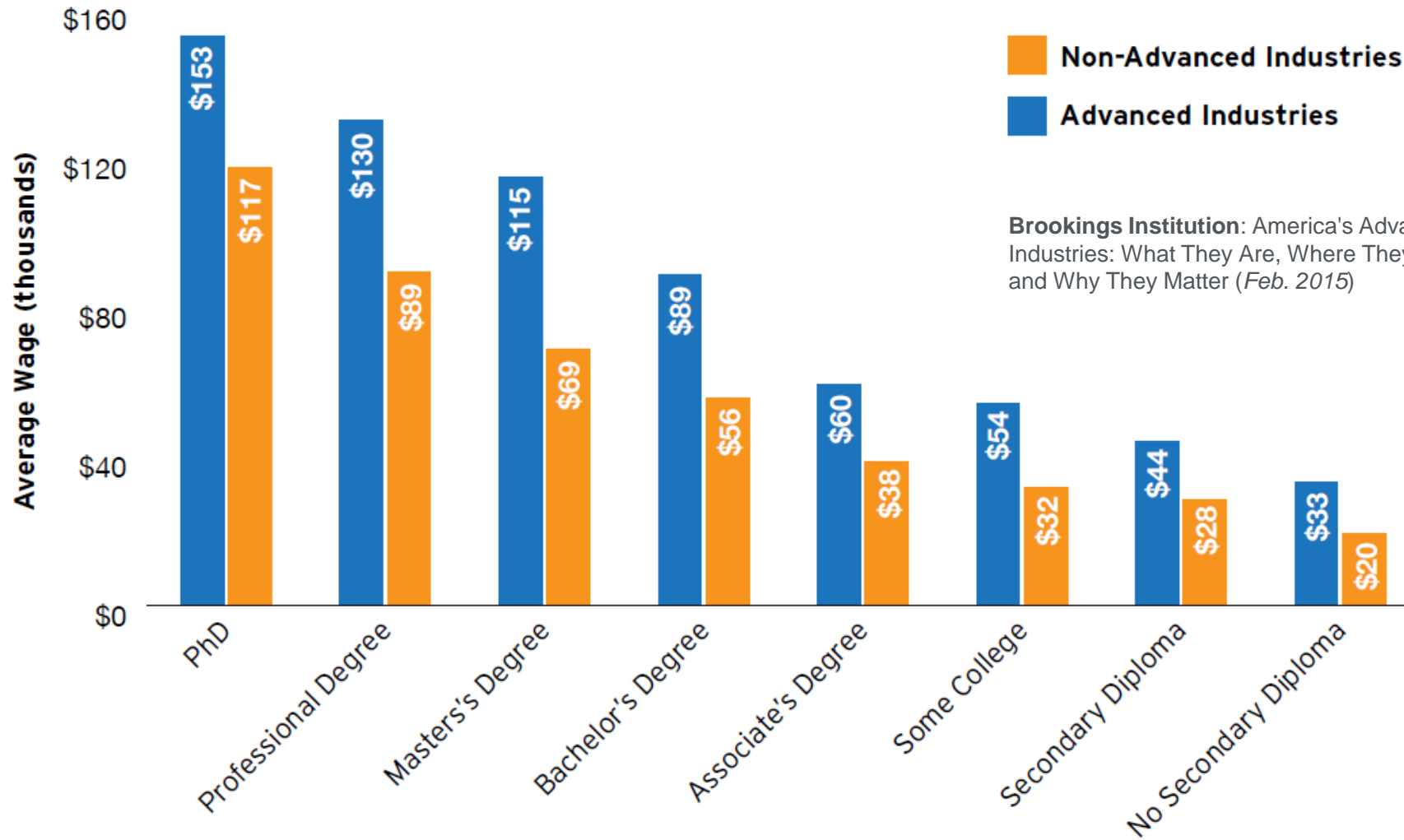


## Powerful multiplier effects mean every new advanced industry job supports more than two others



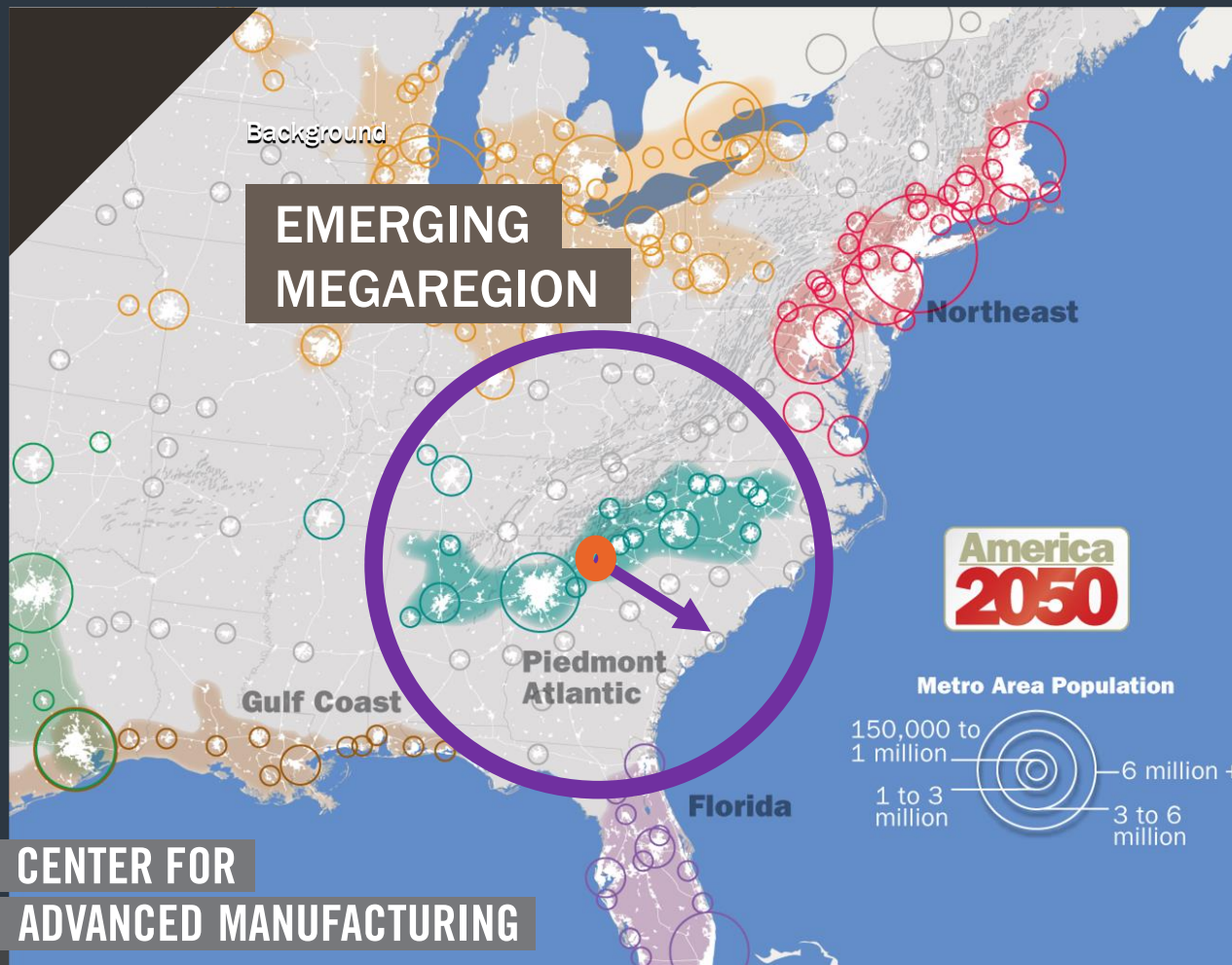
Brookings Institution: America's Advanced Industries: What They Are, Where They Are, and Why They Matter (Feb. 2015)





# Southeast US Mega-Region

Connected Economies of I-85 Piedmont for Manufacturing



- \$1.9T Economy
- 38M People
- ~10% of STEM Degrees
- Exports Competitively in Global Economy



# Campus Landscape in Advanced Manufacturing



Making the Whole Function Greater than the Sum of the Parts in Support of Advanced Manufacturing

Disciplines:

Mechanical Engineering  
Automotive Engineering  
Electrical Engineering  
Chemical Engineering  
Industrial Engineering  
Materials Science  
Computer Science  
Mathematical Science  
Business & Management  
Sociology and Psychology  
Design

Sectors:

Automotive  
Aviation / Defense  
Chemicals, Textiles & Materials  
Consumer Goods  
Food and Bio-Processing  
Electronics and Electrical Devices  
Power and Power Systems





# Partner Engagement

Regional Corporate Leaders – Across Industry Sectors

## Advanced Manufacturing Forum

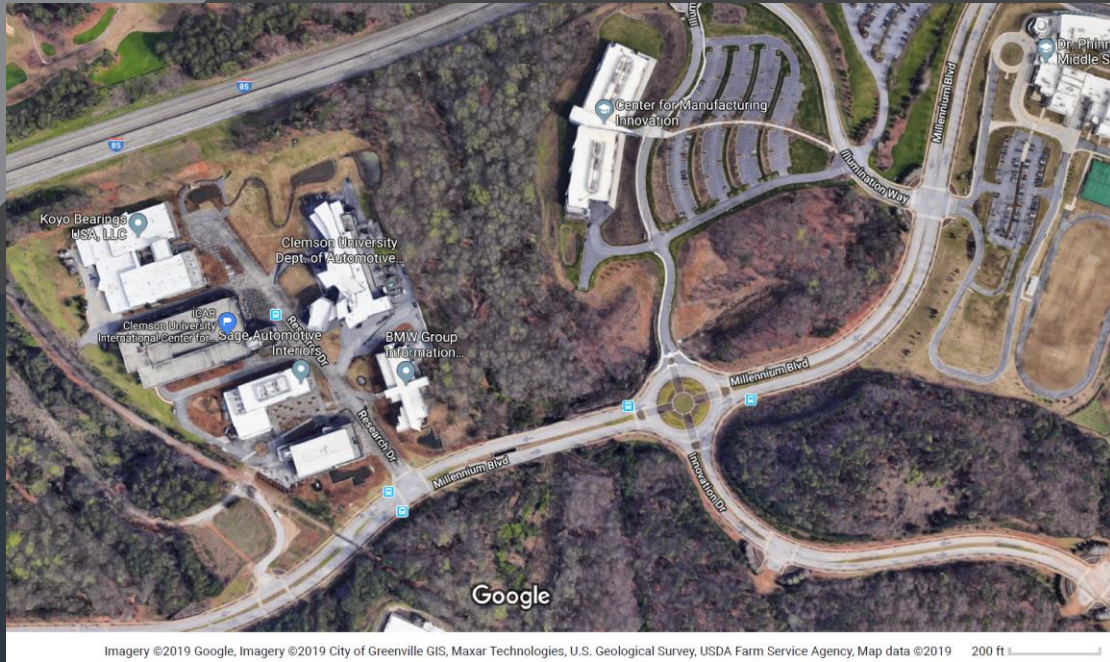


Identify Partnership ‘Homework’

## Focused “Study Sessions”

- University Education for Advanced Manufacturing in the 21<sup>st</sup> Century
- Connecting R&D Partnerships Across Supply Chains and Industry Sectors
- Enhancing the R1/Land-Grant University’s Innovation Eco-System



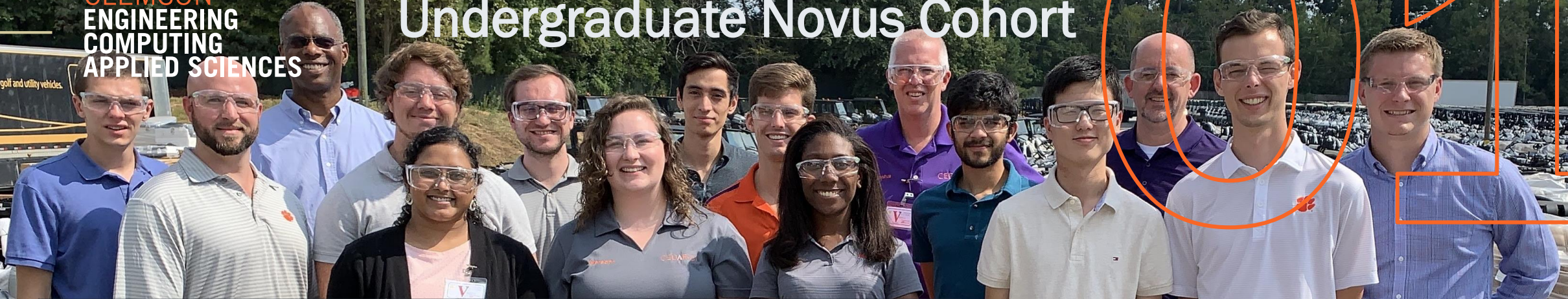


- Place: Community College through Graduate Research
- Convergence: Engineering, (ME, AuE) Computer Science (AI)
- Engagement: Integrate Education with Knowledge Work



# Advanced Manufacturing Undergraduate Novus Cohort

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ENGINEERING  
COMPUTING  
APPLIED SCIENCES



Current Published Main Campus Schedule	Innovation Campus Schedule (Greenville)
<p><b>Junior Fall (17 credits)</b></p> <ul style="list-style-type: none"> <li>ME 3070</li> <li>ENGL 3140</li> <li>MATH 3650</li> <li>ME 3080</li> <li>ME 3030</li> <li>ME 3330</li> </ul>	<p><b>Junior Fall (17 credits)</b></p> <ul style="list-style-type: none"> <li>A&amp;H (non-lit)</li> <li>ENGL 3140</li> <li>MATH 3650</li> <li>ME 3080</li> <li>ME 3030</li> <li>ME 3330</li> </ul>
<p><b>Junior Spring (15 credits)</b></p> <ul style="list-style-type: none"> <li>ME 3050</li> <li>ME 3060</li> <li>ME 3120</li> <li>ME 3040</li> <li>Statistics</li> </ul>	<p><b>Junior Spring (15 credits)</b></p> <ul style="list-style-type: none"> <li>ME 3050</li> <li>ME 3070</li> <li>ME 3040</li> <li>Statistics</li> <li>Social Science</li> </ul>
<p><b>Senior Fall (14 credits)</b></p> <ul style="list-style-type: none"> <li>A&amp;H (non-lit)</li> <li>ME 4030</li> <li>ME 4010</li> <li>ME Tech. Elective</li> <li>ME 4440</li> </ul>	<p><b>Senior Fall (15 credits)</b></p> <ul style="list-style-type: none"> <li>ME 3060 - Machine Design</li> <li>ME 3120 - Manufacturing</li> <li>ME 3040 - Heat Transfer (Hybrid)</li> <li>ME 4030 - Controls (Hybrid)</li> <li>ME 4010 - Design 1</li> <li>ME 6550 - DFM</li> <li>AMFG 6800 - Teamwork in Manufacturing</li> <li>ME 4150 &amp; ME 4900 (as needed)</li> </ul>
<p><b>Senior Spring (16 credits)</b></p> <ul style="list-style-type: none"> <li>Social Science</li> <li>Prof. Elective</li> <li>ME 4000</li> <li>ME 4020</li> <li>ME Tech. Elective</li> <li>CECAS Tech. Elective</li> </ul>	<p><b>Senior Spring (15 credits)</b></p> <ul style="list-style-type: none"> <li>ME 4020 - Design 2</li> <li>ME 4440 - Senior Lab</li> <li>ME 4000 - Senior Seminar</li> <li>ME 6560 (Additive Manufacturing)</li> <li>ME 8200 (Modern Controls)</li> <li>OR AMFG 6XXX (Digital Manufacturing)</li> <li>OR AUE 8XXX (Human Factors)</li> </ul>







# Thoughts on Certification & Undergraduate Engineering

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- Interesting Technical Problems Meeting a Societal Challenge (“a passion”)
- Markets Speak: If Programs Don’t Have Long-Range Impact to the Students, Why Should They Care? (..post-Millennial student environment)
- Professional Recognitions:
  - Undergraduate Degree in STEM field ★
  - Professional Engineer or PMP Certification
  - Extra-curricular / Professional Certifications
  - the next Degree
    - Transition to PhD
    - Immediate Masters Degree (BS/MS)
    - Professional Masters: MBA, Law, ....

Figure 1. Unemployment Rates by Educational Attainment, 1992–2019



Source: Bureau of Labor Statistics.  
Note: Shading denotes a recession.

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# Thank You

## Questions