Nanotechnology Course Outline and Potential Impact

Organized approaches to true research can be such an educational tool. It is an arena where failure is an option...and often encountered. In the right context and environment, with the right support and guidance, failure creates character and intrinsic motivation. It is not the failure that matters, it is what was learned, applied and adapted from that failure that does. In the research world, there is no room for cheating, for skipping steps, or saying, "I've seen this before and I know the answer." The students are left to design [...or redesign^{x}...], solve, and try again. Students who participate in this program will gain practical problem solving experiences and experimental design skills that utilize and challenge what they have learned in their chemistry, physics, and mathematics classes in an exciting and cutting edge way. They will "learn how to learn" and solve a problem through to resolution. It is a true problem solving and solution driven program. Below are some of the goals of the Future is N.E.A.R. program:

1. Inform and educate students about nanotechnology, submicron measurement and the present and future applications of the technology.
2. Identify nanotechnology and its related mathematical and scientific components as a necessary program for cultivating student learning through research and preparing them to be competitive, productive members of a global society.
3. Give students the tools and knowledge to become life-long learners and leaders.
4. Improve science, math and technical knowledge and skills through true, real-world research.
5. Introduce the understanding of how to design an experiment, analyze and quantify collected data and properly present the collected results.
6. Offer opportunities for the students to become the leaders in the global industrial revolution of the 21st century.

Unit 1 Project Overview

1. Project Overview and Justification
2. Engineering Notebook / Importance of Engineering Documentation
3. Problem Statement Development

Unit 2 Introduction to Nanotechnology

1. Nanotechnology Pre-assessment
2. Shaping the World Atom by Atom
3. NNI - Next Industrial Revolution
4. Nanotechnology Introduction PowerPoint
5. Nanotechnology in Products Today Research and Presentation Activity

Unit 3 Introduction to Polymer and Materials Science

1. Materials Science and Polymers PowerPoint
2. Sodium Polyacrylate Laboratory Activity

Unit 4 Laboratory Safety

1. Laboratory Safety PowerPoint
2. MSDS Search and Library Creation Activity

Unit 5 Polymeric Solution Preparation

1. Solution Calculations PowerPoint
2. Solution Preparation / Procedures
    a. MSDS and Handling
    b. Safety
3. Documentation/Labeling (5161)
4. Demonstration

Unit 6 Introduction to Electrospinning

1. Electrospinning Introduction PowerPoint
    a. *Apparatus*
    b. *Electrostatics*
    c. *Electronics I and E*
2. Electrospinning WebQuest
    a. MSDS and Handling
    b. Safety
3. Documentation/Labeling (5161)
4. Demonstration

    Electrospinning Introduction

    Apparatus

    Electrostatics

    Electronics I and E

    Electrospinning WebQuest

    Parameters Affecting Outcome (DOE)

    Field Strength

    Polymer Properties

    Angle

    Viscosity

    Distance (Constant Voltage)

    Voltage (Constant Distance)

    Equipment Usage and Precautions

    Electrospinning Demonstration

    Electrospinning Student Activity (Intro-Practice)

Unit 7 Electrospinning Research

Student Research Activities
D.O.E. Design of Experiment activities
Scientific Research Paper Development Activity

Unit 8 Presentation

Poster / Website / Research Paper
Final Presentation of Research