

An Integrated Multidisciplinary Nanotechnology Undergraduate Education
Program at the University of New Mexico

Abstract:

The goal of this project is to address the *need* to provide the nation with additional, well educated workforce and citizenry to support the rapidly growing nanotechnology industries and encourage students to pursue a career in the multi disciplinary, STEM based fields of nanoscience and its application in nanotechnology. The *approach* taken to meet these goals encompasses (1) Creation of a program in NS&NT for undergraduates at UNM, NM STEM Educators, and local high school students. (2) Institutionalize NS&NT into the UNM-SOE curriculum by creating a concentration in the Nano/Microsciences at the Bachelor of Science level. (3) Fuse NS&NT education with research from the co-PI's NS&NT Research. Three junior faculty members and one research professor of engineering education from two engineering programs, Mechanical Engineering (ME) and Electrical & Computer Engineering (ECE), have employed their collective knowledge in NS&NT to develop new experiments and pedagogical methods that will be institutionalize in UNM's School of Engineering. Courses on NS&NT are available during every year of the degree entailing the fabrication/synthesis of nano-components and NS&NT modules are also included in core courses in both the ME and ECE programs. A concentration in NS&NT will be available to students who complete 3 NS&NT courses. During the course of this program, 4 new courses are created and lecture/lab modules are added to 3 existing courses. Outreach components of the project include developing teaching modules for K-12 and the teaching of STEM secondary Educators. The co-PI's will present components of the NS&NT material developed STEM Educator Workshops. These efforts will *benefit* society by increasing the number of multidisciplinary engineers in NS&NT to solve future problems. During the first year of this program new modules and experiments have been added to three undergraduate core courses in ME department and one undergraduate core course in ECE Department. In the ME Department a laboratory module has been developed for ME 318 (Mechanical Measurements) and 2 Lectures on Nanomaterials and Nanosystems for ME 260 (Introduction to Manufacturing). One new ECE undergraduate course has been developed that covers the NS&NT based biosensors. 36 ECE undergraduate students have been exposed to NS&NT topics through a core course (Materials and Devices) and the newly developed course (Introduction to Modern Biosensor Technologies). These students have written twenty-seven term papers on a large variety of NS&NT topics (selected and defined by the students). Pre/post surveys in these classes indicate that there is an impact as to how the student view Nano engineering degrees and several are considering it in a nano centric graduate level program. There has also been considerable effort in enabling outreach to UNM's surrounding community. A new course (Introduction to NS&NT) is under development and will be introduced for STEM and non-STEM high school, undergraduate students and K-12 educators that gives the students broad understanding and a core set of vocabulary of the science and technology used in the application, creation and manufacturing of nano-enabled devices. This course will be available to high school students as a dual credit course with the intent of engaging them to consider a STEM based career including engineering. The secondary educators will be encouraged to bring the hands-on modules to their respective disciplines as appropriate to amplify the outreach impact. Modules developed are being adapted to allow hybrid course delivery, part online and part face-to-face which is better suited for the non-traditional student targeted populations. Eleven undergraduate students have participated in NS&NT related research in co-PI's lab. These students contributed in experimental activities and theoretical analysis for a large variety of NS&NT projects.