Nano Summit:
Bringing Academia and Industry Together

- A strong partnership with industry is one of the pillars that lead to a successful and strong emerging technology program

Center for Nanotechnology Education

- Funded by the National Science Foundation
    - Lead Institution: Dakota County Technical College (MN)
    - AAS Nanoscience Technologist Program since 2004
    - Deb Newberry; Director/PI, Chair
    - Oakton CC is an affiliate within the Nano-Link Center

- Support 2 year college programs developing technicians to fit industry needs
- Industry partnerships – coordinating student outcomes with industry requirements

- Provide content to educators to infuse nanoscience concepts into traditional classes as well as technical programs
- Provide professional development opportunities for educators

A bit of history

- 2003 –
  - DCTC decides to create Nanoscience Program
  - Hire DN as focal person
  - Multiple industry focus groups –

- Do they need employees with nano SKAs?
- What do they want in a nano-savvy employee?
- Circular/feedback mechanism for curricula content

- Industries Involved: 3M, Hysitron, HB Fuller, Honeywell, General Mills, Isurtec, Aveka, Cima NanoTech, Medtronic

In the Emerging Technology Arena……

Employers need employees with multiple Skills, Knowledge and Abilities (SKAs)

Concepts:

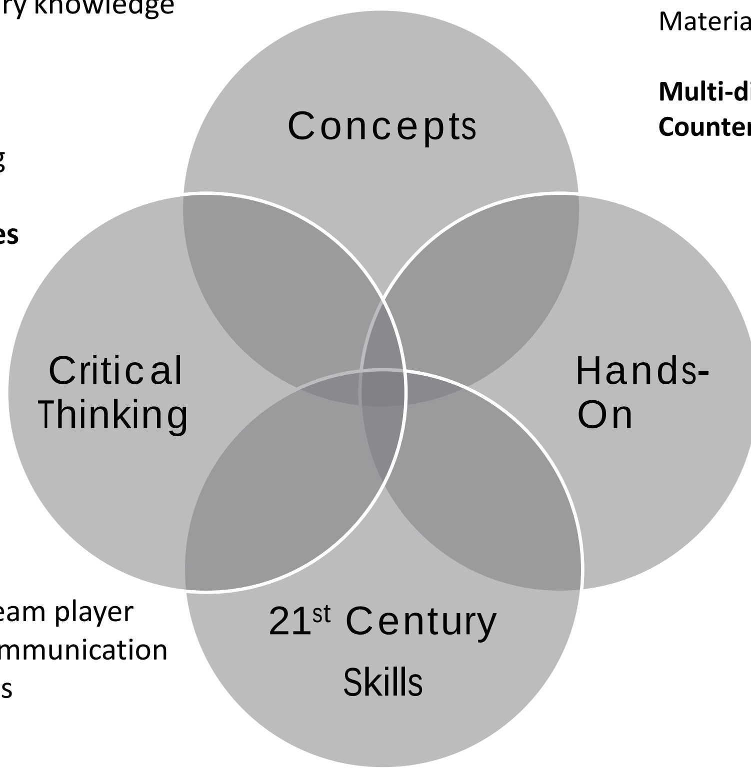
Sense of Scale
Surface area/volume
Forces and Interactions
Material Properties

Multi-disciplinary
Counter intuitive

Critical Thinking:

Requires multi-disciplinary knowledge
Investigations
Design of Experiments
Data Analysis
Statistical Understanding

Unique set of capabilities



Hands-On

Equipment Operation
Sample Preparation
Equipment Maintenance
Equipment strengths and weaknesses
Various Applications

Is Expensive
Need many pieces

21st Century Skills:

Multi-disciplinary team player
Oral and written communication
Variety of Audiences
Life long learning

Not everyone speaks the same technical language

Nano-Link

Dakota County Technical College
Nanoscience Technology Program Course Outline and Credit Allocation
rev. 2011

Semester 1 at DCTC			Semester 2 at DCTC			Semester 3 at DCTC			Semester 4 At Univ. of MN		
Course	Name	Credits	Course	Name	Credits	Course	Name	Credits	Course	Name	Credits
BIOL 1500	General Biology	4	CHEM 1500	Introduction to Chemistry	4	NANO 2101	Nano Electronics	3	MT 3111	Elem. of Micro Manufacturing	3
PHYS 1100	College Physics I	4	PHYS 1200	College Physics II	4	NANO 2111	Nanobiotechnology/ Agriculture	3	MT 3112	Elem. of Micro Mfg Lab	1
ENGL 1100	Writing & Research Skills	3	SPEE 1020	Interpersonal Communication	3	NANO 2121	Nanomaterials	3	MT 3121	Thin Films Deposition	3
MATS 1300	College Algebra	4	MATS 1250	Principles of Statistical Analysis	4	NANO 2131	Manufacturing, Quality Assurance	2	MT 3131	Intro to Materials Characterization	3
NANO 1100	Fund. of Nano I	3	NANO 1200	Fund of Nano II	3	NANO 2140	Interdisciplinary Lab	3	MT 3132	Materials Characterization Lab	1
			NANO 1210	Computer Simulation	1	NANO 2151	Career Planning and Industry	1	MT 3141	Principles and Applications of Bionanotechnology	3
			NANO 1222	Student Lab Experience and Research	3				MT 3142	Nanoparticles & Biotechnology Lab	1
									NANO 2970	Internship	2
Credits		18	Credits		19	Credits		15	Credits		17

DAKOTA COUNTY TECHNICAL COLLEGE

Interpersonal, Research and Communication Skills					
Category	**Competency**	**Sem. 1**	**Sem. 2**	**Sem. 3**	**Sem. 4**
Interpersonal	Ability to work in teams of various sizes.	X	X	X	X
	Developed appreciation of various strengths, skills and background of team members	X	X	X	X
	Ability to lead or follow dependent upon the circumstances	X	X	X	X
Research	Ability to access and efficiently use Internet and publication resources	X	X	X	X
	Capability to read, understand and assess technical information. Determine applicability, viability, technical maturity and integration of information.	X	X	X	X
	Ability to scan or assess in detail technical information.		X	X	X
Communication	Ability to convey information in either a summary or review format via written or oral communication.	X	X	X	X
	Working understanding and application of various presentation media (flip charts, Power Point, graphical methods, Word etc.)	X	X	X	X
	Ability to present information individually or as part of a group presentation.	X	X	X	X
General	Ability to apply and execute scientific methodology	X	X	X	X
	Knowledge and application of design of experiments		X	X	X
	Determine optimum experimental or analytical approach		X	X	X

NanoTechnology Understanding					
Category	**Competency**	**Sem. 1**	**Sem. 2**	**Sem.3**	**Sem.4**
Concept of Scale	Describe the nanoscale by various methods such as analogy, mathematical (decimal or exponential) format and by sizes of representative material and systems.	X	X		
	Determination of the relative importance of properties, interactions and forces at the macro, micro and nano scale.	X	X	X	X
	Application and knowledge of top-down and bottom-up approach to the nanoscale	X	X	X	X
General	Knowledge of the historical and developmental aspect of nanotechnology including key players and contribution	X	X		
	Ability to assess and discuss societal aspects of emerging technologies such as nanotechnology, i.e., regulatory, IP, global competitiveness, environment, awareness	X	X		
	Understanding of various factions in nanoscience technology and their respective approach to political, research, economic and environmental issues.	X	X		
Tools	For all of the basic tools of nanotechnology (ATM, SEM, STM, TEM, FTIR, X-ray diffraction, Ellipsometer, mass spectrometer, confocal microscopes) be able to….				
	Explain and understand the capability and limitations of the equipment	X	X	X	X
	Define in detail how the tool operates and controls required	X	X	X	X
	How to prepare samples for observation		X	X	X
	Define measurement properties and units, capability and variations		X	X	X
	How to independently calibrate and maintain each piece of equipment			X	X
	Ability to independently operate, control and use the machine on different sample types			X	X

Competencies and Outcomes

- NANO ENGINEERING TECHNOLOGY (CVTC)
- 1. Develop manufacturing processes and conduct laboratory activities to create a safe workplace according to documented safety guidelines and procedures.
- 2. Apply continuous improvement and statistical methods to support quality assurance/control, regulatory compliance, and industry standards.
- 3. Assemble, install, and troubleshoot electronic and mechanical systems using fundamental engineering principles.
- 4. Analyze materials for engineering technology applications.
- 5. Design, develop, and prototype nano- and micro-systems and processes.
- 6. Perform basic laboratory functions, including preparation and analysis of samples, by following standard procedures with proper documentation and validation of results.
- 7. Analyze and prepare biomaterials used in emerging medicine, energy, and agriculture by applying aseptic and molecular biological techniques.

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NSF

NanoScience To Traditional Science Concept Correlation

Trad. Concept	NS1	NS2	NS 3	NS4	NS 5	NS6	NS7	NS8	NS9
Physics							NA		
Classical physics – macro level:	X	X		X	X			X	X
Electricity and Magnetism:		X	X	X		X		X	X
Light and Optics:	X			X	X			X	X
Atomic Physics:	X		X	X	X			X	X
Materials Science									
Introductory Materials Properties:		X	X		X	X			X
Atomic Structure:	X		X	X	X	X		X	X
Polymers:		X	X		X				
Ceramics:		X	X		X				
Chemistry									
Aqueous solutions and Solubility:		X		X	X	X			X
Water:	X		X			X		X	X
Structure of atoms	X		X	X	X	X		X	X
Chemical Reactions:		X		X	X	X		X	X
Biology									
Atoms and Molecules:	X		X	X	X	X			X
Biotechnology:	X	X	X	X	X	X		X	X
Immune System:		X		X		X			X

The "Big" Ideas or Concepts of Nanotechnology

- NS 1: Sense of Scale
- NS2: Surface Area to Volume Ratio
- NS3: Nature/Structure of Matter
- NS 4: Forces and Interactions
- NS 5: Size Dependent Properties
- NS 6: Self Assembly
- NS 7: Societal Impacts
- NS 8: Tools of Nanoscience (AFM, SEM, XRD, TEM etc.)
- NS 9: Simulation

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What's in it for Industry?

- Direct input into student competencies
- Access to free labor
  - Literature search
  - Market analysis
  - Competitive analysis
- Access to lab/equipment
- Continuing input into curriculum
- Access to customized training

What in it for the Community College?

- Program awareness among industry
- Access for internships and job placement
- Content direction
- Equipment donation
- Access to guest speakers