



Environmental Engineering

UNIVERSITY OF COLORADO BOULDER

PhD Thesis Defense

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A Data Science Approach to STEM (Science, Technology, Engineering and Math) Identity Research for African American Communities

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Faculty Advisor: Professor Shelly L. Miller and Joseph L. Polman



Abstract:

Science, technology, engineering and math (STEM) professionals, educators, and researchers seek to broaden participation in STEM fields by underrepresented groups, including the specific demographic of African American people. Prior research has established that diversity in STEM contributes to enhanced innovation and economic benefits. A deeper understanding of the bond between STEM learning and STEM identities may be valuable as we pursue methodologies that broaden participation in STEM fields. This dissertation presents interdisciplinary research on STEM identity for African American communities, implemented as two lines of inquiry. One line of inquiry involved developing and deploying the Paralinguistic Element Guru (PEG) toolkit to analyze social media content for patterns that provided visibility into STEM identities in African American STEM communities of practice. This methodology resulted in datasets of thousands of Twitter artifacts that were examples of identity-related evidence from sentiment analysis, theme analysis, and pattern analysis. The study is a proof of concept that data science tools may be used to provide researchers with a source of social media data about STEM identities, including data from specific underrepresented groups such as African American people and including data with paralinguistic elements, that might have been previously overlooked. The PEG toolkit is a customizable tool for researchers who want to explore patterns that reveal insights into STEM identities in social media content. Another line of inquiry involved working with African American families whose children had asthma, helping them to learn introductory data science to analyze data from residential indoor air quality sensors and family asthma symptoms. This line of inquiry revealed indicators of STEM identity work as intergenerational participants developed interdisciplinary fluency with sensor data, air quality analytics, and actionable data science applied to asthma management. It also provided a platform to examine ways that participants expressed their evolving STEM identities, with limited evidence in social circles and almost no evidence in online social media forums. A final aspect of this research involved measurement of potentially hazardous volatile organic compound emissions, initially identified by research study participants in their homes in a community/citizen science capacity, confirmed by scientific methods in a laboratory setting.

Donna Auguste has been an electrical engineer, computer scientist, and entrepreneur for over 20 years. For the past three years she has been a PhD student in the ATLAS Institute, exploring a variety of ways that sensor technology may provide introductions to data science for STEM-curious youth.