2023 Annual Conference & Exposition
Baltimore Convention Center, MD | June 25 - 28, 2023

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Paper ID #37028

Board 381: REU-PATHWAYS: Pathways for Community College Students to Enrich Their Education and Careers

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Ibrahim Zaid is a professor of mechanical, industrial, and manufacturing engineering at Northeastern University. He received his Ph.D. degree from the University of Akron. Zeid has an international background. He received his B.S. (with highest honor) and

Mrs. Claire Duggan, Northeastern University

Claire Duggan is currently Executive Director of The Center for STEM Education at Northeastern Univeristy. She is the Co-Principal Investigator for several National Science Foundation grant efforts including S-STEM, REU, and Includes Alliance grant efforts.

Dr. Jennifer Ocif Love, Northeastern University

Jennifer Love is a full-time faculty member of Northeastern University's College of Engineering, most recently in the First Year Engineering program. She is currently the Associate Director for the Center for STEM Education. She has a Bachelor of Science in Mechanical Engineering from Rensselaer Polytechnic Institute (1993), a Master of Science in Biomedical Engineering from The University of Iowa (1997) and a Doctorate in Education from Northeastern University (2022) where she recently completed her dissertation in elementary STEAM education. She also worked as a professional engineer in the athletic footwear and medical device industries for 10 years before joining the faculty at Northeastern University in 2006.

NSF REU-PATHWAYS: Pathways for Community College Students to Enrich Their Education and Careers

Northeastern University received an NSF grant # 2150417 from the division of Engineering Education and Centers (EEC) to establish a three-year REU (Undergraduate Research Experience) site focusing on smart engineering for community college students. The REU Site hosts 10 students each year during the summer session to participate in research projects focusing on the field of Smart Engineering.

The REU site is guided by two of the grand challenges of the National Academy of Engineering: personalized learning and scientific discovery. Specifically, this project trains students to conduct cutting-edge research as well as how to communicate their research findings to the broader community. The project focuses on recruiting students who are currently underrepresented in the STEM workforce.

The focus of our REU-PATHWAYS Site is to provide not only appropriate and exciting research experiences for community college students planning to continue their academic studies in engineering, but additional learning opportunities for students to expand their career thinking and skills. These supporting activities enhance the research experience of participants. During the summer, seven (7) students attended a full schedule of seminars, workshops and meetings which exposed them to advanced research topics and career opportunities, improved their presentation and public speaking skills, and encouraged their continued interest in science, engineering, and math areas.

Program Overview

- 10-week summer-based experience working with seven (7) professors from across the College of Engineering.
- A hands-on series of workshops in Arduino programming, engineering design and prototyping.
- Additional workshops, seminars, and field trips.
- Each REU students received a $6,000 stipend in addition to commuting expenses.
- Each REU student was provided with a free laptop.
- Each REU student received daily food vouchers.

Orientation

Prior to the start of the program, an orientation meeting introduced the available research projects and allowed students, faculty, and the graduate student mentors to meet each other. An overview of Research Contracts, which were used to structure the individual summer research projects of each student, a brief introduction to the online communications platform (Basecamp), where students turned in materials and engaged in weekly reflections on the program and their research projects, and a Lab and Campus Safety information session were also covered in the orientation meeting.

Program Website https://stem.northeastern.edu/summer/reu/pathways/

Arduino/SparkFun Workshop

Through this workshop series and a 10-week long engineering design project, students also refined their engineering design skills during their REU experience: programming, sensors, data collection, data sampling, data analysis, makerspace skills, and prototype fabrication. Students participated in 15 hours of hands-on learning and instruction with a First Year Engineering faculty member experienced in teaching Arduino programming with a SparkFun Inventors Kit. Students then spent the rest of their weekly workshop time on a team design project working in pairs to design a SMART system, which they formally presented at the end of the 10 week program.

2022 Research Projects, Participants and Affiliated Faculty

Students directly engaged in research with their faculty sponsors and graduate students during the 10 weeks. A list of the 2022 research project by student and faculty member includes:

Accelerating Operations on Graph Neural Network
    Faculty: David Kaeli (ECE)
    REU Student: Lina Adkins, MassBay Community College, Electrical and Computer Engineering

Computational Design of Single Atom Catalysts for Electrochemical CO2 Reduction
    Faculty: Qing Zhao (ChemE)
    REU Student: Tyler Arnold, Bunker Hill Community College, Chemical Engineering

Information Theory to Pinpoint Causal Links from Complex Data
    Faculty: Rifat Sipahi (MIE)
    REU Student: Seartch Delva, North Shore Community College, Electrical and Computer Engineering

Causal Coupling Inference in Mass Shootings Data
    Faculty: Rifat Sipahi (MIE)
    REU Student: Xeon Khan, Bunker Hill Community College, Computer Science

Relating Carbon Nanotube Network Structure to Mechanical and Viscoelastic Performance
    Faculty: Carol Livermore (MIE)
    REU Student: Thomas Fitzgerald, Cape Cod Community College

Using Fourier Transforms to Disambiguate Microstructures of Ferromagnetic FeSiB Ribbons
    Faculty: Laura Lewis (ChemE)
    REU Student: Frances Power, MassBay Community College, Engineering

Analog Computing Simulation Tool for Machine Learning Inference in Edge Biomedical Devices
    Faculty: Aatmesh Shrivastava (ECE)
    REU Student: Matthew Sharon, MassBay Community College, Electrical and Computer Engineering