WE ARE SEED PLANTERS: A LOOK AT TEACHING STUDENTS NANOTECHNOLOGY ENVIRONMENT, HEALTH, AND SAFETY AWARENESS

Presented by
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University of Texas at Tyler

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St. Louis, MO.
CO-AUTHORS

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- **Dr. Craig Hanks**, Department of Philosophy, Texas State University
- **Dr. Robert McLean**, Department of Biology, Texas State University
- **Dr. Fritz Allhoff**, Department of Philosophy, Western Michigan University
- **Mr. Satyajit Dutta**, Ingram School of Engineering, Texas State University
- **Mr. Adam Mokhtari**, Department of Technology, University of Texas at Tyler
HISTORICAL PERSPECTIVE

• A joint Collaboration with UT Tyler & Texas State

• In 2012, the two institutions were funded $197,999 by the Nanotechnology Undergraduate Education Division of NSF from 2012-2014

• This grant was the first federally funded grant in nanotechnology safety education

FOR MORE INFORMATION, GO TO:
http://nsf-nue-nanotra.engineering.txstate.edu/home.html
PURPOSE OF PROJECT

• Develop two modular undergraduate-level courses dealing with nanotechnology environment, health, and safety awareness

• Build on pedagogical research by employing a variety of teaching methods to engage students, particularly women and Hispanic students, including hands-on training, socially-relevant case studies, plant tours, videos and guest lectures

• Promote interdisciplinary interactions among engineering, engineering technology, science, and industrial management/technology majors

• The proposed project will help to educate students so that they will have the knowledge to make wiser and more informed decisions when selecting nanomaterials in products, providing appropriate workplace safety, and considering environmental implications.
THE URGENCY OF IMPLEMENTATION...

- The rapid growth of emerging nanomaterials in industry
- Who is going to manage potential hazards???
- Who is going to manage the unknowns and find solutions????
- Realizing the full potential of revolutionary nanotechnologies and at the same time minimize undesirable consequences, engineers and technologists need to be educated in how to judge health and safety risks, how to weigh ethical considerations, and how to make informed decisions.
<table>
<thead>
<tr>
<th>UT TYLER COURSES</th>
<th>TEXAS STATE COURSES</th>
<th>INTRO. MODULES</th>
<th>ADVANCED MODULES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 3303-Intro. to Nanotechnology</td>
<td>US 1100: Seminar</td>
<td>1A. What is nanotechnology and ethics in nanotechnology?</td>
<td>1B. Overview of Occupational Health and Safety</td>
</tr>
<tr>
<td>TECH 4314-Principles of Risk Management of Nano-Scaled Materials</td>
<td>PHIL 1320: Society and Ethics</td>
<td>2A. Ethics of Science and Technology</td>
<td>2B. Applications of Nanotechnology</td>
</tr>
<tr>
<td>TECH 4380: Industrial Safety</td>
<td></td>
<td>3A. Societal Impacts</td>
<td>3B. Assessing Nanotechnology: Health and Risk</td>
</tr>
<tr>
<td>ENGR 2300: Materials Engineering</td>
<td></td>
<td>4A. Ethical Methods and Processes</td>
<td>4B. Sustainability Nanotechnology Development</td>
</tr>
<tr>
<td>ENGR 2300: Materials Engineering</td>
<td></td>
<td>5A. Nanomaterials and Manufacturing</td>
<td>5B. Environmental Health and Risk</td>
</tr>
<tr>
<td>IE 3330: Quality Engineering</td>
<td></td>
<td>6A. Environmental Sustainability</td>
<td>6B. Ethical and Legal Aspects of Nanotechnology</td>
</tr>
<tr>
<td>EE 2400: Circuits and Devices</td>
<td></td>
<td>7A. Nanotechnology in Health and Medicine</td>
<td>7B. Nanotechnology Risk Management</td>
</tr>
<tr>
<td>MFGE/EE/TECH 4392: Microelectronics Manufacturing</td>
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<td>8A. Military and National Security Implications</td>
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<td>IE 4380: Industrial Safety</td>
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<td>9A. Nanotechnology Issues in the Distant Future</td>
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<tr>
<td>MFGE 4367: Polymer Prop. and Processes</td>
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<td>MFGE 4399: Polymer Nanocomposites</td>
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METHOD OF IMPLEMENTATION OF MODULES

TX STATE INTRO. MODULES

US 1100-MODULES: 2A
PHIL 1320-MODULES: 1A, 2A, 3A, & 4A
TECH 4380-MODULE: 1A
ENGR 2300-MODULES: 1A, & 2A
MFGE 2332-MODULES: 6A & 8A
EE 2400-MODULE: 1A
MFGE/EE/TECH 4392-MODULE: 9A
IE 4380-MODULE: 1A
MFG 4367-MODULE: 7A & 8A
METHOD OF IMPLEMENTATION OF MODULES

- TECH 4380 - MODULES: 3B, 4B, 6B, & 7B
- IE 3330 - MODULES: 7B
- EE 2400 - MODULE: 2B
- MFGE/EE/TECH 4392 - MODULES: 3B, 4B
- IE 4380 - MODULES: 3B, 4B, 6B, & 7B
- MFG 4399 - MODULES: 2B, 4B, 5B, & 9B
METHOD OF IMPLEMENTATION OF MODULES

UT-TYLER
INTRO. COURSE

TECH 3303-MODULES 1A-9A
METHOD OF IMPLEMENTATION OF MODULES

UT-TYLER ADVANCED COURSE

TECH 4314-MODULES 1B-7B
WHAT DOES THE STUDENTS THINK?
Classification

- Sophomore: 9.52%
- Junior: 71.43%
- Senior: 19.05%
HOW EASY WAS THE MODULE TO UNDERSTAND?
WERE THE TOPICS COVERED IN SUFFICIENT DETAIL?
Were the materials, handouts, and activities useful?

Course: TECH 4313 (SPRING 2014)

Likert Scale:
- Neutral
- Good
- Excellent

Count

0 2 4 6 8 10

Were the materials, handouts, and activities useful?
How well did the course materials follow the course?

- Neutral
- Good
- Excellent

Course: TECH 4313 (Spring 2014)
OVERALL RATING OF COURSE
• Well organized
• I liked the clear instructions and the generous time to complete the module. There isn’t much to improve on modules
• I liked the clear instructions and the generous time to complete the module. There isn’t much to improve on the modules
• A lot of information to cover
• I liked the visual aids for this modular, the goals and objectives, and diagrams
• The least helpful are power point is big in size and loading is a bit slow could deliver a PDF, different picture resolution can help is file size
HOW EASY WAS THE MODULE TO UNDERSTAND?
WERE THE MATERIALS, HANDOUTS, AND ACTIVITIES USEFUL?
WERE THE TOPICS COVERED IN SUFFICIENT DETAIL?
How well did the course materials follow the course

Count

Neutral
Good
Excellent

ENGR 2300 MODULE 2A83A (DR. LONDA)

MODULE

OVERALL QUALITY OF MODULE MATERIALS
• Instructor able relate to the real world
• Ethics that was taught was very useful for the future, like the video examples
• Prefer longer lecture involving nanotech with physical examples
• More examples of ethics tied to nanotechnology
ORGANIZATION OF MODULES

TRACS SYSTEM
Module Evaluation at Texas State

<table>
<thead>
<tr>
<th>Module:</th>
<th>Instructor:</th>
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<tbody>
<tr>
<td>Course:</td>
<td>Date:</td>
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<tr>
<td>Student Name (optional):</td>
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We welcome your comments about the time you have spent training with us. Please complete the module evaluation so that we can continue to improve it. Pass your completed form to your instructor at the end of the module.

<table>
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<tr>
<th>Module Overall:</th>
<th>Poor</th>
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# Course and Instructor Evaluation

**Course:**

**Instructor:**

**School:**

**Date:**

**Student Name (optional):**

We welcome your comments about the time you have spent training with us. Please complete the course and instructor evaluation so that we can continue to improve the course. Pass your completed form to your instructor at the end of the course along with your Post-Test.

In your view, what were the three most important strengths of the program?

In your view, what were the three most important weaknesses of the program?

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<td>Would you recommend this course to others?</td>
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<td>Ability to provide real world experience?</td>
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### NSF-NUE NanoTRA

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<th>Ability to respond appropriately to questions?</th>
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<td>How well prepared were the instructors?</td>
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<td>Knowledge of subject matter?</td>
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### Demographic Information about Course Participants

- **Gender:** Male ___ Female ___
- **Ethnicity:** Caucasian___ African American___ Latino/Hispanic___ Asian Pacific___ Other___
- **Age Group:** 18-23 ___ 24-30 ___ 30-35___ 36-40____ 40 and above ___
- **Major:** Engineering___ Engineering Technology___ Industrial Technology___ Other (specify)___
WHAT HAVE WE LEARNED?

- We were successful, but more work is needed
- Students enjoy a different learning experience in STEM
- The results from the grant is preparing us for self-sustainability for permanent modules in courses
- Content developed can be used to develop a NANO-SAFETY certification or used to develop training materials for industry
QUESTIONS

Comments

THANK YOU
INFORMATION ON MODULES

http://nsf-nue
nanotra.engineering.txstate.edu/curriculum/introduction.html