Board 218: Building Student Success in Assistive Technology

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Prof. Li Liu innovated many assistive technologies that improve software accessibility for people with disability when they interact with new computing devices and emerging digital contents. His work on building a tongue-machine interface is the first one reported on using tongue as computer input device in a non-contact way. His research projects were funded by NSF, DoD, NASA, Amazon, Disability Communication Fund, Silicon Valley Community Foundation, and other foundations. At CSUN, Liu also developed a master's degree program in Assistive Technology Engineering that prepares graduates to become innovative and cross-field team leaders in assistive technology fields.

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Abstract

Assistive technology is highly interdisciplinary and requires experience working with a team of professionals that has not always been accessible to under-represented student groups. With support from NSF's Improving Undergraduate STEM Education program, California State University Northridge creates the first minority student development program that specifically targets students for careers in assistive technology by leveraging institutional commitment to engage underrepresented and underserved minority students in STEM fields. The project uses student-centered principles and focuses on the significance of a learning environment by applying an integrated STEM approach.

Introduction

CDC reports that 61 million adults in the United States live with a disability, constituting 26% of the population. The number of older people is also surging. This age structure change in population has caused an increasing number of older adults with a disability. Studies consistently find that disability rates rise with age. The 2018 Health and Retirement Study sponsored by the National Institute on Aging shows that 41% of older adults aged 65-79 have at least one disability. Assistive technology is a technology that's been specifically designed to help a person with a disability perform a task. The application of assistive technology has moved beyond medical recovery to helping people with disabilities integrate into society in different aspects, assisting people with disabilities in coping with either activities of daily living (ADLs) or instrumental activities of daily living (IADLs). The Department of Labor predicts long-term growth in this area. In the next five years, the employability skill gap is going to widen as the gulf between higher education training and industry-relevant competencies in emerging technologies grows [1].

Experimental Methods/Materials/Project Approach

Assistive technology has an interdisciplinary character because it improves an individual's independence, quality of life, and social inclusion. However, discipline-based professional development shows its efficacy in STEM fields [2]. Human touch, human feelings, and the human experience must be part of the innovation process, along with technology development requiring a deep integration across different disciplines. This project utilizes the resources from its home institute, California State University Northridge (CSUN), to build a supporting system for underrepresented students in STEM and provide them with an authentic learning experience through tailored activities. CSUN is one of 23 primarily undergraduate four-year institutions in the California State University (CSU) system. Since it was first established in 1956, CSUN has set its mission to educate students from underrepresented communities, particularly from backgrounds nationally underrepresented.

This project team includes faculty from Engineering, Kinesiology, Humanity, Arts, and Communication Disorders. They are joined by a community partner, Rancho Los Amigos National Rehabilitation Center (RLANRC). RLANRC is an acute rehabilitation hospital in Southern California. It is recognized as an international leader in rehabilitation medicine and

clinical research, and was voted as the 2nd best physical rehabilitation center in California for 2021. As one of the largest rehabilitation centers in the United States, RLANRC cares for more than 4000 inpatients and services 75,000 outpatient visits per year. Faculty and clinicians together bring their expertise from five different domains, human-centric computing, disability study, rehabilitation science, design thinking, and entrepreneurship to stimulate student's curiosity about discovery and innovation.

Results and Discussion

The project builds on this prior knowledge to create the following interventions,

1) Culturally responsive pedagogy training

Faculty in this project received formal mentor training via CSUN's Undergraduate Mentoring program, developed through CSUN's NIH BUILD PODER (Building Infrastructure to Diversity Promoting Opportunities for Diversity in Education and Research) project. BUILD PODER is funded by a 10-year grant from the National Institutes of Health (NIH).The overall mission of BUILD PODER is to promote best practices in mentoring diverse populations. Faculty integrated these concepts in mentoring, focused on their specific concerns including stigma and cultural barriers of assistive technology [3] [4].

2) Interdisciplinary curriculum development

The interdisciplinary project team created learning modules that cover multiple aspects involved in developing assistive technology, including a) disability, relevant historical background, from medical model to social model, policies, ADA; b) the basics of assistive technology, hardware, software, digital accessibility, and how emerging technology such as AI and VR can be used to remove barriers; c) inclusive designs as they relate to disability, diversity, and culture integration. d) best practices for social interaction with people with disabilities, using appropriate terminologies and languages.

3) Engineering Senior Design

Engineering Senior Design puts students at the center of learning and can incorporate several forms of active learning. Project-oriented senior design courses allow students in Computer Science to apply their knowledge of software engineering to the design and implementation of a system to solve a real-world problem in a 2-semester sequence. Faculty-student mentorship (FSM) as part of a project-based learning curriculum has proven to be a key to maximizing the competitiveness of URM students entering STEM careers. 4 projects were created in a group setting for Assistive Technology Senior Design starting in Fall 2023.

The evaluation team from the Center for Assessment, Research, and Evaluation (CARE) at CSUN comprised of Drs. Andrew Ainsworth and Scott Appelrouth, supported by Alby Luchko (Administrative Assistant), developed a set of tools and instruments to assess the project. Project evaluation is guided by the outputs, aims, and outcomes of students' technical knowledge gains, Computer Science Motivation, Engineering Self-Efficacy, Engineering, and student STEM identity theory by using both formative assessments and summative assessments. The preliminary result shows that the project develops a strong professional identity critical to the persistence of students enrolled in a minority-serving institute in STEM majors and the motivation to pursue a STEM career, particularly in careers at the human-technology frontier.

References

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