

## Emerging Technologies in Engineering Technology Education Roundtable Discussions

1. Are you already including these emerging technologies at your college/university?
  - Purdue University is integrating biomedical into technology programs
  - Salt Lake Community College is interested in Bio-Engineering
  - DeVry University has biomedical in development
  - Excelsior College is looking into a nanotechnology/microtechnology program
  - Miramar City College has a bio manufacturing program
  - Albuquerque TVI has a MEMS program
  - Do not currently offer these emerging technologies, but will be looking at them in the future. Need to partner with other colleges to support curriculum, facilities and instruction
  - What about photochemical? Industry is offering equipment for instruction, how do we incorporate this equipment into our curriculum offerings?
  - New Hampshire Community Technical College wants to incorporate MEMS/NANO into bio manufacturing program
  - Purdue's program teaches fundamental technology skills. If students want nano, they go to Penn State
  - At Portland State, they developed a nanotechnician program
  
2. How can the presentations on emerging technologies impact your college/university?
  - These can offer alternatives to nursing programs
  - Developing entrepreneurial programs and programs for displaced workers
  - Integrate emerging technologies into existing disciplines
  - Nano+Chemistry/Physics/Bio/Mechanical
  - Need to identify overlap and gain awareness – TVI is interested in Penn State's Microfluidic material
  - UCSD (they are at the research level) but to extract what they are doing
  - Entrance requirements are an issue
  - Link with nursing: BMET could be a good first technical program
  - No local demand for nano or MEMS
  - Schools lack facilities => online model might be workable
  - The idea of a "technologist" is intriguing but cf. ABET/ASEE definition of technician (2 year) and technologist (4 year)
  - Competencies include skills and knowledge
  - Beware of lumping 2 year and 4 year educated individuals
  - See specific TAC criteria for programs
  - Penn State's nanofabrication program can be a replicable model
  - Community college partnering with a research university that has the facility and equipment required. Minimizes the capital equipment cost
  - Issues around tuition, state subsidy, other costs and revenue sharing amongst the partner institutions. Many states (Pennsylvania, Minnesota, South Carolina and others offer models to consider)

- It is critical that students come in prepared with math skills. Beef up tech math, change to meet need of emerging technologies, but transferability is a problem. Work on articulation
- Purdue's experience: there's not enough expertise at one particular college, so they partnered with other faculty from other colleges to develop curriculum

### 3. What can be easily implemented or adapted?

- Not easy, grant dollars needed
- Online programs
- Integration into existing programs
- Create technology generalist with basic skill sets such as ability to learn, critical thinking skills, work-readiness skills
- Perhaps the microfluidics stuff from Penn State and the Bio Sensor material from Purdue for Bio Tech can be implemented at Albuquerque TVI
- How do you create a partnership of schools that can share the equipment and instruction, even if these partner schools are not physically located nearby?
- Sharing of equipment at a distance. NSF could fund this
- What are the core competencies? Do we need to perform DACUMs in every region of the US? The competencies should be common across regions. The bar needs to be raised – manufacturers need to set the minimum requirements for employment and then abide by those requirements for hiring (associate degree, minimum math skills, etc). Some companies are already doing this, others continue to hire workers without the minimum requirements
- Manufacturers will say that technical skills are secondary to the soft skills. How you teach your courses, the pedagogy, can address the soft skills (interpersonal, communication, presentations, etc)
- Do we need to invest in equipment? Most 2 year schools (and probably 4 years as well) cannot afford the hardware
  - Other options:
    - Industry donations
    - Simulations
    - Weekend visits to industry facilities
- Combining internships with scholarships with Intel's reputation made a successful program. Student word-of-mouth carries it now. Be creative in how you put together a marketing program
- Beef up tech math, change to meet need of emerging technologies
- To translate changes to math and science, include faculty from each area like advisory committee. Also, classes were scheduled for Intel that were not typical of the common college schedule to meet the needs of the Intel workers
- Machine is down and don't have money to fix it, so money is the gate
- Brought industry in and they gave lecture for two years. We videotaped and used it to create lectures and labs

4. What differences will this make?

- Conflict with community needs
- Sentiments of advisory boards
- Preparation for rapidly-changing global economy
- Create individuals with portable skills
- Perpetuate life-long learning
- Get into other areas wrt MST – Bio, Microfluidic (we are biased with Surface and Bulk Micromachining)
- Graduates will be more employable (assuming local need)
- Greater options for graduates
- Critical that students come in prepared with math skills
- How can students go from start to finish in two years in emerging technologies?  
Students may have to take class hours that don't apply toward graduation
- Do you see increasing/decreasing of students because of new programs? New Hampshire Community Technical College: we see an influx of students. Univ of NH requires classes from this college
- Recruiting tool
  - Note: Penn State's regional model
  - First 3 semesters common: only need to produce a few grads a year
  - Fourth semester = capstone at regional center (eg, PSU)
  - The residential capstone may be attractive to some potential students

5. Do you know of other emerging technologies being implemented at colleges and/or universities?

- Fuel-Cell Technologies/hybrid fuel technology
- Optical Technologies
- RFID Micro-technology
- Battery Technology
- Construction Engineering Technology
- Biogenetics (UT)
- Gas Chromatography
- Cyber security
- Bio Informatics
- Security Engineering
- High tech corridors
- New nanoapplications: construction, energy
- Photonics
- Question: How does traditional electronics fit into this?
- Watch what DOE and DOL are funding
- Alternative energy
- Rapid prototyping
- Simulation
- Biological sciences – agriculture

- Biogenetics
- Medical equipment design
- RFID and printer electronics
- Enabling technologies like vacuum and plasma technology

6. What additional resources would you need to implement these emerging fields?

- Funding for training and equipment
- Online applications and resources
- Partnerships with business and industry
- Partnerships with state and local government
- Facilities
- System / Model for upskilling
- MATEC Networks (Resource Centers)
- CSI – like hype about technologies
- Time and resources for faculty
- Formal training and/or continuing education for faculty
- Access to industrial facilities
- Define the core program and then include these specialization courses
- Generalized program with capstone projects that apply to the student's specialization
- Need to consider accreditation requirements in the program design
- Need to consider employer recognition and acceptance of the degree (associate and/or baccalaureate)
- Qualified faculty

7. How can ATE Resource Centers assist you?

- Get Dr. Whitt from Purdue University's material into the resource center – can be used for a variety of applications
- Share modules at a reduced cost
- Share resources
- Partner on funding opportunities
- Information network
- Digital library/repository
- Online Labs
- Link resources
- Video on how to present materials
- Demonstrate need for programs
- Provide curriculum models
- Provide access to facilities for regional models
- National Science Digital Library
- Clearinghouse of course outlines
- Recommended core courses
- Recommended structure for online courses

- Need to adopt the model that resources should be shared
- Many have syllabi online and available, but not the specific learning activities
- If 70% of the course content is common, we should share it and not reinvent this same content at numerous sites
- National conference on sharing of curriculum
- Personnel available to participate in regional discussions/roundtables, etc
- Podcasting to share resources/information
- Web seminars on specific topics – less expensive than traveling to conferences
- Do centers have formal training for faculty?

8. Do you know of additional resources?

- Small Times for Small Jobs
- Trade Magazines
- Best Practices
- Competitions (ROBO Rocks)
- Expose K-12 to science and technology
- Demystify the engineering process
- Government: NIST, DARPA, CINT, MESA, Berkeley Interns....
- Professional societies