Utilization of Nano-Themed Research to Enhance Undergraduate Research

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Introduction

Nanotechnology is defined as the study of particles in the 1-100 nm range. Its application in chemistry involves the ability to manipulate and see individual atoms and molecules, although it can be applied to many different disciplines within science, engineering and medicine. At Pasadena City College (PCC) we are approaching nanotechnology through projects based on the ability to characterize and isolate different particle sizes. Instrumental techniques, such as Scanning Electron Microscope (SEM), Atomic Force Microscope (AFM) and qNano particle size analyzer, and research collaborations with four-year universities, such as CSU Northridge and UC Riverside are being used to give students hands on experience in laboratory techniques.

Over the past five years, PCC has designed a robust Earl Career Undergraduate Research Experience (eCURe) which engages students in research projects embedded within undergraduate STEM courses, partners students with mentors and encourages applications to summer URE opportunities. The combination of nanotechnology and undergraduate research has led to over thirty PCC students being accepted into summer URE programs, eight peer reviewed publications and over fifty regional and national conference presentations.

Tiered Approach to Undergraduate Research

Goals of eCURe at PCC

- Increase student success and retention in STEM fields through collaborative and interdisciplinary projects in basic science
- Inspire enthusiasm for scientific research by introducing students to research projects with a broader impact in terms of energy, the environment and emerging scientific technologies
- Provide students with opportunity to participate in all aspects of a scientific campaign, including research experience (lab work, literature review) and communication of scientific data (oral/poster presentations, writing manuscripts).

Nanotechnology-Based Projects

Conclusions

- Incorporating advanced technology into science lessons and research increases students interest and success in STEM.
- Student attitudes toward Scientific Research and understanding increased.
- This redefines the role of undergraduate research in community college STEM Pathways

Remotely-Accessible Instruments in Nanotechnology (RAIN)

Student Learning

Comparison of students’ scores on the pre-survey compared to the post-survey. Multiple choice questions tracked student fact based learning. Due to different number of questions in each category, the relative mean score was taken. As expected, students showed no difference in their knowledge of ET versus TE at the beginning of the school year. Matched pair t-test confirms, at the end of the lesson sequence, students clearly had a greater understanding of advanced scientific technologies.

Student Attitudes

Bar chart displays changes in student attitudes on Likert items with a 1-5 scale. Questions were divided into Attitudes toward Technology (TE), College (AC), and science in general (ASTEM). AC and ASTEM showed no significant change. However, TE showed an increase in student interest and positive attitudes towards scientific technologies. Wilcoxon Matched Pairs Signed Ranks Test confirms.

Acknowledgements

Thanks to the students of Aspire Middle School, who participated in the labs and surveys, and Jill Mayonga and Diana Campos at Aspire. Thanks to the RAIN network, including Robert Ehrman and Dr. Osama Anwar-Akbari at Pennsylvania State University. Support came from BUILD PODER, funded by National Institute of General Medical Sciences of the National Institutes of Health under award number R55GM118975. eCURe is an undergraduate research program at Pasadena City College funded by National Science Foundation Advanced Technical Education grant award number 1601813. Thanks to Dr. Brandon Rodriguez and NASA Education for supporting the research.